Watt Connects Us: Environmental Identity and the Need for Affiliation in Joining Energy Communities

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Abstract

As a construct rooted in environmental values and past behaviours, Environmental Identity (EI) may play a role in shaping individuals' sustainable choices. Understanding how EI relates to decisions, such as joining an Energy Community (EC), can help tailor more effective engagement strategies. This study explores how EI influences individuals' willingness to join an EC. Using the Ease of Retrieval (EoR) technique to manipulate EI, and McClelland's Theory of Needs to test for a moderating effect of the Need for Affiliation, an experimental between-groups design was applied (n = 107). Participants were assigned to either an easy or difficult recall conditions. The EoR manipulation did not alter the perception of EI, comparing both recall conditions. However, EI was found to be a significant predictor of intention to join an EC. However, no moderating effect of the Need for Affiliation was found. These insights could be used to target EC advertisements more specifically. Future research should consider alternative manipulation strategies, such as Narrative Identity Theory or group identity approaches, and examine affiliation needs in broader societal values within the EC context.

Keywords: Environmental Identity (EI), Energy Community (EC), Need for Affiliation, Ease of Retrieval

Introduction

Thousands of people worldwide took action on the weekends of September 15-17, 2023, with the same aim in mind: to induce the end of the usage of fossil fuels (Euronews, 2023). The "Global Fight to End Fossil Fuels" strike was a response to human-caused climate change. As extreme weather events like Hurricane Idalia and torrential flooding in Delhi led to chaos in many people's lives, climate activists came together to raise awareness just in time for the UN Secretary General's Climate Ambition Summit (Euronews, 2023).

Environmental changes, including rising global temperatures and shifting weather patterns, are only two examples of climate change and its effects on the ecosystem and society (Gasper et al., 2011). To combat these damages, e.g. the adoption of Renewable Energy Sources (RES) contributes to substantial CO₂ reductions across various countries (Attanayake et al., 2024). Several policies have been established, next to the well-known Paris Agreement, which sets the goal to achieve emission neutrality by the second half of this century, the European Union introduced the 2019 Clean Energy Package, which emphasises initiatives such as Energy Communities (EC) and collective self-consumption (Horowitz, 2016; Grignani et al., 2021b). These programs aim to actively involve individuals and local groups in the energy transition by enabling decentralised renewable energy production and distribution.

As part of this broader policy shift, ECs have gained attention as promising tools for achieving these climate and energy goals. ECs are on the rise to be seen as key actors in the transition to renewable energy. They represent a promising strategy to reduce CO_2 emissions by enabling citizens and local organisations to collaboratively produce and manage renewable energy (Barabino et al., 2023). Therefore, they enhance sustainability and energy independence (Elena & Andreas, 2020). While the structural benefits of ECs are clear, their success depends on active public participation in renewable energy initiatives. However, for this transition to be successful, public engagement and acceptance are crucial. Therefore, the willingness of people to join such initiatives should be investigated more closely. Understanding individual differences in the context of EC participation seems necessary, as this might offer valuable insights into joining behaviour. Although the motives of EC membership have been studied before, they often overlook the potential role of Environmental Identity (EI), a factor that may be key to understanding what drives individual participation.

Psychological and social factors play a crucial role in shaping individual interest and engagement in sustainability efforts (Cheng & Lee, 2022). EI is considered a psychological construct and refers to the extent to which individuals perceive environmental responsibility as an integral part of their self-concept (Gatersleben et al., 2012). It can be assumed that those with a strong EI are more likely to adopt sustainable behaviours and support environmental policies. However, the specific mechanisms through which EI influences participation in ECs remain underexplored.

This study seeks to address this gap by examining the relationship between EI and the willingness to join ECs.

RQ: How does Environmental Identity influence the willingness to join an Energy Community?

Theoretical Framework

Advantages of Group Membership

The individual profits from being a group member for several reasons. Especially the social aspects make group membership valuable. Consulting the concept of Social Capital (SC), the advantages become clear. Although there is no precise definition of SC, Giacovelli (2022) found commonalities, looking at different descriptions of SC.

Firstly, SC enables individuals to reach goals by drawing on shared group resources. When each member contributes their assets, the collective pool grows, enhancing the group's overall capacity (Giacovelli, 2022). Since members are expected to share common norms, values, and beliefs, SC can be invested toward a shared goal (Giacovelli, 2022). The success of achieving the goal increases as group membership enhances opportunities and influence (Hogg et al., 2008).

Bonding refers to relationships that develop inside a community and are based on a common social identity (Giacovelli, 2022), These close-knit connections are formed by people who share similar attitudes and behaviours, and they are characterised by a high level of mutual trust and emotional closeness (Hinds et al., 2000; Bauwens, 2016; Giacovelli, 2022). SC promotes cooperation and the formation of energy-related values through strong social networks and a feeling of community, making it an important place in developing sustainable energy practices (Giacovelli, 2022).

In this context, the role of group identity merges. Beyond individual EI, a shared sense of belonging to a group can strengthen commitment and participation in initiatives like ECs (Fielding & Hornsey, 2016). These dynamics, namely connectedness, group identity, and trust, all contribute to the attractiveness of ECs.

Environmental Identification and Energy Communities

As group membership often builds on shared norms and goals, environmental values frequently become a core part of group identity, especially within collective initiatives like ECs. In this context, EI emerges as a relevant concept.

Environmental identity is defined as "the meaning that one attributes to the self as they relate to the environment" (Stets & Biga, 2003, p.406). Clayton (2003) was the first to introduce this concept, challenging the traditional perspective that identity is formed solely through social relationships. Instead, she proposed that identity is also influenced by an individual's connection to the natural environment (Clayton, 2003). Given that some people connect more deeply with nature than others (Di Fabio & Rosen, 2019), this concept may be useful to explain individual differences.

Van der Werff et al. (2014) further developed this notion through the term Environmental Self-Identity, which is defined as "[...] the extent to which people see themselves as an environmentally-friendly person" (p.274). Their framework highlights that EI is formed by two key antecedents, namely personal environmental values and past proenvironmental behaviours. For readability, the term Environmental Identity (EI) will be used throughout this text to refer to the concept of Environmental Self-Identity.

Additionally, past behaviours play a central role in shaping EI. When individuals can easily recall their previous pro-environmental actions, they are more likely to internalise these behaviours as part of their self-concept (Van der Werff et al., 2024). Mariuzzo et al. (2023) found that individuals who strongly identify with environmental goals are more inclined to engage in actions that align with those values. Supporting this, joining an EC itself can be considered a pro-environmental act, suggesting that the relationship between EI and joining an EC may offer important insights.

These insights might contribute to a better understanding of participation in ECs, which exemplify an act of pro-environmental behaviour. Individuals with a strong EI are expected to be motivated to engage in EC initiatives, as participation aligns with their values and self-concept. Importantly, the recall of past pro-environmental behaviours might make those actions more salient, therefore reinforcing the perception of EI.

Ease of Retrieval (EoR)

The cognitive Ease of Retrieval manipulation was first introduced by Schwarz et al. (1991) and suggests that the ease with which people can recall information influences their judgements. In a study, Schwarz and colleagues found that the ease of recalling behaviours

influences self-assessments of traits; in their case, they looked at assertiveness. In the study, participants who recalled six examples of assertive behaviour rated themselves as more assertive than those who recalled twelve examples. The study shows that self-perception is shaped not only by what we recall, but by the perceived ease or difficulty (Schwarz et al., 1991). It can be expected that the recall of more items is perceived as a more difficult condition, inducing negative feelings in the person (Tormala et al., 2007).

According to the EoR theory, recalling fewer examples may strengthen the perception of a certain trait by making the retrieval process feel easy, thereby the perceived consistency between past actions and identity is enhanced (Schwarz et al., 1991). In this way, EoR could be argued to affect EI, and thus it may affect participation in ECs.

Motivations of EC Members

While elements like EoR might affect EI, and thus possibly influence individuals' choices to join an EC, it is essential to consider motivational forces that drive participation in ECs. Understanding the multifaceted motivations helps explain why individuals are drawn to ECs.

Radtke and Bohn (2023) investigated the motivations of people who are part of an EC and found several factors. According to their research, members of ECs value sustainability and climate protection. Furthermore, individuals who care about the environment tend to reflect a strong (pro-) EI and hence support renewable energy development and contribute to positive changes to the climate (Bauwens, 2016).

Moreover, some people see the chance to reduce their energy costs and obtain financial benefits from being a member of an EC, indicating a financial drive. Although this may not appear to be psychologically relevant at first, this motivating feature may lead to a desire to comply with social standards and peer pressure, particularly for persons seeking approval from significant others (Radtke & Bohn, 2023). The willingness to join an EC may be influenced by a variety of social and psychological factors, among which the feeling of connectedness plays a significant role (Radtke & Bohn, 2023). Many individuals are motivated by a desire to adhere to shared norms to feel included and maintain a sense of affiliation with others (Cialdini & Goldstein, 2004). Participation in ECs can provide a sense of belonging, which is a powerful motivator for human behaviour (Baumeister & Leary, 1995). Social alignment not only strengthens personal beliefs but also reinforces mutual commitment to a common goal (Giacovelli, 2022). These findings suggest that social factors may be key drivers of participation in ECs alongside environmental concerns.

McClelland's Theory of Needs

Given that the sense of belonging may play an influential role in motivating individuals to join an EC, it is important to explore this idea in more detail. One useful framework for examining motivational factors is McClelland's Theory of Needs (1985). According to McClelland (1985), individuals are motivated by three needs that influence decision making and willingness to display certain behaviours. The first need is referred to as the Need for Power, where individuals want to influence others, such as through teaching or motivating them, placing high importance on discipline (Osemeke & Adegboyega, 2017). The Need for Achievement is associated with performance-driven actions, where individuals aim to accomplish particular goals and pursue success. Lastly, the Need for Affiliation involves the desire for friendships and social connections, with people striving to establish and maintain relationships (Osemeke & Adegboyega, 2017).

The Need for Affiliation as a Moderator

Given that norms and peer pressure play a significant role in shaping behaviour, individuals with a high Need for Affiliation may be especially drawn to pro-environmental groups like ECs (Cialdini & Goldstein, 2004). Participation offers social acceptance and alignment with shared environmental values. Hence, membership not only strengthens the EI of EC members but also fulfils their desire to maintain social relations.

Therefore, people have a desire to contribute to group goals, such as in EC, and affiliate themselves with groups. This desire differs between individuals, as some have a higher Need for Affiliation than others. Therefore, the link between EI and intention to join an EC will be stronger for people with a high Need for Affiliation.

The Current Study

This current study investigates the relationship between Environmental Identity and intention to join an Energy Community, while accounting for individuals' Need for Affiliation. The EI was manipulated using the Ease of Retrieval technique. Participants were asked to recall past environmental behaviours related to their energy use. Subsequently, the intention to join an EC was measured. Two main hypotheses emerged:

H1: People with a high level of EI have a higher willingness to join an EC than people with a low EI.

H2: The effect of EI on joining an EC is moderated by the Need for Affiliation. When the Need for Affiliation is high, this effect will be stronger than when there is no perception of EI.

Figure 1

Example of a Simple Conceptual Model with a Moderator



Methods

The method sections of the three students are virtually very similar, due to close collaboration on the experiments. Sections about the moderator differ, as each student was investigating a different moderator. The first supervisor recommended this approach and expressed permission.

Participants and Design

The study used an experimental, between-groups, independent design. Two groups of participants were compared, one in an easy condition with two recalls and one in a difficult condition with twelve recalls. This design compared intention to join an EC by manipulating an individual's level of EI using the EoR technique.

Through snowball and convenience sampling, 138 participants were recruited. A convenience sample was obtained by recruiting participants via the SONA system of the University of Twente. For their participation in the study, participants received 0.5 SONA credits. The snowball effect was created during the process of sharing the questionnaire with relatives, who were in turn encouraged to share it with their friends and family. Of 138 participants initially recruited, 108 fully completed the study. One participant was omitted as the survey had three attention checks, and the participant failed to complete these checks correctly. Thus, an overall sample of 107 people was obtained.

Within the sample, 76 participants were female, and 31 were male. The age ranged from 17 to 64, with a mean age of 24.3 (SD = 7.68). Participants were from the Netherlands (n = 12), Germany (n = 56) or other countries (n = 39). 66 participants had a high school diploma, 27 had a bachelor's degree, four had a master's degree, five had a PhD, and three had another education as their highest degree completed. Before the data collection, ethical approval was obtained by the Ethics Committee of the Behavioural, Management, and Social Sciences Faculty at the University of Twente.

Of the sample, 54 participants were assigned to the study's easier condition, and 53 were assigned to the more difficult condition. Three reasons for joining were derived from previous literature by Sloot et al. (2019). Using a seven-point Likert scale, participants indicated to what extent of the following reasons they would join an EC. The aspects of interest were "1. saving money", "2. Contribute to a better environment", "2. Be involved in my neighbourhood". The first aspect yielded a mean of 5.92 (SD = 1.06). The second reason reached a mean of 5.9 (SD = 0.99). Lastly, the third aspect was demonstrated with a mean of 4.27 (SD = 1.46).

Procedure

Participants were first informed about the purpose and duration of the study, their right to anonymity and their right to withdraw. Once the informed consent was obtained, the participants could start with the study. The informed consent can be found in Appendix B. First, demographic data were obtained. The demographic variables included gender (1 = "Male", 2 = "Female", 3 = "Non-binary", 4 = "Prefer not to say"), age (self-indication in numbers), country of origin (1 = "Netherlands", 2 = "Germany", 3 = "Other" including space for self-indication), and level of highest degree completed (1 = "No schooling completed", 2 = "High school graduate, diploma or the equivalent", 3 = "Bachelor's degree", 4 = "Master's degree", 5 = "Doctorate degree", 6 = "Other", 7 = "Prefer not to say").

Next, participants answered statements measuring the three motivational needs for Achievement, Power, and Affiliation by McClelland (1985). This study focuses on the Need for Affiliation, as the elaboration of the other needs would go beyond the scope of this research.

Ease of Retrieval

Afterwards, people were instructed to recall past behaviours. Participants were automatically assigned to one of two groups: an easy recall condition or a difficult recall condition. Depending on the distributed group, people had to either recall two or twelve past pro-environmental behaviours. The idea stems from the EoR manipulation by Schwarz et al. (1991). In the original experiment, people had to either recall six or twelve assertive or unassertive behaviours. In adapting this method for the current study, the easier recall condition was reduced from six to two behaviours. This decision was made to ensure a clearer distinction between the easy and difficult conditions, as recalling six behaviours could already pose a challenge in this context. Reducing the number creates a more evident contrast between the two conditions and increases the likelihood that the easy recall condition is truly perceived as such.

This manipulation was designed to create differences in perceived difficulty, assuming that recalling more examples would be more cognitively demanding (Tormala et al., 2007). In this scenario, people are more likely to conclude they are environmentally friendly when they recall fewer items and thus experience an Ease of Retrieval compared to recalling more items.

Manipulation Check

This task was followed by a manipulation check, asking participants about their perceived EoR with the previous task on a 7-point Likert scale. To assess whether the EoR manipulation was successful, independent-sample t-tests were conducted comparing participants of the easy condition with those who were assigned to the difficult condition on perceived difficulty of EI.

There was a significant difference in perceived difficulty between the two groups, b = -1.61, p = <.001, 95% CI [-2.28, -.93]. Participants in the difficult condition rated the task as

significantly more difficult (M = 4.66, SD = 1.73) than those in the easy condition (M = 3.06, SD = 1.80), indicating that the manipulation successfully influenced EoR. However, there was no significant difference in EI between the groups, t (104.98) = -0.99, p = .33. Participants in the difficult condition (M = 4.49, SD = 0.95) did not differ significantly in EI from those in the easy condition (M = 4.30, SD = 0.98). Although the recall task was perceived as more demanding in the difficult condition, the manipulation did not alter EI perception, not yielding the desired effect.

Environmental Identity and Energy Communities

This section was followed by a questionnaire about EI to measure participants' level of it. Upon completion, the participants received a description of what ECs are, explaining the management of renewable energy within a group. The full description can be found in Appendix C.

The explanation was followed by the last set of questions measuring the intention to join an EC. After completing the last set of questions, participants were debriefed on the purpose of the study, which was to assess the relationship between EI and intentions to join an EC. They were informed that the EoR task was used to manipulate their EI. Upon the debrief, participants were asked if they still consented to the use of their data and thanked for their participation in the study. Afterwards, they were awarded 0.5 SONA credits if they did the study via the SONA system.

Measures

The data was collected using a questionnaire that was created in Qualtrics. The questionnaire included different scales that each intended to measure the variables of interest. The questionnaire was distributed online via the SONA system of the University of Twente and by sharing the URL link with acquaintances.

Motivational Needs Questionnaire

The first scale measured the Need for Affiliation of participants, using the Motivational Needs Questionnaire adapted from Neill (2009) and Junker (2001). The original questionnaire included eleven statement questions, with three answer options each. Each answer option corresponded to one of the three needs based on the model of McClelland (1985). For the current study, the answer options were adapted as statement answers measuring the level of agreement. The adaptation from question format to statements was used to get a better idea of the level of each need per individual and to gain an idea of the high and low scorers. Each statement was to be ranked on a seven-point Likert scale, with one indicating the least agreement ("Strongly disagree"), four indicating a neutral response ("Neither agree nor disagree"), and seven indicating the highest level of agreement ("Strongly agree"). Two examples are "I enjoy and seek warm, friendly relationships" and "I am sensitive to others, especially when they are angry". The full list of questions can be found in Appendix D. The reliability of the scale was high, indications could be found in Cronbach's alpha coefficient ($\alpha = .79$). Barlett's test of sphericity supports the finding that the items of the scale are significantly correlated (χ^2 (428) = 115.27, p < .001). The Kaiser-Meyer-Olkin (KMO) was used to support the appropriateness of the data. The overall KMO value of 0.6 indicates that the dataset is acceptable.

Environmental Identity

The second scale measured the EI. The scale included twelve questions adapted from the Revised Environmental Identity Scale of Clayton et al. (2016) and Van der Werff et al. (2013). The responses were based on a seven-point Likert scale, with one indicating the least agreement ("Strongly disagree"), four indicating a neutral response ("Neither agree nor disagree") and seven indicating the highest level of agreement ("Strongly agree"). Examples of the items are: "Behaving responsibly toward nature -living a sustainable lifestyle- is important to who I am" and "I use energy-efficient light bulbs". The full list of questions can be found in Appendix E. The reliability of the scale was high, indications could be found in Cronbach's alpha coefficient ($\alpha = .83$). Barlett's test of sphericity supports the finding that the items of the scale are significantly correlated (χ^2 (78) = 478.07, p < .001). The overall KMO value of .83 indicates that the dataset is acceptable.

Intention to Join an Energy Community

Lastly, participants were asked about their motivations to join. The three reasons incorporated are "contribute to a better environment", "save money", and "be involved in my neighbourhood". A seven-point Likert scale was used for that.

The scale measuring the intention to join an EC was adapted from the study of Sloot et al. (2019). The study of Sloot et al. (2019) measured specifically the intention to join the Buurkracht initiative in a sample of Dutch households. For the current study, five questions were adapted to fit the overall intention to join any EC. The scale included statements to be ranked by a seven-point Likert scale, with one indicating total disagreement ("Strongly disagree"), and seven indicating total agreement ("Strongly agree"). Statements included "I would like to know more about the energy community initiatives in my neighbourhood", "I am considering joining the new energy community in my neighbourhood". The full list of questions can be found in Appendix F.

Data Analysis

The data was converted into a CSV. file from Qualtrics, after which it was transferred to RStudio Version 2024.12.1+563. The R script is included in Appendix I and demonstrates the analysis plan.

Before the data could be analysed properly, the file was screened for missing values. Participants who did not give their consent before and/or afterwards were excluded. Additionally, people who failed to get all three attention checks correct and people who did not complete the manipulation, hence the EoR task, were omitted.

The actual analysis started by looking at the descriptive statistics, including the values of the demographics. First, the effect of EI on the manipulation check was assessed. The manipulation check was effective in influencing EoR. Nevertheless, comparing participants of both conditions, there was no significant difference in their strength of EI. Thus, the manipulation did not influence the level of EI in participants. The parametric assumptions of linearity, homoscedasticity and normality were analysed to ensure the applicability for the hypothesis testing.

Using EoR as a predictor is less theoretically justified, as the manipulation failed to affect the level of EI. In contrast, EI is a reliable, measurable variable that predicts willingness to join. Accordingly, two hierarchical regression analyses were conducted to examine the predictors of willingness to join an EC. In the first model, the EoR and Need for Affiliation were included. However, due to the failed manipulation, a second regression model was constructed using EI instead of EoR. In the first block of the regression, EI and the moderator were included, whereas the interaction term EI x moderator was included in the second block. This model aligned more closely with the theoretical expectations of this study, which justifies the choice of using this model.

Subsequently, an additional analysis was conducted to examine the needs of the participants in terms of their reasons for joining an EC, which concern money, environment, and neighbourhood. A seven-point Likert scale was used for that. Although this examination is outside the scope of this research, the information will be used for the discussion of previous research.

Results

Assumption Testing

Before testing the main hypotheses, descriptive statistics and the manipulation check were computed. Two assumption tests were conducted, the first one included the model incorporating EoR, the second one EI instead.

To test the first assumption, including EoR as part of the regression analysis, several diagnostic tests were conducted. Concerning the normality of residuals, the Shapiro-Wilk test was performed. The results yielded p = .03, indicating a deviation from normality. The assumption of linearity was supported as the residuals versus fitted values plot showed a random scatter, without evidence of systematic patterns (Appendix G), supporting the assumption of homoscedasticity, as the spread of residuals appeared relatively constant across the range of fitted values. To evaluate the multicollinearity, Variance Inflation Factors (VIFs) were computed. All VIF values were well below five, there was no of violation. In summary, despite a minor deviation from normality, there is no substantial violation of the assumption, and the results overall support the validity of the results.

Regarding the model including EI, the Shapiro-Wilk test resulted in a p-value of .14, leading to a failure to reject the null hypothesis, suggesting that the residuals follow a normal distribution. The assumption of linearity was supported as the residuals versus fitted values plot shows a random scatter (Appendix H). Additionally, there was no major sign of heteroscedasticity, supporting the assumption of constant variance in the model residuals. Lastly, testing the multicollinearity, the VIF values (all below five) indicate no significant multicollinearity among the predictors, ensuring stable regression coefficients. Concludingly, there was no violation of the assumptions.

Generally, regression models are relatively robust and yield reliable results despite minor violations (Flatt & Jacobs, 2019). Violations of heteroscedasticity and non-normality may be acceptable, especially when the research aims to examine relationships rather than make predictions. Robustness depends, amongst others, on the severity of the violations, sample size and study intent (Flatt & Jacobs, 2019). In this study, there are no severe violations of the assumption in either model, therefore, the regression model can be trusted and used for the analysis.

To get a better overview of the descriptive patterns and initial associations relevant to the hypotheses, a correlation table was created. Table 1 shows the means, standard deviations and intercorrelations among measured variables.

Table 1

Correlations Between Variables and Their Descriptives^a

Variable	М	SD	1	2	3	4	5
1. Joining (EC)	4.26	1.22					
2. Need for Affiliation	4.87	0.58	.22*				
3. EI	4.51	0.89	.58***	.26**			
4. Education Level ^b	2.56	0.99	.26**	07	.13		
5. Nationality ^c	1.89	0.32	.11	.14	.03	.05	
6. Gender ^d	1.71	0.46	.23*	.17	.23*	01	.01

^a N=107; scale categories: 1-7; ^b Education Level 1= "no schooling completed", 2 = "high school graduate, diploma or the equivalent", 3 = "Bachelor's degree", 4 = "Master's degree", 5 = "Doctorate degree", 6 = "other", 7 = "prefer not to say"; ^c Nationality 1 = "Netherlands", 2= "Germany and Other"; ^d Gender 1 = "Male", 2= "Female" *** p < .001, ** p < .01, * p < .05

Effects on Intention to Join

Effects of Ease of Retrieval and Need for Affiliation on Joining

A hierarchical regression was conducted to examine whether EoR, Need for Affiliation, and their interaction predict willingness to join an EC. This analysis showed that EoR was not significant (b = -.09, p = .12, t = -1.55, 95% CI [-.21, .03]). However, the Need for Affiliation showed a significant positive effect on joining an EC (b = .47, p = .02, t = 2.35, 95% CI [.07, .86]). This means that the more people need affiliation, the higher their intention to join. Adding the interaction term of both predictors, the effect was not statistically significant (b = .17, p = .12, t = 1.57, 95% CI [-.05, .4]). This suggests that the combined effect of the two predictors did not significantly influence the outcome beyond their individual effects. The relationship between EoR and intention to join does not depend on the Need for Affiliation.

Effects of Environmental Identity and Need for Affiliation on Joining

The analysis above was originally planned to manipulate the perception of EI using the EoR technique. As this manipulation did not yield the desired effect, an additional analysis was conducted. EI and Need for Affiliation were set as predictors of the effect of joining. Because the manipulation did not alter the perception of EI, the regression should be adjusted to see whether the results will change. A hierarchical multiple regression was conducted to examine whether EI, Need for Affiliation, and their interaction predict willingness to join an EC. EI was a strong and significant positive predictor (b = .71, p < .001, t = 6.74, 95% CI [.5, .91]), as illustrated in Figure 2. The higher the level of EI, the more people show a willingness to join an EC.

Figure 2

Effect of EI on Willingness to Join an EC



The Need for Affiliation was not statistically significant (b = .16, p = .363, t = .91, 95% CI [-.19, .50]). Adding the interaction term resulted in a non-significant effect (b = -.22, p = .188, t = -1.33, 95% CI [-.55, .11]). Thus, the relationship between EI and joining does not depend on the Need for Affiliation.

Discussion

This study examined how Environmental Identity influences the intention to join an Energy Community, and whether this relationship is moderated by the Need for Affiliation. The Ease of Retrieval Manipulation was used to subtly activate EI. While the manipulation influenced perceived task difficulty, it did not influence participants' level of EI.

The Role of Environmental Identity in Joining an Energy Community

As hypothesised, individuals with higher EI reported a stronger willingness to join an EC. This supports prior research suggesting that people who value the environment are more likely to engage in pro-environmental behaviours (Van der Werff et al., 2014). In this study, joining an EC was conceptualised as such a behaviour (Mariuzzo et al., 2023).

The study by Van der Werff et al. (2014) found that behaviours connected to EI were mainly based on behaviours of the individual. Although this study assessed EI at an individual level, the collective nature of ECs may engage a form of group-based identity. This points to the importance of understanding EI not just as a personal trait, but also as a socially embedded construct. Regular involvement in collaborative settings may shape how individuals perceive themselves within the group. As members align with shared goals and values, their EI might also reflect a sense of belonging to a group following a common purpose (Hinds et al., 2000).

The Role of the Need for Affiliation

Looking at the joint influence of EI and Need for Affiliation on joining revealed that the effect of EI on willingness to join an EC is not moderated by the Need for Affiliation. Regardless of whether individuals exhibited a Need for Affiliation, EI remained a consistent predictor of willingness to join an EC. This finding indicates that the Need for Affiliation is not influencing the strength of the relationship of EI on joining an EC. The insufficient effect of the need likely reflects shared variance between EI and Need for Affiliation.

Furthermore, there is a lack of knowledge concerning the Need for Affiliation in the context of environmentalism. Whereas the Need for Affiliation has already been investigated in different contexts, amongst others those of work, management and leadership behaviours (Steinmann et al., 2016), its role in shaping environmentally relevant actions remains underexplored. This is important as the phrasing of the statements used may not have been fully adapted to the environmental context. As a result, the construct may not have effectively captured participants' motivations for engaging in environmental initiatives, hence limiting insights into individual differences.

Sloot et al.'s (2019) research aligns with the findings of the additional analysis conducted concerning reasons to join an EC. Their research concerns people's motives for

their involvement in the EC. Although the current research focuses on willingness to join instead of involvement, it can be expected that the reasons might be similar. Sloot et al. (2019) found that whereas communal motives for involvement are less important, financial and environmental reasons are more relevant for individuals. However, Radtke & Bohn (2023) found that social factors are one of the main contributors to people deciding whether they want to join an EC. Hence, there is contradictory literature about the reasons to join.

Because the Need for Affiliation largely involves the desire to maintain friendly and harmonious relationships (Osemeke & Adegboyega, 2017), its influence may be more important to actual engagement in an EC rather than the initial decision to join. Group membership often relies on shared norms and values (Giacovelli 2022), thus, it can be expected that people who want to join an EC are likely to have pro-environmental views. In this regard, affiliation may not be a primary driver for joining, but it may play a more important role after membership is established, when individuals seek to maintain relationships.

Given that this study focuses on intention to join an EC, there might be a misalignment between the construct of the need and the behaviour of interest, which is joining, not active involvement. While Social Capital is crucial in shaping group dynamics, it tends to focus on the collective rather than the individual level. The Need for Affiliation is influenced by external social cues, such as opinions and expectations of others (Osemeke & Adegboyega, 2017).

In contrast, strong intrinsic motivations may provide a better explanatory framework. According to Self-Determination Theory (Ryan & Deci, 2000), intrinsic motivation is enhanced when people feel autonomy, competence, and relatedness, factors that relate to more self-directed decision making. In the context of ECs, individuals may be more inclined to join out of internalised values, such as personal responsibility for the environment, rather than a desire to affiliate with others.

While the Need for Affiliation may impact continued engagement within ECs, intrinsic motivation rooted in EI may be a more important element in explaining initial willingness to join. Further exploration into the role of external and internal motivations is needed to make more certain statements.

Evaluating the Ease of Retrieval Manipulation

The findings on whether the Need for Affiliation influences the willingness to join an EC are mixed. When combined with EoR, the need seemed to be relevant as people with a stronger need were more likely to join an EC. But when EoR was substituted with EI, the effect of the Need for Affiliation faded. This might be because EI has a stronger influence and possibly overlaps with the Need for Affiliation. EI appears to be a robust factor in explaining willingness to join an EC.

A possible explanation for why the manipulation of EI did not work might be due to the stability of the identity. Clayton (2003) mentioned that EI can be seen as a relatively stable construct. Therefore, the EI was resistant to short-term manipulation. Contrary to Clayton (2003), Oyserman (2015) suggests that identity is context-dependent and dynamically activated. According to this view, EI becomes relevant when environmental topics are top of mind. This aligns with the Identity-Based Motivation Theory, which posits that behaviours consistent with one's self-concept are more likely to be enacted (Oyserman, 2015).

Alternatively, the manipulation may have only impacted cognitive fluency, not the identity level. Cognitive fluency describes how effortlessly mental tasks are processed and is known to shape various judgements, such as how familiar or frequent something seems, or how confident one feels (Unkelbach, 2006). However, fluency does not inherently convey

meaning as its effect is shaped by learned associations between fluency and types of judgment (Unkelbach, 2006). This means that the felt ease is not automatically linked to personal relevance, such as EI, unless individuals have previously learned to interpret such ease as meaningful in that context. Participants might have interpreted this ease merely as reflecting the task's complexity, rather than as an indication of their level of EI.

If participants did not connect the Ease of Retrieval with their EI, the manipulation failed to influence their self-perception. Since cognitive fluency can shift rather quickly, but identity is more stable and context-dependent, the task may not have been influential in altering perceived EI. Because EI is a promising predictor of willingness to join, a proper manipulation could help to understand this relationship better.

The Narrative Identity Theory (McAdams, 2011) could improve the manipulation of EI. This theory sees identity as a personal story shaped by past behaviours and future goals. Manipulating identity through storytelling could potentially activate EI more deeply than the EoR manipulation. Taking this way of manipulation might yield more concrete statements about the relationship with the willingness to join EC.

Limitations

Due to the use of the SONA system, many participants have been recruited from the University of Twente, mainly psychology students. Considering that the main sample consists of students, it can be assumed that the minority has shown interest in ECs before. Considering their reasons for participation, they might have been more practical than out of pure interest. As most students do not own property or make energy decisions, they might be sceptical of ECs as the mechanisms connected to it might be too complicated (Botsaris et al., 2021). Additionally, students or younger people more generally may face multiple challenges referred to as the "quarter-life" crisis, mainly concerning dissatisfaction with the job (Robinson, 2018). The choice of respondents might have influenced lower engagement and response reliability. Another participant group for this survey might counterbalance this effect.

Self-reporting biases also present limitations. Social desirability and availability heuristics may have influenced participants' recollection of pro-environmental behaviours. Participants might have exaggerated environmentally friendly actions or recalled what came to mind easily (Bernadi & Nash, 2022; Schwarz et al., 1991). Concludingly, the given answers by participants might not have reflected their actual values, challenging the truthfulness of the answers.

Finally, due to the limited timeframe and scope of this thesis, the analysis was restricted to testing a small selection of theoretical frameworks only. While this approach allowed for focused investigation, it also meant that potentially more suitable or complementary theories could not be explored in depth. Nevertheless, this opens valuable opportunities for future research to examine alternative perspectives that may offer deeper insights into the relationships observed.

Strengths

This research's topics are relevant to the current environmental challenges. As promoting sustainable behaviours and strategies to combat climate change is more important than ever, this study addresses the energy issue in particular. As ECs align with several environmental goals and try to reduce or even stop the use of fossil fuels, it is crucial to investigate influences that promote the choice to join an EC (Elena & Andreas, 2020). The choice of designing advertisements that concern EC could be targeted to certain population groups, as EI is an influential aspect. Focusing on environmental, financial benefits and social aspects might offer valuable answers to possible EC contribution, as these factors are important to individuals. Moreover, this study offered valuable insights into the relationship between EI on Joining. As this relationship has been barely focused on before, this research found an influential effect. Future research could study this effect more closely, considering other possible influences such as group identity or needs that have not been investigated yet.

Directions for Future Research

This discussion of this research shows that improvements could be made in future research. Although it was assumed that the sample is not of main relevance, students can be seen as a group of interest because they fall into the categorisation of "Generation Z". This generation incorporates the age groups from 1997-2012 (Tsevreni et al., 2023). A synonym for this group is "the climate generation", which refers to the importance of climate. This generation has grown up with the consequences of global warming and has a heightened awareness of its consequences. As Tsevreni et al. (2023) describe, closely related to this is the term "eco-anxiety", which encompasses the negative feelings people experience as they are confronted with the consequences of the crisis. It can be assumed that people want to escape the negativity of the effects of climate change. This could be seen as a motivating factor to combat this feeling. The generation might be particularly interested in ways to combat climate change, whether at the individual or collective level. As ECs form opportunities to act on both levels, this might be an attractive consideration. Positive feelings could emerge as individuals might find a way to reduce fossil fuels, which affects the amount of CO₂ released (Nagy & Mizsey, 2013).

Closely tied to this is the research on the effect of EI on joining an EC. As it has been mentioned before, EI may shape environmental behaviours, such as joining, not only on an individual level, but also on a collective level. In the case of ECs, people with a strong EI might feel more connected to others who share the same values and may be more likely to

join such initiatives. This suggests that EI could help bring people together around shared environmental goals.

Given that ECs are fundamentally built on collective engagement and cooperation, it may be interesting to consider the role of group identity rather than individual EI in predicting joining. The shared sense of belonging to a group with common goals might more effectively foster commitment in collective initiatives such as ECs. Group identification can enhance pro-environmental behaviour by aligning personal actions with perceived group norms (Fielding & Hornsey, 2016). This exploration might offer valuable insight into the social dynamics of joining ECs. Future research should explore this idea further, as it could help in finding better ways to promote ECs to a wider audience.

Although the Need for Affiliation did not show the desired effect, the need may still play a subtle role. It is possible that this need operated indirectly, particularly through social dynamics not fully captured in this study design. Individuals with a high Need for Affiliation may be more receptive to the communal and interpersonal aspects of the ECs. This study focused on the average scores of the need, as this was sufficient for this scope. However, it did not explore differences between individuals with high or low levels of this need. Future research could benefit from examining the subgroups more closely, as it is reasonable to assume that those with a high expression of this need may be drawn to ECs for social, rather than purely environmental reasons. Investigating social motivators more closely could provide valuable insights into how the Need for Affiliation influences participation in collective environmental actions. Such research could improve understanding of what motivates people to join ECs, which would in turn improve targeted communication and increase participation rates.

Future research should consider the investigation of a person's self-concept about environmental action, as discussed in the literature on Identity-Based Motivation Theory by Oyserman (2015). While EI focuses more strongly on the aspect of how strongly an individual sees themselves as environmentally connected and responsible, this suggested theory of Identity-Based Motivation could complement the description of EI by offering a more dynamic perspective. This theory proposes that people are more likely to engage in environmental behaviours if they are congruent with their self-concept and actionable in the moment (Oyserman, 2015). Even if there is no strong pre-existing EI, the performance of pro-environmental behaviours could be explained more thoroughly.

Lastly, changing the technique to manipulate EI could be very helpful as it would allow for investigating the actual effect of EI on willingness to join more precisely. Since the EoR manipulation did not alter perception of EI, this limits the ability to conclude the role of EI. As alternatives, the Narrative Identity Theory or investigating group identity could offer promising approaches. For the first alternative, people could get randomly assigned to an experimental or control group. The experimental group would read an environmentally themed narrative to evoke identification with the protagonist, while the control group would read a neutral text. The narrative engagement could enhance EI among those in the experimental condition. More effective ways to activate EI should be studied and assessed for their influence on behaviour.

Conclusion

This research found that Environmental Identity influences willingness to join an Energy Community, which confirms the first hypothesis. The second hypothesis had to be rejected as the Need for Affiliation did not moderate the relationship between EI and willingness to join EC. Future research should investigate other moderating variables which could explain more variance in the addressed relationship. Several suggestions were made to improve the research, with particular emphasis on refining the manipulation technique. It is crucial to investigate this topic in the future, as ECs form a good way to mitigate the everincreasing pressure of climate change.

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Appendices

Appendix A

AI Statement

During the preparation of this work, the author used ChatGPT (GPT-4) in order to generate and adjust R-codes for the data analysis of this research. This tool was used for assistance with paraphrasing in some parts of the theoretical framework and verifying citation formatting in the reference list. After using this tool, the author reviewed and edited the content as needed and takes full responsibility for the content of this work.

Appendix B

Informed Consent

Dear Participant,

Thank you for your interest in this study. The purpose of this research in to investigate the willingness to join an energy community (EC). Energy communities are based on voluntary citizen participation, contributing to the transition to renewable energies (Elena & Andreas, 2020). They enable local stakeholders to produce, share, and manage energy collectively.

Your participation will help us to conclude possible motivating factors for joining.

This participation will take 20-30 minutes in total. Amongst others, we would like to uncover people's opinions of energy communities through this questionnaire.

While participating, we expect that you read the instructions carefully, answer honestly and not overthink your answers. This will help us to draw reliable information about the willingness to join an EC.

The BMS Ethics Committee/domain Humanities & Social Sciences has reviewed and approved this research project.

All information collected in this study will be kept confidential and will only be accessible to the research team. The data will be used solely for the purpose of this research and may be included in bachelor theses. At all times, your data will remain anonymous. The data will be securely stored and retained for ten years.

Participation in this study is entirely voluntary. You may withdraw at any time without providing a reason. If you withdraw before completing the questionnaire, your data will not be used. In the next section, we will ask you to provide some demographic information for data analysis purposes.

If you have further questions, feel free to contact: m.kremer-2@student.utwente.nl ethicscommittee-hss@utwente.nl (Ethics Committee)

By taking part in this study I agree that:

Consent Form for the Bachelor Theses on "CIRCUS- Creating Resilient Energy Communities"

Taking part in the study	Yes	No
I have read and understood the study information:		

I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study, without giving a reason: \Box \Box

I understand that taking part in the study involved answering questions in an online survey:

I understand that the information I provide will be used anonymously for data collection and analysis:

Appendix C

Description of Energy Communities in the Online Questionnaire

An energy community is a group of people, businesses, or organisations that come together to produce, share, and manage renewable energy, like solar or wind power. The goal is to reduce energy costs, increase sustainability, and help local communities become more energy-independent. Members of the community can generate energy themselves or share it from common resources, making it easier to access clean energy and support each other.

Appendix D

Motivational Needs Questionnaire

- 1. When doing a job, I need feedback
- 2. I prefer to work alone and be my own boss
- 3. I am uncomfortable when forced to work alone
- 4. I go out of my way to make friends with new people
- 5. I enjoy a good argument
- 6. After starting a task, I am uncomfortable until it is finished
- 7. Status symbols are important to me
- 8. I am always getting involved with group projects
- 9. I work better when there is a deadline
- 10. I work best when there is some challenge involved
- 11. I would rather give orders than take them
- 12. I am sensitive to others, especially when they are angry
- 13. I am eager to be my own boss
- 14. I accept responsibility eagerly
- 15. I get personally involved with my superiors
- 16. I include others in what I am doing
- 17. I prefer to be in charge of events
- 18. When given responsibility, I set measurable standards of high performance
- 19. I am concerned about my reputation or position
- 20. I desire to out-perform others
- 21. I am concerned about being liked and accepted
- 22. I enjoy and seek warm, friendly relationships
- 23. I get completely involved in a project
- 24. I want my ideas to be used
- 25. I desire unique accomplishments
- 26. I don't like being left out of things
- 27. I enjoy influencing the direction of things
- 28. I think about consoling and helping others
- 29. I am verbally fluent
- 30. I am restless and innovative
- 31. I think about my goals and how to attain them
- 32. I think about ways to change people
- 33. I think about my feelings and the feelings of others

Appendix E

Environmental Identity Scale and Past Behaviour Measures

- 1. Behaving responsibly toward nature -living a sustainable lifestyle- is important to who I am
- 2. I turn off electrical appliances (to save energy)
- 3. I often go to work or studies by bike instead of by car
- 4. I turn off the heater when I leave my room
- 5. I use energy-efficient light bulbs
- 6. I turn off the light when no one is in the room
- 7. I often buy organic products
- 8. I shower very shortly
- 9. I am a member of an environmental organisation
- 10. I always actively search for the most environmental-friendly products
- 11. I refuse plastic bags in clothing shops
- 12. I rarely eat meat

Appendix F

Intention to Join an Energy Community Scale

If you would take part in an energy community initiative, to what extent would the following reasons play a role for you? (1= strongly disagree, 7= strongly agree)

- 1. Save money
- 2. Contribute to a better environment
- 3. Be involved in my neighbourhood

Please indicate to what extent you agree with the following statements (1= strongly disagree, 7 strongly agree)

- 4. I would like to know more about the energy community initiatives in my neighbourhood
- 5. I am considering joining the new energy community in my neighbourhood
- 6. I would like to know more about the energy community initiative in my neighbourhood
- 7. I plan to join the energy community initiative in my neighbourhood in the future
- 8. I am interested in the energy community initiatives

Appendix G

Visualisation of Assumption of Linearity (Model with EoR)

Residuals vs Fitted Values



Appendix H

Visualisation of Assumption of Linearity (Model with EI)



Appendix I

R-Script

library(tidyverse) install.packages("tidyverse") library(broom) library(readr) library(psych) install.packages("ggplot2") library(ggplot2) library(readxl) install.packages("fastDummies") library(fastDummies) install.packages("dplyr") library(dplyr) install.packages("tidydr") library(tidydr) #view dataset Copy of Bachelor Thesis 1 Mai 2025 06 11 <- read excel("TWENTE/Year 3/Thesis Bachelor/Copy of Bachelor Thesis 1. Mai 2025 06.11.xlsx") View(Copy of Bachelor Thesis 1 Mai 2025 06 11) #delete rows/ people who did not consent in the end Copy_of_Bachelor_Thesis_1_Mai_2025_06_11 <-Copy_of_Bachelor_Thesis_1_Mai_2025_06_11 [-c(81, 82, 83, 84, 85, 87, 91, 92, 94, 98, 99, 100, 101, 103, 104, 105, 106, 107, 109, 113, 116, 119, 125, 126, 128, 134, 136), Copy of Bachelor Thesis 1 Mai 2025 06 11 <-Copy of Bachelor Thesis 1 Mai 2025 06 11 [c(91,92,93),] ##Attention ChecK: remove those who got 0 for all attentioncheckcorrect <- Copy of Bachelor Thesis 1 Mai 2025 06 11 %>% mutate(Attention $1 = ifelse(Q6 \ 16 \ Attention == "2", 1, 0),$ Attention $2 = ifelse(Q6 \ 32 \ Attention == "4", 1, 0),$ Attention $3 = ifelse(Q8 \ 7 \ Attention == "6", 1, 0))$ attentionsum<- c("Attention_1", "Attention_2", "Attention_3") attentioncheckcorrect <- attentioncheckcorrect %>% mutate(sum attention = rowSums(select(., all of(attentionsum)))) fulldata <- attentioncheckcorrect[attentioncheckcorrect\$sum_attention != 0,] #subset easy (2 behaviours)

- easy_condition <- select(fulldata, -Group2)</pre>
- easy_condition <- easy_condition %>% drop_na(Group1)
- #subset difficult (12 behaviours)
- diff_condition <- select(fulldata, -Group1)</pre>
- diff_condition <- diff_condition %>% drop_na(Group2)
- easy_condition_achievement <- c("Q6_1_Ach", "Q6_6_Ach", "Q6_9_Ach", "Q6_10_Ach", "Q6_14_Ach", "Q6_14ACh", "Q6
- "Q6_19_Ach", "Q6_21_Ach", "Q6_24_Ach", "Q6_26_Ach", "Q6_33_Ach")
- easy_condition_average <- easy_condition %>%
- mutate(achievement_total = rowMeans(select(.,all_of(easy_condition_achievement))))
- easy condition power <- c("Q6 2 Pow", "Q6 5 Pow", "Q6 7 Pow", "Q6 11 Pow", "Q6 13 Pow",
- "Q6 18 Pow", "Q6 20 Pow", "Q6 25 Pow", "Q6 28 Pow", "Q6 30 Pow", "Q6 34 Pow")
- easy condition average <- easy condition average %>%
- mutate(power total = rowMeans(select(.,all of(easy condition power))))
- $easy_condition_affiliation <- c("Q6_3_Aff", "Q6_31_Aff", "Q6_4_Aff", "Q6_8_Aff", "Q6_12_Aff", "Q6_12_Aff", "Q6_4_Aff", "Q6_Aff", "Q6_4_Aff", "Q6_4_Aff", "Q6_4_Aff", "Q6_4_Aff", "Q6_4_Aff", "Q6_4_Aff", "Q6_Aff", "Q6_Aff",""Q6$
- "Q6_15_Aff", "Q6_17_Aff", "Q6_22_Aff", "Q6_23_Aff", "Q6_27_Aff", "Q6_29_Aff", "Q6_35_Aff")
- $easy_condition_average <- \ easy_condition_average \ \%>\%$
- mutate(affiliationr_total = rowMeans(select(.,all_of(easy_condition_affiliation))))
- #average score for the manipulation check in the easy condition
- $easy_condition_average <- \ easy_condition_average \ \%>\%$
- mutate_at(c(46:69), as.numeric)
- easy_manipulation_check <- c("Q7_1_difficulty")
- $easy_condition_average <- \ easy_condition_average\% > \%$
- mutate(manipulation_check = rowMeans(select(.,all_of(easy_manipulation_check))))
- #average score environmental identity
- easy_identity <- c("Q8_1", "Q8_2", "Q8_3", "Q8_4", "Q8_5", "Q8_6", "Q8_8", "Q8_9", "Q8_10", "Q8_11", "Q8_12", "Q8_13", "Q8_14")
- easy_condition_average <- easy_condition_average%>%
- mutate(identity = rowMeans(select(.,all_of(easy_identity))))
- #average score joining an EC
- easy_ec <- c("Q9_1_money", "Q9_2_environment", "Q9_3_neighborhood", "Q10_1_DV", "Q10_2_DV", "Q10_3_DV", "Q10_4_DV", "Q10_5_DV")
- easy condition average <- easy condition average%>%
- mutate(joining ec = rowMeans(select(.,all of(easy ec))))
- view(easy_condition_average)
- #difficult
- diff_condition_achievement <- c("Q6_1_Ach", "Q6_6_Ach", "Q6_9_Ach", "Q6_10_Ach", "Q6_14_Ach", "Q6_14ACh", "Q
- "Q6_19_Ach", "Q6_21_Ach", "Q6_24_Ach", "Q6_26_Ach", "Q6_33_Ach")
- diff_condition_average <- diff_condition %>%
- mutate(achievement_total = rowMeans(select(.,all_of(diff_condition_achievement))))
- diff_condition_power <- c("Q6_2_Pow", "Q6_5_Pow", "Q6_7_Pow", "Q6_11_Pow", "Q6_13_Pow", "Q6_18_Pow", "Q6_20_Pow", "Q6_25_Pow", "Q6_28_Pow", "Q6_30_Pow", "Q6_34_Pow")
- diff condition average <- diff condition average %>%
- mutate(power_total = rowMeans(select(.,all_of(diff_condition_power))))
- $diff_condition_affiliation \quad <- \quad c("Q6_3_Aff", "Q6_31_Aff", "Q6_4_Aff", "Q6_8_Aff", "Q6_12_Aff", "Q6_12_Aff", "Q6_12_Aff", "Q6_12_Aff", "Q6_12_Aff", "Q6_12_Aff", "Q6_14_Aff", "Q6_14_Aff",""QGG"], "Q6_14_Aff",""QGG"], "Q6_14$
- "Q6_15_Aff", "Q6_17_Aff", "Q6_22_Aff", "Q6_23_Aff", "Q6_27_Aff", "Q6_29_Aff", "Q6_35_Aff")
- diff_condition_average <- diff_condition_average %>%
- mutate(affiliationr_total = rowMeans(select(.,all_of(diff_condition_affiliation))))
- #average score for the manipulation check in the difficult condition
- diff condition average <- diff condition average %>%
- mutate at(c(46:69), as.numeric)
- diff manipulation check <- c("Q7 1 difficulty")
- diff condition average <- diff condition average%>%
- mutate(manipulation check = rowMeans(select(.,all of(diff manipulation check))))
- #average score environmental identity
- diff_identity <- c("Q8_1", "Q8_2", "Q8_3", "Q8_4", "Q8_5", "Q8_6", "Q8_8", "Q8_9", "Q8_10", "Q8_11", "Q8_12", "Q8_13", "Q8_14")
- diff condition average <- diff condition average%>%
- mutate(identity = rowMeans(select(.,all_of(diff_identity))))

#average score joining an EC diff ec <- c("Q9 1 money", "Q9 2 environment", "Q9 3 neighborhood", "Q10 1 DV", "Q10 2 DV", "Q10 3 DV", "Q10 4 DV", "Q10 5 DV") diff condition average <- diff condition average%>% mutate(joining ec = rowMeans(select(.,all of(diff ec)))) view(diff condition average) ###visualisation # Already done: Add condition labels and combine datasets easy condition average\$condition <- "Easy" diff condition average\$condition <- "Difficult" combined data <- bind rows(easy condition average, diff condition average) # Select and pivot to long format plot data <- combined data %>% select(condition, achievement total, power total, affiliationr total, manipulation check, identity, joining ec) %>% pivot longer(-condition, names to = "Measure", values to = "Score") # Summarize to get mean and SE for each measure by condition library(dplyr) library(ggplot2) plot_summary <- plot_data %>% group by(condition, Measure) %>% summarise(mean score = mean(Score, na.rm = TRUE), se = sd(Score, na.rm = TRUE) / sqrt(n()), .groups = "drop")# Plot with lines ggplot(plot_summary, aes(x = Measure, y = mean_score, group = condition, color = condition)) + $geom_line(size = 1) +$ geom_point(size = 3) + geom_errorbar(aes(ymin = mean_score - se, ymax = mean_score + se), width = 0.1) + labs(title = "Comparison of Easy and Difficult Conditions Across Measures", x = "Measure", y = "Mean Score") + theme minimal() + scale color manual(values = c("Easy" = "#4DB6AC", "Difficult" = "#FF8A65")) + theme(axis.text.x = element text(angle = 45, hjust = 1)) ###demographic data ##age Copy_of_Bachelor_Thesis_1_Mai_2025_06_11\$Q3_age <as.numeric(Copy of Bachelor Thesis 1 Mai 2025 06 11\$Q3 age) Copy of Bachelor Thesis 1 Mai 2025 06 11 %>% summarise(n = n(),mean age = mean(Q3 age, na.rm = TRUE), sd age = sd(Q3 age, na.rm = TRUE), min age = min(Q3 age, na.rm = TRUE), max age = max(Q3 age, na.rm = TRUE)##gender: 1=male 2=female table(Copy of Bachelor Thesis 1 Mai 2025 06 11\$Q2 gender) ##education: 1=no schooling 2=High school diploma etc 3=Bachelor 4=Master 5=PhD 6=Other table(Copy of Bachelor Thesis 1 Mai 2025 06 11\$Q5 education) ##nationality: 1=Netherlands 2=Germany 3=Others table(Copy of Bachelor Thesis 1 Mai 2025 06 11\$Q4 nationality) table(Copy of Bachelor Thesis 1 Mai 2025 06 11\$Q4 nationality other) ###correlations identity value dataset identity full <- fulldata %>% select(48:53,55:61) identity full %>% cor() #correlations needs needs full <- fulldata %>% select(10:24,26:40,42:44) needs_full %>% cor() #KMO

identity full %>% KMO() needs full %>%KMO() #Bartlett identity full%>% cortest.bartlett() needs full %>% cortest.bartlett() #Eigenvalues of Identity eigenIdentity <- identity_full %>% cor() %>% eigen() eigenIdentity\$values #Eigenvalues of needs eigenNeeds <- needs full %>% cor() %>% eigen() eigenNeeds\$values #scree plot of identity identity full %>% scree(, factors = FALSE) #scree plot of needs needs full %>% scree(, factors = FALSE) #cronbachs alpha alpha(identity full) alpha(needs full) ##visuals FOR AFFILIATION # Group affiliation into Low, Medium, High combined data\$aff group <- cut(combined data\$affiliationr total, breaks = quantile(combined dataaffiliationr total, probs = c(0, 0.33, 0.66, 1), na.rm =TRUE), labels = c("Low", "Medium", "High"), include.lowest = TRUE) # Plot ggplot(combined_data, aes(x = identity, y = joining_ec, color = aff_group)) + geom point(alpha = 0.6) + geom smooth(method = "lm", se = FALSE) + facet wrap(\sim condition) + labs(title = "Moderation of Affiliation on Environmental Identity \rightarrow Joining EC", x = "Environmental Identity", y = "Joining an Energy Community", color = "Affiliation Level") + scale color manual(values = c("Low" = "#FF8A65", "Medium" = "#FFD54F", "High" = "#4DB6AC")) + theme minimal() ###calculate mean and sd in easy condition for EI mean(rowMeans(easy condition average[, c("Q8 1", "Q8 2", "Q8 3", "Q8 4", "Q8 5", "Q8 6", "Q8 8", "Q8_9", "Q8_10", "Q8_11", "Q8_12", "Q8_13", "Q8_14")], na.rm = TRUE), na.rm = TRUE) sd (rowMeans(easy_condition_average[, c("Q8_1", "Q8_2", "Q8_3", "Q8_4", "Q8_5", "Q8_6", "Q8_8", "Q8_9", "Q8_10", "Q8_11", "Q8_12", "Q8_13", "Q8_14")], na.rm = TRUE), na.rm = TRUE) #same for difficult condition mean(rowMeans(diff_condition_average[, c("Q8_1", "Q8_2", "Q8_3", "Q8_4", "Q8_5", "Q8_6", "Q8_8", "Q8 9", "Q8 10", "Q8 11", "Q8 12", "Q8 13", "Q8 14")], na.rm = TRUE), na.rm = TRUE) sd (rowMeans(diff condition average[, c("Q8 1", "Q8 2", "Q8 3", "Q8 4", "Q8 5", "Q8 6", "Q8 8", "Q8 9", "Q8 10", "Q8 11", "Q8 12", "Q8 13", "Q8 14")], na.rm = TRUE), na.rm = TRUE) ##EoR; perceived difficulty #easy condition # Calculate the mean of a column mean value <- mean(easy condition average\$Q7 1 difficulty, na.rm = TRUE) # Calculate the standard deviation of a column sd value \leq sd(easy condition average\$Q7 1 difficulty, na.rm = TRUE) # Print the results print(paste("Mean: ", mean value)) print(paste("Standard Deviation: ", sd value)) #difficult condition # Calculate the mean of a column

mean value $d \le mean(diff condition average \$Q7 1 difficulty, na.rm = TRUE)$ # Calculate the standard deviation of a column sd value $d \le sd(diff \text{ condition average} Q7 \ 1 \ difficulty, na.rm = TRUE)$ ##t-test comparing both groups etc. # Group 1 (Environmental Identity) $mean_group1_EI \le 4.3048$ sd_group1_EI <- 0.9806 n_group1_EI <- 54 # Group 2 (Environmental Identity) mean group2 EI <- 4.4891 sd group2 EI <- 0.9476 n group2 EI <- 53 # Calculate t-statistic for Environmental Identity (EI) t stat EI <- (mean group1 EI - mean group2 EI) / sqrt((sd group1 EI^2 / n group1 EI) + (sd group2 EI^2 / n group2 EI)) # Calculate degrees of freedom for EI df EI <- ((sd group1 EI^2 / n group1 EI + sd group2 EI^2 / n group2 EI)^2) / (((sd group1 EI 2 / n group1 EI) 2 / (n group1 EI - 1)) + ((sd group2 EI 2 / n group2 EI) 2 / (n group2 EI - 1))) # Calculate p-value for EI p value EI <- 2 * pt(-abs(t stat EI), df EI) # Print results for Environmental Identity (EI) cat("t-statistic for EI:", t stat EI, "\n") cat("Degrees of Freedom for EI:", df_EI, "\n") cat("p-value for EI:", p_value_EI, "\n") # Group 1 (Ease of Retrieval) mean_group1_EoR <- 3.055 sd_group1_EoR <- 1.7953n group1 EoR <- 54 # Group 2 (Ease of Retrieval) mean group2 EoR <- 4.6603 sd group2 EoR <- 1.7314 n group2 EoR <- 53 # Calculate t-statistic for Ease of Retrieval (EoR) t stat EoR <- (mean group1 EoR - mean_group2_EoR) / sqrt((sd_group1_EoR^2 / n_group1_EoR) + (sd group2 EoR² / n group2 EoR)) # Calculate degrees of freedom for EoR df EoR <- ((sd group1 EoR 2 /n group1 EoR + sd group2 EoR 2 /n group2 EoR 2)/ $(((sd group1 EoR^2 / n group1 EoR)^2 / (n group1 EoR - 1)) + ((sd group2 EoR^2 / n group2 EoR)^2 / (n group1 EoR)^2 / (n grou$ (n group2 EoR - 1))) # Calculate p-value for EoR p_value_EoR <- 2 * pt(-abs(t_stat_EoR), df_EoR) # Calculate b (mean difference) b EoR <- mean group1 EoR - mean group2 EoR # Calculate Standard Error SE EoR \leq sqrt((sd group1 EoR²/n group1 EoR) + (sd group2 EoR²/n group2 EoR)) # Calculate critical t value for 95% CI t crit EoR <- qt(0.975, df EoR) # Two-tailed # Calculate confidence interval CI lower EoR <- b EoR - t crit EoR * SE EoR CI upper EoR <- b EoR + t crit EoR * SE EoR # Print results for Ease of Retrieval (EoR) cat("t-statistic for EoR:", t stat EoR, "\n") cat("Degrees of Freedom for EoR:", df EoR, "\n") cat("p-value for EoR:", p value EoR, "\n") cat("b (mean difference) for EoR:", b EoR, "\n") cat("95% CI for b: [", CI_lower_EoR, ",", CI_upper_EoR, "]\n") # Print results for Environmental Identity (EI) cat("t-statistic for EI:", t_stat_EI, "\n")

cat("Degrees of Freedom for EI:", df EI, "\n") cat("p-value for EI:", p_value_EI, "\n") # Print results for Ease of Retrieval (EoR) cat("t-statistic for EoR:", t_stat_EoR, "\n") cat("Degrees of Freedom for EoR:", df_EoR, "\n") cat("p-value for EoR:", p_value_EoR, "\n") ###hierarichal regression with EoR plus preparation ADD ##STEP 1 compute composite scores # Create DV (Joining EC) composite score fulldata\$EC <- rowMeans(fulldata[, c("Q10 1 DV", "Q10 2 DV", "Q10 3 DV", "Q10 4 DV", "Q10 5 DV")], na.rm = TRUE) # Create Need for Affiliation composite score fulldata\$nAff <- rowMeans(fulldata[, c("Q6 3 Aff", "Q6 4 Aff", "Q6 8 Aff", "Q6 12 Aff", "Q6 15 Aff", "Q6 22 Aff", "Q6 17 Aff", "Q6 27 Aff", "Q6 29 Aff", "Q6 31 Aff", "Q6 35 Aff")], na.rm = TRUE) ##STEP 2 center variables and create interaction # Center predictor and moderator fulldata\$EoR_c <- scale(fulldata\$Q7_1_difficulty, center = TRUE, scale = FALSE) fulldata\$nAff c <- scale(fulldata\$nAff, center = TRUE, scale = FALSE) # Create interaction term fulldata\$interaction <- fulldata\$EoR c * fulldata\$nAff c ##STEP 3 run hierarchical regression #main effects only; Block 1 model1_hier <- lm(EC ~ EoR_c + nAff_c, data = fulldata) tidy(model1 hier, conf.int = TRUE) #add interaction model2 hier \leq lm(EC ~ EoR c + nAff c + interaction, data = fulldata) tidy(model2 hier, conf.int = TRUE) ##STEP 4 review results summary(model1 hier) summary(model2 hier) #compare models anova(model1 hier, model2 hier) ###hierarichal model but with EI as first predictor THIS ONE WAS USED ##STEP1 compute EI composite fulldata\$EI <- rowMeans(fulldata[, c("Q8 1", "Q8 2", "Q8 3", "Q8 4", "Q8 5", "Q8 6", "Q8 8", "Q8 9", "Q8 10", "Q8 11", "Q8_12", "Q8_13", "Q8_14")], na.rm = TRUE) ##STEP 2 center variables and create interaction # Center EI and nAff fulldata\$EI c <- scale(fulldata\$EI, center = TRUE, scale = FALSE) fulldata\$nAff c <- scale(fulldata\$nAff, center = TRUE, scale = FALSE) # Create interaction term fulldata\$interaction_EI <- fulldata\$EI_c * fulldata\$nAff_c ##STEP3 run hierarchical regression #Block 1: MAin effects (EI and nAff) model1 EI <- $lm(EC \sim EI c + nAff c, data = fulldata)$ tidy(model1 EI, conf.int = TRUE) #add interaction model2 EI $\leq lm(EC \sim EI c + nAff c + interaction EI, data = fulldata)$ tidy(model2 EI, conf.int = TRUE) #STEP 4: view and compare results # Summaries summary(model1 EI) summary(model2 EI) # Model comparison anova(model1 EI, model2 EI)

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1. Normality of residuals shapiro.test(residuals(model2 EI)) # Visual check: Q-Q plot and histogram par(m frow = c(1, 2))qqnorm(residuals(model2 EI)); qqline(residuals(model2 EI)) hist(residuals(model2_EI), main = "Histogram of Residuals", xlab = "Residuals") # 2. Linearity and homoscedasticity plot(model2 EI\$fitted.values, residuals(model2 EI), main = "Residuals vs Fitted Values", xlab = "Fitted Values", ylab = "Residuals") abline(h = 0, col = "red")# 3. Multicollinearity: Variance Inflation Factor (VIF) install.packages("car") # only if not already installed librarv(car) vif(model2 EI) # 4. Optional: Outliers and influence (Cook's Distance) par(mfrow = c(1, 1))plot(model2 EI, which = 4) # Cook's distance ##assumption check model with EoR # 1. Normality of residuals shapiro.test(residuals(model2 hier)) # Visual check: Q-Q plot and histogram par(m frow = c(1, 2))qqnorm(residuals(model2_hier)); qqline(residuals(model2_hier)) hist(residuals(model2_hier), main = "Histogram of Residuals", xlab = "Residuals") # 2. Linearity and homoscedasticity plot(model2_hier\$fitted.values, residuals(model2_hier), main = "Residuals vs Fitted Values", xlab = "Fitted Values", ylab = "Residuals") abline(h = 0, col = "red")# 3. Multicollinearity: Variance Inflation Factor (VIF) install.packages("car") # only if not already installed library(car) vif(model2 hier) # 4. Optional: Outliers and influence (Cook's Distance) par(m frow = c(1, 1))plot(model2 EI, which = 4) # Cook's distance ###values for correlation matrix # Load required packages install.packages("dplyr") library(dplyr) library(psych) # 1. Create scale scores fulldata <- fulldata %>% mutate(EC = rowMeans(select(., Q10 1 DV:Q10 5 DV), na.rm = TRUE), EI = rowMeans(select(., Q8 1:Q8 14), na.rm = TRUE), nAff = rowMeans(select(., Q6_3_Aff, Q6_4_Aff, Q6_8_Aff, Q6_12_Aff, Q6 15 Aff, Q6 17 Aff, Q6 22 Aff, Q6 27 Aff, Q6 29 Aff, Q6 31 Aff, Q6 35 Aff), na.rm = TRUE)) # 2. Select variables for correlation cor data <- fulldata %>% filter(Q2 gender %in% c("1", "2")) %>% # Keep only Male (1) and Female (2) select(EC, nAff, EI, Q5 education, Q4 nationality, Q2 gender) # 3. Compute correlation matrix with descriptives cor results <- psych::describe(cor data) cor matrix <- psych::corr.test(cor data) #4. View results

###assumption-testing without EoR

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print(cor results, digits = 2) print(cor matrix\$r, digits = 2) # Correlation coefficients print(cor matrix\$p, digits = 3) # p-values ####compute average scores of question 9 rg. motivations; financial, environmental, involvement neighbourhood mean(fulldata\$Q9_1_money, na.rm = TRUE) sd(fulldata\$Q9_1_money, na.rm = TRUE) mean(fulldata\$Q9_2_environment, na.rm = TRUE) sd(fulldata\$Q9_2_environment, na.rm = TRUE) mean(fulldata $\overline{Q9}$ 3 neighborhood, na.rm = TRUE) sd(fulldata\$Q9 3 neighborhood, na.rm = TRUE) ###visualisation IV and DV # EI: Average of selected Q8 items fulldata\$EI_avg <- rowMeans(fulldata[, c("Q8 1", "Q8 2", "Q8 3", "Q8 4", "Q8 5", "O8 6", "O8 8", "O8 9", "O8 10", "O8 11", "Q8 12", "Q8 13", "Q8 14")], na.rm = TRUE) # WEC: Average of Q10 1 DV to Q10 5 DV fulldata\$WEC_avg <- rowMeans(fulldata[, c("Q10_1_DV", "Q10_2_DV", "Q10_3_DV", "Q10_4_DV", "Q10 5 DV")], na.rm = TRUE) # Plotting library(ggplot2) ggplot(fulldata, aes(x = EI avg, y = WEC avg)) +geom point(alpha = 0.6) + geom smooth(method = "lm", se = TRUE, color = "blue") + labs(title = "Effect of Environmental Identity on Willingness to Join an EC", x = "Environmental Identity (Average Score)", y = "Willingness to Join EC (Average Score)")+ theme minimal()