Universiteit Utrecht

The interplay of social comparison, social connectedness and environmental concern and how gender moderates these effects.

Abstract

In order to mitigate environmental change, it is vitally important for society to implement a wide range of measures, including reducing our daily consumption of electricity (IPCC, 2018). Enzler, Diekmann and Liebe (2019) found a strikingly large difference in environmental behaviour between men and women. A conceivable explanation for this conclusion is missing in the existing literature, while public policies regarding environmental change could be set up more effectively by understanding the apparently significant impact of gender. Therefore, the current study will contribute to the existing literature on environmental concern and public interest, by examining the unknown relationships between gender, social comparison, social connectedness and environmental concern. Statistical analyses were done with the original dataset from the study of Enzler, Diekmann and Liebe (2019). In line with the predicted relations, social comparison (n = 1364) and social connectedness (n = 1360) were found to positively correlate with environmental concern. In addition, women were found to report 29% more pro-environmental concern. However, no evidence was found to prove the moderating effect of gender on the predicting relations of social comparison and social connectedness on environmental concern.

Keywords: Environmental concern, gender, social comparison, social connectedness and climate change mitigation.

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1. Introduction

In order to mitigate environmental change, it is vitally important for society to implement a wide range of measures, including the reduction of our daily electricity consumption (Intergovernmental Panel on Climate Change, 2018). De Graaf (2007) describes in his book "Pursued Policy" how the effectiveness and efficiency of public policy is affected by the presence or absence of support among the population of a community. Since it is hardly possible for governments to exercise direct control on citizens their use of electricity, reducing electricity consumption is expected to be merely feasible when the majority of the population is willing to do so (Cho, Thyroff, Rapert, Park & Lee, 2013). Thus, it is valuable to gain insight into what motivates more sustainable energy consumption among citizens.

In order to understand some of the underlying mechanisms of pro-environmental behaviour, the study of Enzler, Diekmann and Liebe (2019) examined the relations between respondents' environmental concern, future orientation and the actual pro-environmental behaviour. Enzler, Diekmann and Liebe assumed that the measured use of electricity was a decent benchmark for measuring pro-environmental behaviour. In their study they present evidence for the predicting role of environmental concern and future concern for metered household electricity use. A high score on both environmental concern as well as future orientation is a predictor of a lower metered use of electricity. As a by-product of their study, Enzler, Diekmann and Liebe found that women roughly used 23% less electricity than men. This difference was still significant after controlling for relevant factors such as the respondents' income and the size of their apartment. These findings are in line with the majority of the other studies concerning the relation between gender and environmental behaviour. In line with the results of Enzler, Diekmann and Liebe (2019), Kollmuss and Agyman (2000) concluded, based on their literature study, that women were likely to act more climate-consciously than men. Just as Kollmuss and Agyman (2000), Zelezny, Chua and Aldrich (2000) carried out a literature study on environmentalism. Chua and Aldrich (2000) focused their attention on gender differences in environmentalism and found evidence that reported stronger environmental behaviour for women. Räty and Carlsson-Kanyama (2010) found in their study on energy consumption by gender in Germany, Norway, Greece and Sweden, evidence to conclude that men in Greece and Sweden used significantly more electric energy than women.

Although the studies of Enzler, Diekmann and Liebe (2019) and Räty and Carlsson-Kanyama (2010), among others, provide scientific evidence for the positive predicting relation between gender and environmental behaviour, it is unlikely that the strikingly large difference between women and men that was reported by Enzler, Diekmann and Liebe (2019), is the result

of a direct relation between these two variables. Hines, Hungerford and Tomera (1987), for instance, argue how knowledge about environmental change acts as a mediator between gender and environmental behaviour. Their study provides evidence to conclude that women are more concerned about the environmental change than men and that knowledge about environmental change has a mediation effect on this relation. Women were found to have greater knowledge about environmental change. Hines, Hungerford and Tomera (1987) concluded that this difference was explaining the found differences in environmental concern between men and women. Although these study is three decades old and a lot has changed in the meantime, it seems that there is a trend. Smith (2001) argues that feminism has a mediation effect. Smith found that the relation between gender and environmental regulation was suppressed by feminism and environmentalism. The study of Vicente-Molina, Fernández-Sainz and Izagirre-Olaizola (2018) indicates that differences between men and women in motivation and knowledge regarding environmental concern, are influential factors for pro-environmental behaviour. In other words, it is more plausible that there are other factors that predict electricity usage than gender in itself. One of these other factors is environmental concern. The predicting relation between environmental concern and environmental behaviour is supported by multiple studies (e.g. Enzler, Diekmann & Liebe, 2019; Gaspar & Antunes, 2011; Viklund, 2004).

The current study attempts to examine predictors for environmental concern that might differ per gender. In order to so, this study will look into the relationship between social comparison and social connectedness on the one hand and environmental concern on the other hand as well as how gender might have a moderation effect on these relationships. Although social comparison and social connectedness are neither mentioned in the study of Enzler, Diekmann and Liebe (2019), nor in many other scientific literature regarding environmental concern, there are indications in the literature that imply social comparison and social connectedness to be influential for pro-environmental behaviour and environmental concern. The study of Petkov, Köbler, Foth, Medland and Krcmar (2011), for instance, suggests that since environmental issues are important topics, people compare themselves on this. Flache (1996) describes how social connectedness can help solving social dilemmas, such as environmental change. There are also indications in the literature that imply that gender might affect the predicting relation between social comparison, social connectedness and environmental concern. The study of Steil and Hay (1997), for instance, concluded that women are more likely to compare themselves to others relative to men. According to the research of Cornwell, Laumann and Schumm (2008) women are more likely to experience higher levels of social connectedness than men. Since little is known about the predicting relation between

social comparison and social connectedness on the one hand and environmental concern on the other hand, and even less is known about how gender might moderate these effects, the research question of this thesis is:

"What are the predicting effects of social comparison and social connectedness on environmental concern and how does gender moderates these effects?"

The predicting effect of environmental concern on pro-environmental behaviour was already tested and has yielded a positive significant relationship by Enzler, Diekmann and Liebe (2019). Their findings are supported by the studies of Gaspar and Antunes (2011) and Viklund (2004). Since Cho et al. (2013) expected public policy regarding climate change mitigation to be the most effective when it is focussed on intrinsic motivation, this thesis will take a look into some of the underlaying mechanisms of environmental concern, one of the independent variables of the study of Enzler, Diekmann and Liebe (2019). The mechanisms that are central to this current study are social comparison and social connectedness. Although both of these variables were not mentioned in their study, both social comparison and social connectedness were questioned extensively during the survey of Enzler, Diekmann and Liebe (2019).

A considerable amount of scientific research has studied the underlying mechanisms responsible for the predicting relationship between gender and environmental concern (McCright & Xiao, 2014). However, scientific research into the relations between gender, social comparison, social connectedness and environmental concern is lacking. The current study will contribute to the existing literature on environmental concern, by examining the unknown relationships between gender, social comparison, social connectedness and environmental concern. It is important to understand why the study of Enzler, Diekmann and Liebe (2019) has found evidence to conclude that women exhibit more pro-environmental behaviour and more environmental concern than men. By understanding what the impact of gender is and what the explaining mechanisms behind this are, public policy could be more effectively setup in the future and could have a greater effect in order to reduce electricity consumption and mitigate climate change.

2. Theory

2.1 Environmental concern and the use of electricity

Environmental concern is an evaluation or attitude towards facts about environmental change (Fransson & Gärling, 1999). Based on the study of Enzler, Diekmann and Liebe (2019), one

may assume that if this current research finds a correlation between social comparison and social connectedness on the one hand and environmental concern on the other hand, it is plausible that this relation will predict the actual use of electricity as well. Enzler, Diekmann and Liebe (2019) have found evidence to prove that people who are more concerned about the environment, are also more likely to use less electricity. Enzler, Diekmann and Liebe assumed that the measured use of electricity was a decent benchmark for measuring pro-environmental behaviour. They expected that a higher environmental concern, meaning that a respondent was more concerned about the environmental change, would predict less use of electricity. After they controlled for relevant factors, such as the size of the apartment and income, Enzler, Diekmann and Liebe found a significant negative correlation between environmental concern and the use of electricity. In different words, Enzler, Diekmann and Liebe have found evidence to prove that people who are more concerned about the environment, are more likely to use less electricity. Environmental concern is therefore considered as a valid benchmark to predict environmental behaviour.

As argued by the Intergovernmental Panel on Climate Change (2018), the climate is changing for the worse and reducing the use of electricity can be seen as a public good. Reducing electricity usage is motivated by public interests such as clean air and climate change mitigation (Ohler & Billger, 2014). In this current study we assume, in line with the research of Enzler, Diekmann and Liebe (2019), that reducing the use of electricity is the public good and that pro-environmental concern is the corresponding attitude that leads to this behaviour.

The definition of environmental concern that was given by Fransson and Gärling (1999) claims that environmental concern refers to an attitude that directly leads to intentions that are corresponding with the attitude. However, Ohler and Billger (2014) argue that environmental concern is a social dilemma. A social dilemma is a situation in which the public good and the individual interests could conflict each other (Flache, 1996). Ohler and Billger (2014) concluded that acting more pro-environmental, and therefore reducing electricity usage, is in line with the public good, such as climate change mitigation. Pro-environmental behaviour involves an individual's effort to limit negative actions which may be harmful to the environment, but this effort to serve the public good could be contrary to individual interests. Thus, adapting pro-environmental behaviour will be at the expense of the personal comfort of using electricity. Therefore, environmental concern and environmental behaviour are assumed to be a social dilemma. As a consequence of this, there is a distinction between how people value environmental change mitigation and how they act towards this perception.

2.2 Social comparison and environmental concern

The study of Petkov et al. (2011) suggests that since environmental issues are important topics, people compare themselves on this. People tend to align their beliefs and behaviour to the beliefs and behaviour of their surroundings. This is explained by Festinger's social comparison theory (1954). The social comparison theory centres the belief that there is a drive within people to evaluate their opinions and abilities in relation to others. There is an universal desire to learn about the self and the world through comparison with others (Gibbons & Buunk, 1999). The more people compare themselves to others in terms of environmental concern, the more information about environmental change will become available to them. Social comparison ensures that people align their behaviour to the behaviour and beliefs of others. Social comparison is therefore focused on the respondent themselves. At first glance, opinions and abilities in the theory of Festinger (1954) are two different affairs. However, Festinger argued that they are both important aspects of social comparison, because they both affect behaviour to a great extent. Both someone's beliefs about how he or she should approach a situation and the personal abilities to act in a particular way are considered to have a significant effect on the actual individual response to a situation.

It can be argued that social comparison is affecting environmental concern because people tend to align their behaviour to the behaviour and beliefs of others (Gibbons and Buunk, 1999). Gibbons and Buunk claim that there are three motives for social comparison that could affect environmental concern and environmental behaviour: self-evaluation, self-enhancement and self-improvement. Self-evaluation is derived from the original social comparison theory from Festinger (1954). The study of Allcott (2011) concluded that individuals compare themselves to their surroundings and adapted their electricity usage to the electricity usage of their of neighbours. Within self-evaluation there are two elements: opinions and abilities. These elements are based on social norms. Ek and Söderholm (2008) found evidence to conclude that social norms affect the usage of green electricity to a great extent. The second motive of Gibbons and Buunk (1999), self-enhancement, has not been discussed in Festinger's theory, but is focused on self-esteem. People compare themselves to others in order to enhance their self-esteem in relation to uncertainty (Gibbons & Buunk, 1999). Gibbons and Buunk argue that social comparison will be promoted in situations where there is a lot uncertainty. Uncertainty regarding how to think about environmental change or about how to act upon environmental change could be overcome by taking the opinions and abilities of others as an example. Self-improvement, the last motive, has not been discussed in the original theory of Festinger (1954) either. Gibbons and Buunk (1999) argue that people compare themselves to others in order to

learn more about their own abilities, and improve them. Hines, Hungerford and Tomera (1987) designed a model of predictors of environmental behaviour and pro-environmental attitudes. An essential part in their model is the impact of knowledge of the issue, the knowledge of action strategies and the action skills within a person. Individuals are expected to improve their own abilities regarding pro-environmental behaviour, by learning from their surroundings.

In line with the model of Hines, Hungerford and Tomera (1987), Fishbein and Ajzen (1980) argue that people in essence are rational and that they 'make systematic use of information available to them'. Ek and Söderholm (2010) concluded, based on their study on Swiss electricity consumers, that electricity consumers found it hard to develop behaviours in everyday life that reduce electricity usage. As Hines, Hungerford and Tomera (1987), as well as Gibbons and Buunk (1999), described, the more information about environmental change is available to them, the more likely they are to change their attitude into a more favourable attitude according to environmental concern. Moreover, the more they are comparing themselves to others, the more expertise they will have to develop behaviours in everyday life that reduce electricity usage.

Based on the original theory of social comparison (Festinger, 1954), one may assume that the more people compare themselves to others in the field of environmental concern, the more they will adapt their opinion and abilities to the opinion and abilities from others. Furthermore, the more people compare themselves to others regarding a specific subject, the more information they will have about this subject (Gibbons & Buunk, 1999). These findings are supported by the study of Petkov et al. (2011), who concluded social comparison to be a motivator for the reduction of electricity usage. However, since the conclusions of Petkov et al. (2011) are based on a study with a very small number of respondents, further research is needed to clarify this. In line with the findings of Petkov et al. (2011) we expect people to compare themselves on environmental concern to their surroundings, since environmental issues are important topics in contemporary society. These findings indicate that respondents who are comparing themselves to others regarding environmental concern to a greater extent, are expected to adapt more pro-environmental opinions and are expected to be more concerned about environmental change. This is reflected in Hypothesis 1:

H1: "The more people compare themselves to others, the more they will be concerned about the environment."

2.3 Social connectedness and environmental concern

As argued by Ohler and Billger (2014), reducing the use of electricity is the public good and a social dilemma. A social network may help the subordination of individual benefits of electricity usage to the public good of environmental concern (Flache, 1996). Although almost the overall population is well aware of the significance of reducing the use of electricity, this is not in line with the individual interests. Adapting pro-environmental behaviour will be at the expense of individual benefits of electricity usage. Social connectedness can help solving a social dilemma, such as the dilemma to use less electricity for the public good (De Cremer, 2002; Flache, 1996; Homans, 1974). Social connectedness can be described as an attribute of an individual that reflects cognitions of enduring interpersonal closeness with the social world (Lee, Draper & Lee, 2001). Social connectedness starts to develop in the early childhood of a person and extends during the rest of someone's life (Baker & Baker, 1987; Lee & Robbins, 1995). When people are young, attachment towards others provides feelings of safety and broad appreciation. When people become older, the feelings of attachment in the past and in the present together can provide a relatively stable sense of connectedness (Lee, Draper & Lee, 2001).

Being socially connected to your social environment means that you are part of a social network. Social networks are groups wherein social interaction takes place and wherein information is exchanged (Barlett-Brag, 2006). A social networks has various kinds of social functions. According to Heaney and Israel (2008) these are social influence, social control, social undermining, social comparison, social companionship and social support. In an early study on the functioning of social networks, House (1981) described how social networks are used to gain emotional support, like self-esteem, affection, trust, concern and listening and appraisal support, such as affirmation, feedback and social comparison. Social influence and social control are the two main functions of social networks that play a part in influencing people's attitudes and behaviour about daily situations like pro-environmental behaviour, trough social exchange (Cook, Cheshire, Rice & Nakagawa, 2013).

According to Flache (1996), the social cohesion within a social network encourage the willingness of individuals to think about the public good and act upon it. According to Cook, Cheshire, Rice and Nakagawa (2013) the willingness to act upon the public good is based on the ideas of social exchange. They argue that the principle of social exchange is for an individual to act upon the interest of another person 'while there is a general expectation of some future return'. Based on these findings, due to social exchange, a social network will help the

subordination of individual benefits of electricity usage to the public good of environmental concern.

People with a low sense of connectedness tend to feel interpersonally distant from other people and from the world at large (Lee, Draper & Lee, 2001). They will be less connected to a social network and they are less likely to have a strong feeling of involvement with their social environment and their beliefs and interests. People with a low sense of social connectedness are therefore expected to be less concerned about the environmental change. By contrast, people with a high sense of connectedness will have a stronger feeling of involvement with their social environment and are therefore expected to be more concerned about the environmental change. According to these findings, Hypothesis 2 is expressed as follows:

H2: "The more people are connected to their social environment, the more they will be concerned about climate change."

2.4 The role of gender on social comparison

According to Festinger (1954), social comparison is the drive within people to evaluate their opinions and abilities in relation to others. Some type of people may be more inclined to engage in social comparison than others (Steil & Hay, 1997) and therefore there could be disparities in environmental concern between social groups who are comparing themselves to a greater extent than others. According to the results from the study of Steil and Hay (1997), women are more likely to compare themselves with others than men. The authors gave some possible explanations for the found difference in social comparison. Autonomy and dominance were assumed to explain the lower level of social comparison of men. By contrast, nurturance and affiliation were given as explanations for the higher level of social comparison of women. Steil and Hay (1997) concluded that women in general assessed maintaining their social relationships as more important than expressing dominance. The study of Lengua and Stormshak (2000) argues that women are more focussed on social support than men. These findings are in line with the findings of Steil and Hay (1997). Both studies concluded that women are more affected by their surroundings than men. Therefore it seems reasonable to argue that women are more likely to align their behaviour to the behaviour and beliefs of others, regarding environmental concern.

The finding of Steil and Hay (1997) that women compare themselves more with others than men, seems like a finding that needs further research. The differences with regards to what elements of success men and women compare themselves on, seem to have more support.

Women compare themselves based upon other elements of success (Acker, 1992). This is called 'gender socialization' (McCright & Xiao, 2014). According to the article of Alesina, Giuliano and Nunn (2013) the appropriate role of women in society differs from the appropriate role of men. The study of Deaux and Lewis (1984) indicates that gender stereotypes may be based on some sort of 'core' masculinity and femininity. Deaux and Leweis (1984) argue that femininity goes hand in hand with caretaking and masculinity goes with dominance. This idea was supported by the study of Ebert, Steffens and Kroth (2014). Ebert, Steffens and Kroth found evidence to support that women were indeed more focussed on social warmth. Kachel, Steffens and Niedlich (2016) argued, based on the findings of Deaux and Lewis (1984), that individuals use such core masculinity and femininity for developing their self-construal.

The different expected gender roles for women and men are the foundation for different elements to measure personal success. The differences in elements that are used to measure personal success are therefore socially constructed (Fischer, Reuber & Dyke, 1993). In their paper, Adler, Kless and Adler (1992), argued that men tend to be more competitive in social interaction, where women are more focussed on the pleasure of social contact. Adler, Kless and Adler claimed that men generally are more focused on being independent where women tend to be more focused on their relationships with others. According to Heilman, Wallen, Fuchs and Tamkins (2004), the success of men is to a large extent measured based upon financial success and career development. Women, however, are assumed by Heilman and colleagues to be more socially sensitive and are being judged on their service-oriented communal traits for which women are positively valued. O'Neil, Helms, Gable, David and Wrightsman (1986) described in their paper the 'fear of femininity'. According to their model, men are afraid to be regarded as a female by other members of the society and in order to avoid being regarded as a female, men act conform to the expected behaviour. Evidence for the fear of femininity was also found by Szymanski and Carr (2008). The research of Szymanski and Carr (2008) revealed that gender role conflicts were related to a lower reported self-esteem. Szymanski and Carr (2008) argued that men in general are therefore focussed on restricting emotional feelings, are obsessed with personal achievements and show independency. Women, by contrast, are according to Szymanski and Carr (2008) more focussed on emotional feelings and the beliefs and opinions of others. This will have an effect on how men and women value the opinion of others (Szymanski & Carr, 2008).

Based on these findings one can argue that women are not only more likely to compare themselves to others, but that they are also more likely to think and act towards the public interest, because they are expected to do so, due to gender roles. Since Petkov et al. (2011)

suggests that, due to the importance of environmental issues, people compare themselves on this, women are expected to change their attitudes and behaviour towards environmental change, based upon the opinions of their social environment, to a larger extent. Hypothesis 3 is based upon these findings:

H3: "The relation between social comparison and environmental concern is stronger for women than for men."

2.5 The role of gender on social connectedness

Reducing the use of electricity is the public good and at the same time it is a social dilemma (Flache, 1996). According to Flache, the social cohesion within a social network encourages the willingness of individuals to think about the public good and act upon it. In this way, a social network can help solving a social dilemma (Homans, 1974). The stronger the participants within a social network are connected to each other, the more they will be influenced and controlled by the interests of the majority within this social network. Therefore, there could be disparities in environmental concern between social groups with higher levels of social connectedness and social groups with lower levels of social connectedness.

According to the research of Cornwell, Laumann and Schumm (2008) about the social connectedness of adults in the United States, women are slightly more likely to experience higher levels of social connectedness than men. Scientific support is there for the findings of Cornwell et al. (2008) that show that women have significantly larger social networks than men (e.g. Ajrouch, Blandon & Antonucci, 2005; Gurung, Taylor & Seeman, 2003). The study of Gurung et al. (2003) found that, unlike men, women in general were using multiple kinds of relationships in their social network. Men were to a large extent focussed on their spouses, whereas women were more likely to also use their relations with friends and relatives. Thus, the social networks of women were not only larger, but were also more diverse. These divers social networks consists out of weak ties, as they are called by Granovetter (1983). In his widely cited work, Granovetter (1983) described the difference between strong ties and weak ties. Strong ties are the relations with people that are close to someone. Weak ties are the relations with people that are less close to someone. A social network of someone consists of both strong ties (e.g. spouses) as weak ties (e.g. acquaintances). According to Granovetter, every single network has its own sources of information and therefore his own knowledge. Where strong ties are supposed to share a social network, the weak ties within a social network are all maintaining a social network on their own and therefore are supposed to serve as a bridge

between different social networks. Individuals with a more extensive social network are therefore expected to be exposed to a more varied flow of information.

When taking the theory of weak ties by Granovetter (1983) and the findings of Ajrouch, Blandon and Antonucci (2005), Cornwell Laumann and Schumm (2008) and Gurung, Taylor and Seeman (2003), we expect women to have a larger and more varied social network. These findings, along with the findings of Flache (1996) regarding social networks and social dilemma's , indicate that women will show more willingness to think about the public good of using less electricity and have more environmental concern than men. Hypothesis 4 is based upon these findings:

H4: "The relation between social connectedness and environmental concern is stronger for women than for men."

All of the expected relationships may be found in Figure 1.

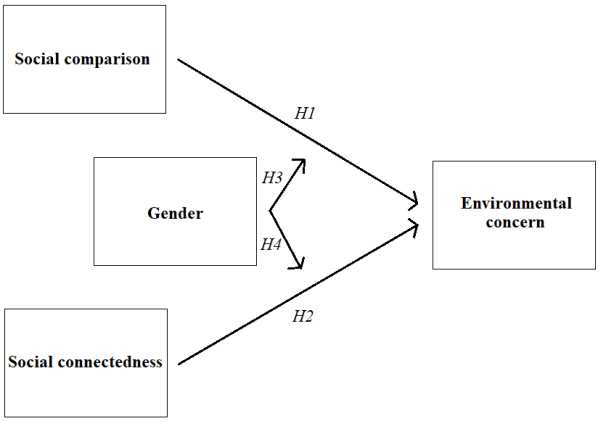

Figure 1. Moderation effect gender on the predicting relation between social comparison and social connectedness and environmental concern.

3. Method section

3.1 Data

In order to find out to what extent social comparison and social connectedness predict environmental concern and how gender has a moderation effect on these relations, the researcher was fortunate to have been able to use the original dataset from Enzler, Diekmann and Liebe (2019). The data was collected by carrying out an online survey in the German-speaking part of Switzerland. Enzler, Diekmann and Liebe did this in cooperation with one of the energy suppliers in Switzerland in 2016. The survey originally focussed on environmental

concern and the CFC scale[1]. Initially 10.000 consumers of the utility company were asked to fill out an online survey. The survey was introduced as a survey about energy use, instead of saving energy. As a consequence, potential self-selection was minimised. As 1.392 consumers responded on this request, the response rate was approximately 14%. The original study of Enzler, Diekmann and Liebe (2019) made a distinction between respondents who reported to live in an one-person household and other households. This distinction was not made in this current study.

The anonymity of the respondents was ensured before respondents started the survey and Enzler, Diekmann and Liebe (2019) ensured that the researchers did at no point know the identity of the respondents. Due to ensuring anonymity, the impact of the feeling of being observed or being part of an experiment on the behaviour of a respondent will be reduced to a minimum. This effect is known as the 'Hawthorne effect' (Schwartz, Fischhoff, Krishnamurti & Sowell, 2013). By ensuring anonymity, this bias was avoided. Ensuring anonymity will therefore be conducive for the reliability of the used data.

Enzler, Diekmann and Liebe (2019) concluded that the composition of the respondents in their dataset was not a completely accurate representation of the Swiss population. Approximately 63% of the respondents in the dataset is male, while, according to the Swiss Federal Statistical Office (2018), only 49% of the actual Swiss population is male. Furthermore, the respondents in the dataset were on average older than the general population of Switzerland. The average age of the respondents was 54 years old, while the average age of the Swiss population is 49 years old (Swiss Federal Statistical Office, 2018).

3.2 Variables

In this current study, there are four variables which were questioned in the original questionnaire of Enzler, Diekmann and Liebe (2019). The questions may be found in Table 2 below. Before the different topics were converted into variables, internal consistency of these questions was measured by calculating their Cronbach's Alpha scores. Based on the Cronbach's Alpha's scores that are reported in Table 1, we may conclude that all of the topics reached the minimum value of Cronbach's Alpha of $\alpha = .700$ and therefore we can assume that there exists internal consistency within the questions. Since internal consistency within the questions has been demonstrated, the different topics may be combined into the corresponding variables (Allen, Bennett & Heritage, 2014).

[1] For more information about the CFC scale, see Enzler, H., Diekmann, A., &; Liebe, U. (2019). Do environmental concern and future orientation predict metered household electricity use? Journal of Environmental Psychology, 62 (February), 22–29.

Environmental concern, the dependent variable of this current study, was questioned by nine items (α = .866). A five-point response scale ranging from "does not apply at all" to "applies fully" was used to categorise the answers. The variable environmental concern range from 1 to 5 (i.e. the sum of response scores divided by the number of questions). On average, the respondents scored 3.832 on this scale. The descriptive statistics may be found in Table 1.

In the original survey of Enzler, Diekmann and Liebe (2019), social comparison and social connectedness were questioned separately. From the 1.392 participants of the original study, 1364 participants submitted valid answers to all questions concerning social comparison and 1.360 participants submitted valid answers to all questions concerning social connectedness. To ensure that no valuable information was lost, the predicting relations concerning social comparison and social connectedness were tested separately. The statistical analyses regarding social comparison, gender and environmental concern were tested in Model 1 and Model 2. The analyses regarding social connectedness, gender and environmental concern were tested in Model 3 and Model 4.

Table 1. Descriptive statistics (Model 1 & 2: n = 1364, Model 3 & 4: n = 1360)

Variable	*Minimum*	*Maximum*	*Mean (μ)*	*Std. dev.*	*Cronb. α*
Environmental concern	1.11	5.00	3.832	0.727	.866
Social comparison	1.00	5.00	2.851	0.683	.754
Social connectedness	1.43	5.00	3.030	0.503	.775
Gender (female = 1)	0	1	0.423	0.494	-

Social comparison was measured by six items (α = .754). As with ‘environmental concern’ a five-point response scale ranging from "does not apply at all" to "applies fully" was used to categorise the answers. The variable social comparison ranged from 1 to 5 and the respondents scored 2.851 on average on this scale (i.e. the sum of response scores divided by the number of questions). This independent variable is used for Model 1 and Model 2. There were 1364 respondents who submitted a valid answer to environmental concern, social comparison and gender. The respondents who did not submit a valid answer to all of the questions regarding environmental concern, social comparison and gender were excluded from the analyses. This concerns 2% from the 1.392 persons that participated in the survey.

To measure social connectedness, the survey asked the respondents how closely associated they were with seven types of persons around them (α = .775). The answers were categorised in a five-point response scale ranging from "not at all" to "very much". Social connectedness ranged from 1 to 5 and on average the respondents scored 3.030 on the scale (i.e.

the sum of response scores divided by the number of questions). This variable was used for Model 3 and Model 4. There were 1360 respondents who submitted a valid answer to environmental concern, social connectedness and gender. The respondents who did not submit a valid answer to all of the questions regarding environmental concern, social connectedness and gender were excluded from the analyses. This concerns 2,3% of the 1.392 persons that participated in the survey.

Table 2. Items questioned in the survey for the used variables

	Item text
Environmental concern	It bothers me when I think about the environmental conditions in which our children and grandchildren will probably have to live. If we continue down the same path, we are heading toward an environmental catastrophe. If I read news or watch TV news reports about environmental problems, I often become outraged and angry. There are limits on growth that our industrialized world has already exceeded or will soon reach. Most people in this country still do not act in an environmentally conscious way. In my opinion, many environmentalists exaggerate claims about environmental threats. * Politicians still do not do enough to protect the environment. In order to protect the environment, we should all be willing to reduce our current standard of living. Actions to protect the environment should be implemented even if they cause job losses.
Social comparison	I value how I handle things compared to others a lot. I compare my social skills and politeness a lot with other people. I am not one to compare himself to others a lot. * I am trying to figure out how other people think when they are confronted with similar problems. I want to know how other people act in comparable situations. Whenever I want to learn something, I try to figure out how other people think about it or what they know about it.
Social connectedness	My family. My friends. My close neighbours. The people in my neighbourhood. The people who are living in Bern. The people who are living in the German-speaking part of Switzerland. The persons who are living in Switzerland.
Gender	I am male / I am female

Notes: a. Items were derived from Enzler, Diekmann and Liebe (2019).

b. Items were originally asked and answered in German.

* Items with stars were reverse-scored before creating the indexes.

Gender, the moderation variable or interaction variable in this current study, was measured as a dichotomous variable. Respondents had to answer whether they were male or female. Men are represented by a 0 and women by a 1. Partly because gender was reduced to a dichotomous variable, 26 respondents did not submitted a valid answer. This is 1,9% of the

total amount of respondents in the dataset. Respondents who did not submit a valid answer were excluded from the analyses in the current study.

3.3 Analytical approach

The quantitative data has been analysed with the use of SPSS (IBM Statistics SPSS 25). As the research question examines the relation between the dependent variable and multiple independent variables (e.g. social comparison, social connectedness, gender and an interaction variable) that were simultaneously entered into the regression equation, the four hypotheses were analysed by means of two simultaneous multiple regression models with both a single dummy variable. The hypotheses regarding social comparison were tested in Model 1 and Model 2. The hypotheses regarding social connectedness were tested in Model 3 and Model 4. Therefore, their results are discussed separately as well.

The various questioned topics from Table 2 were converted into the variables that were used for the analyses: environmental concern, social comparison, social connectedness and gender. Before running and interpreting the multiple regression analyses, four assumptions have to be considered (Allen, Bennett & Heritage, 2014). First, boxplots and stem-and-leaf plots were used to test the four variables for normality and potential univariate outliers. Thereafter, Mahalanobis Distance was used to test for multivariate outliers. The third assumption, multicollinearity, was tested by the Tolarance and de VIFs. The last assumption, homoscedasticity, was tested with the scatterplot of residuals. The results of these tests will be discussed in the next part before the substantive results of the statistical analyses are displayed.

Two dummy variables were made in order to analyse the expected interaction effect: one dummy variable was made for gender and social comparison and one dummy variable was made for gender and social connectedness. The effects concerning social comparison (i.e. Hypotheses 1 and Hypotheses 3) are analysed in Model 1 and Model 2. The effects concerning social connectedness (i.e. Hypotheses 2 and Hypotheses 4) are analysed in Model 3 and Model 4. The detailed syntax may be found in appendix A.

4. Results

4.1 Social comparison and environmental concern

4.1.1 Assumptions of the regression procedure

According to Allen, Bennett and Heritage (2014) four assumptions of a regression model should be evaluated before the substantive results of our study can be analysed. First, stem-and-leaf plots and boxplots for the predictors social comparison and gender were analysed. These plots

indicated that there were no univariate outliers and that the variables were normally distributed. Second, analysing Mahalanobis distance for multivariate outliers showed that the critical X^2 for *df* = 2 (at α = .001) of 13.816 was not exceeded with a Mahalanobis distance of 11.171 (Allen, Bennett & Heritage, 2014). Third, the relatively high amount of tolerance (.993) and low amount of VIF (1.007) indicated the absence of multicollinearity. Finally, the Plot of Regression Standardized Residuals and the Scatterplot of Standardized Residuals showed the normal distributed residuals. Based on these findings, the four assumption of the regression analysis were met and the content analyses could be carried out (Allen, Bennett & Heritage, 2014).

4.1.2 The substantive results regarding social comparison

In combination, social comparison, gender and the interaction variable for gender and social comparison accounted for a significant 6.4% of the variability in environmental concern, R^2 = .064, adjusted R^2 = .063, F (3, 1360) = 26.274, p < .000. The unstandardized regression coefficients (B), standardised regression coefficients (β) and standard errors (s.e.) for each predictor in Model 1 may be found in Table 3.

Model 1 has tested Hypothesis 1 and Hypothesis 3. De results of these analysis may be found in Table 3. Positive correlation effects were found for both social comparison and gender on environmental concern. Additionally a negative moderation effect of gender on the predicting relation between social comparison and environmental concern was found. However, as the results in Table 3 show, the moderation effect of gender on the predicting relation of social comparison on environmental concern has not found to be statistically significant (β = -.111, *t* = -.778, *p* = .436). Therefore there is no evidence that support Hypothesis 3 and therefore it has to be rejected.

Due to the statistical non-significant moderation effect of gender on the predicting relation of social comparison on environmental concern, the statistical analyses of the data has been redone without the interaction variable. Model 2 in Table 3 below reflects the statistical results of this analysis. In combination, social comparison and gender accounted for a significant 5,4% of the variability in environmental concern, R^2 = .054, adjusted R^2 = .053, F (2, 1361) = 19.199, p < .000. Redrafted, 5,4% of the variance in environmental concern within this dataset can be explained by social comparison and gender. As can be seen in Model 2, social comparison has a positive predicting effect on environmental concern. The analyses shows this predicting effect is statistical significant (β = .108, *t* = 4.095, *p* < .000). A one-unit increase of social comparison on the used scale was associated with an increase of 15,5% of environmental concern after controlling for gender. The effect size for the multiple regression

analysis was defined by calculating Cohen's f^2. Cohen's f^2 for $R^2 = .054$ is .057. According to Cohen (1988) this is considered to be a small effect. These results are in line with Hypothesis 1 and therefore this hypothesis is further supported. Model 2 also tested the findings of, inter alia, Kollmuss and Agyman (2000) and McCright and Xiao (2014). In line with their findings, gender was found to have a positive predicting effect on environmental concern. In the survey, women responded 29% higher on environmental concern. This finding is also in line with the assumptions of Enzler, Diekmann and Liebe (2019).

Table 3. Model 1 & 2: Social comparison, gender and environmental concern

	Variable	*B* [95% CI]	*β*	*s.e.*	*t*	*Sig.*
Model 1	Environmental concern (constant)	2.917 [2.421, 3.413]***	-	.253	11.536	.000
	Social comparison	.179 [.009, .350]*	.168	.087	2.064	.039
	Gender (female = 1)	.417 [.089, .745]*	.283	.167	2.496	.013
	Gender on social comparison	-.044 [-.155, .067]	-.111	.057	-.778	.436
Model 2	Environmental concern (constant)	3.099 [2.912, 3.287]***	-	.096	32.425	.000
	Social comparison	.155 [.060, .171]***	.108	.028	4.095	.000
	Gender (female = 1)	.290 [.214, .367]***	.197	.039	7.463	.000

Notes: a. N = 1364. *b.* CI = confidence interval. * $p < .05$. ** $p < .01$. *** $p < .001$.

4.2 Social connectedness and environmental concern

4.2.1 Assumptions of the regression procedure

The four assumptions of a regression model of Allen, Bennett and Heritage (2014) were evaluated before the substantive results of our study were analysed. First, stem-and-leaf plots and boxplots for the predictors social connectedness and gender were analysed. These plots indicated that there were no univariate outliers and that the variables were normally distributed. Second, analysing Mahalanobis distance for multivariate outliers showed that the critical X^2 for $df = 2$ (at $\alpha = .001$) of 13.816 was exceeded with a Mahalanobis distance of 16.312 (Allen, Bennett & Heritage, 2014). The multivariate outliers have been identified and none of the outliers exceeded the maximum of Cook's Distance of 1. The maximum value of the individual cases on Cook's Distance was .020. The outliers were therefore not removed from the dataset. Third, the relatively high amount of tolerance (.997) and low amount of VIF (1.003) indicates the absence of multicollinearity. Finally, the Plot of Regression Standardized Residuals and the Scatterplot of Standardized Residuals showed the normal distributed residuals. Since the variables of the current study comply with the assumptions for the regression model of Allen, Bennett and Heritage (2014) were met, the substantive results of our study could be analysed.

4.2.2 The substantive results regarding social connectedness

In combination, social connectedness, gender and the interaction variable for gender and social connectedness accounted for a significant 6.5% of the variability in environmental concern, R2 = .065, adjusted R2 = .062, F (3, 1356) = 31.176, p = .000. The unstandardized regression coefficients (B), standardised regression coefficients (β) and standard errors (s.e.) for each predictor in Model 3 may be found in Table 4.

Model 3 has tested Hypothesis 2 and Hypothesis 4. As can been seen in Model 3, positive effects for both social connectedness and gender on environmental concern and a negative moderation effect of gender on the predicting effect of social connectedness on environmental concern, meaning the effect of social connectedness on environmental concern might be smaller for women was found. However, as can be seen in Model 3 as well, the effect of the interaction variable 'gender on social connectedness' did not reached statistical significance (β = -.121, t = -.664, p = .507). The lack of significance suggests that there is no statistical evidence to prove Hypothesis 4. No evidence has been found to prove that gender has a moderation effect on the predicting relation between social connectedness and environmental concern. Therefore Hypothesis 4 has to be rejected.

Because of the absence of a statistically significant interaction variable, the statistical analyses of the data has been redone without the interaction variable. The results of this analyses may be found in Model 4 in Table 4 below. In combination, social connectedness and gender accounted for a significant 6,4% of the variability in environmental concern, R^2 = .064, adjusted R^2 = .063, F (2, 1357) = 46.563, p < .000. In other words, 6,4% of the variance in environmental concern within this dataset can be explained by social comparison and gender. The effect size for the multiple regression analysis was defined by calculating Cohen's f^2. Cohen's f^2 for R^2 = .063 is .067. According to Cohen (1988) this is considered to be a small effect. Model 4 provides evidence that support the predicting relation of both social connectedness and gender on environmental concern. First, social connectedness has been found to positively correlate with environmental concern. This relation was found to be statistical significant (β = .147, t = 5.604, p < .000). A one-unit increase of social connectedness on the used scale was associated with an increase of 21,2% of environmental concern after controlling for gender.

These findings suggest that Hypothesis 2 is supported. Secondly, gender has been found to positively correlate with environmental concern as well. This predicting effect was found to be significant (β = .199, t = 7.552, p < .000). After controlling for social connectedness, the difference between men and women concerning environmental concern was found to be 29,3%. Women were found to be 29,3% more concerned about the environment. This result

corresponds to the results in Model 2 of Table 3. The minimal increase in respondents in Model 4 compared to Model 2 hardly changed the results of the statistical analyses.

Table 4. Model 3 & 4: Social connectedness, gender and environmental concern

	Variable	*B* [95% CI]	*β*	*s.e.*	*t*	*Sig.*
Model 3	Environmental concern (constant)	2.564 [1.875, 3.253]***	-	.351	7.296	.000
	Social connectedness	.284 [.059, .509]*	.197	.115	2.478	.013
	Gender (female = 1)	.449 [-.019, .916]	.305	.238	1.883	.060
	Gender on social connectedness	-.051 [-.203, .100]	-.121	.077	-.664	.507
Model 4	Environmental concern (constant)	2.782 [2.534, 3.029]***	-	.126	22.055	.000
	Social connectedness	.212 [.138, .287]***	.147	.038	5.604	.000
	Gender (female = 1)	.293 [.217, .369]***	.199	.039	7.552	.000

Notes: a. N = 1360. *b.* CI = confidence interval. * $p < .05$. ** $p < .01$. *** $p < .001$.

5. Conclusion and discussion

5.1 Conclusion

As a by-product of their study towards environmental concern, future orientation and metered household electricity usage, the original study of Enzler, Diekmann and Liebe (2019) found a gap of 23% between the use of electricity of men and the use of electricity of women. In their study, they provided evidence to conclude that environmental concern has a predicting effect on environmental behaviour. This current study attempted to find an explanation for the found difference in electricity usage between men and women by Enzler, Diekmann and Liebe (2019) and to provide evidence for this explanation. The statistical analyses, based on the original dataset of Enzler, Diekmann and Liebe (2019), were therefore used to answer the following research question: "What are the predicting effects of social comparison and social connectedness on environmental concern and how does gender moderates these effects?".

The first hypothesis predicted a higher reported environmental concern for respondents who reported more social comparison. The statistical analyses showed that indeed there is a predicting relationship between social comparison and environmental concern. Evidence was found to conclude that people who compare themselves to others to a larger extent, will be more concerned about environmental change. This conclusion provides evidence to assume that comparison with a social environment is conducive for environmental concern. Festinger (1954) stated in his theory of social comparison that there is a universal desire to learn about the self and the world through comparison with others. Gibbons and Buunk (1999) argued that social comparison ensures that people align their behaviour to the behaviour and beliefs of others. Based upon our conclusions, one can argue that these theories also apply to adapting a

more pro-environmental attitude. Based on these findings, one might conclude that taking social comparison into account could help to reduce electricity usage. This conclusion is in line with the findings of both Allcott (2011) and Petkov et al. (2011), which both provide evidence to conclude that individuals compare themselves to their surroundings and adapted their electricity usage to the electricity usage of their of surroundings.

The second hypothesis predicted a higher reported environmental concern for respondents who reported stronger connections with their social environment. This current study provides evidence to conclude that people who feel more connected to their social environment are more concerned about the environment. Since group benefits ask for the sacrifice of individual benefits, pro-environmental behaviour is a social dilemma. However, as described by Flache (1996), a social network can help solving a social dilemma. The social cohesion within a social network encourages the willingness to think and act upon the public good. Lee, Draper and Lee (2001) argued how a feeling of involvement is derived from a feeling of connectedness. Based on these findings, we may conclude that taking social connectedness into account could improve the reduction of electricity usage. The current findings are in line with the findings of findings of De Cremer (2002), Flache (1996) and Homans (1974), who concluded that socially connectedness may help solving social dilemmas.

Contrary to the first and the second hypothesis, no evidence was found to support the hypotheses regarding the moderation effect of gender, neither for social comparison, nor for social connectedness. Although no evidence was found to support the moderation effects, gender still remains a predictor of environmental concern. The current study found a difference of roughly 29% in environmental concern between men and women. Women reported approximately 29% more environmental concern than men. These findings are in line with previous studies (e.g. Finucane et al., 2000; McCright & Xiao, 2014; Xiao & McCright, 2012).

In summary, the current study investigated the moderation effect of gender on the relationship between social comparison and social connectedness on the one hand and environmental concern on the other hand. Both social comparison and social connectedness were found to have a predicting effect on environmental concern. Higher scores on social comparison or social connectedness were both associated with a higher level of environmental concern. Gender was not found to be a moderator for either the relation between social comparison and environmental concern, or for the relation between social connectedness and environmental concern. Gender difference in environmental concern was found, with women reporting roughly 29% more pro-environmentally. However, this only supports the findings of Enzler, Diekmann and Liebe (2019) and does not explain them.

5.2 Discussion and future research

The current study stated the objective to contribute to the existing literature by examining the unknown relationships between gender, social comparison, social connectedness and environmental concern. Social comparison, social connectedness and gender were all found to predict environmental concern. However, from the point of view of our results, it should be noted that there are some comments to make. First, Enzler, Diekmann and Liebe (2019) concluded that the composition of the respondents in their dataset was not a completely accurate representation of the Swiss population. Moreover, Enzler, Diekmann and Liebe (2019) argued that a major limitation of the used data is potential self-selection. The response rate was low, as only 1.392 of the initially 10.000 customers of the energy supplier completely filled out the questionnaire. Despite the fact that the researchers introduced their study as a research about energy use, instead of energy saving, it cannot be excluded that a disproportionate part of the sample consisted of environmentally motivated respondents. In addition, the analyses of the current study are based upon self-reported data from the survey of Enzler, Diekmann and Liebe (2019). Therefore there is a danger that respondents reacted socially desirable on the questions asked in the survey. However, according to Enzler, Diekmann and Liebe, this so called 'Hawthorne effect' was avoided by ensuring anonymity.

Second, in this current study, the moderation-effect of gender was tested with a single survey question about gender. On this question respondents could apply with either male or female. Therefore, the variable 'gender' was reduced to a dichotomous variable. However, it is questionable whether gender, within the current society, should be measured as a dichotomy or a continuum (Doan, 2010). Future research could explore if gender measured as a continuum would change the results of our analyses.

Third, within the current study, social influence was assumed to be corresponding with the public good, meaning pro-environmental concern. However, pro-environmental concern is not shared by all members of the society. Therefore people will probably also be exposed to people who are less pro-environmental. Social connectedness, in this study, was measured by the amount of contact with seven types of people in a respondents network. Because the attitudes towards environmental change were not asked to these seven people, there was not made a distinction between the people who were supposed to positively influence the environmental concern and those who would negatively influence the environmental concern. Future research is needed to clarify the effects of different attitudes towards environmental concern.

Fourth, the first hypothesis of the current study was based on the model of social comparison of Gibbons and Buunk (1999). In their model, they outlined three motives for social comparison, to know self-evaluation, self enhancement and self-improvement. Although this current study provides evidence to conclude the model of Gibbons and Buunk (1999) to be wright, it is unclear which motive is the most relevant for affecting social comparison. Future research may want to examine the exact manner in which the model of Gibbons and Buunk (1999) is applicable to predicting environmental concern.

Lastly, the main effects of social comparison and social connectedness were found to be significant. However, both social comparison and social connectedness were found to count for only a small part of the variance in environmental concern. Therefore, one should be careful with the interpretation of the results of the current study.

Although women in this current study reported 29% more environmental concern than men, gender was not found to moderate the predicting relations between social comparison, social connectedness and environmental concern. The two assumed moderation effects were therefore rejected. First, the study of Alesia, Giuliano and Nunn (2013) argued that the appropriate role of women in society differs from the appropriate role of men. The gender socialization theory, used by McCright and Xiao (2014), expanded on this idea. Gender was therefore assumed to moderate the relation between gender and social comparison. However, the study of Scott (2006) concludes that gender roles are changed in de past decades. Scott argues that due to socio-economic- and cultural changes, the clear distinction between the appropriate role of women and the appropriate role of men is faded. Our hypothesis that gender moderates the predicting relationship between social comparison and environmental concern was based upon what are assumed to be traditional gender roles. However, based on our findings, one might assume that the core masculinity and femininity is not a playing a significant part in understanding the predicting relationship between social comparison and environmental concern. Further research may want to examine the actual role of gender roles regarding environmental concern.

Second, research of Cornwell et al. (2008) and Gurung et al. (2003) suggested that women have a larger and more divers social network than men. Granovetter's model of strong ties and weak ties (1983) showed how weak ties could create a more divers flow of information. Therefore, gender was expected to moderate the predicting relationship between social connectedness and environmental concern. However, Kumar, Novak and Tomkins (2010) concluded that the structure of social networks is drastically changed, due to the launch of online social networks and the study of Skopek, Schulz and Hans-Pet (2011) concluded that

women are more likely to tent towards educational homophily in their online social networks than men. The findings of this current study, along with the findings of Skopek et al. (2011), indicates that the emergence of online social networks could have affected the composition of contemporary social networks. Further research should elucidate the disparities between online social networks and offline social networks regarding the relation between social connectedness and environmental concern.

This current study was not able to explain the gender differences with regards to environmental concern and electricity use, but does support the notion that such differences should be further investigated and should also be addressed by policy makers. Furthermore, this current research points out the importance of social comparison and social connectedness in predicting environmental concern. Pro-environmental policies that are aimed at the voluntary reduction of electricity usage, will likely provoke greater attention and response from people who are more social connected to their social environment and from people who compare themselves to others to a larger extent. It could therefore be very helpful for policy makers to understand these relations and take them in consideration.

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