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Mobile application to encourage change in favor of the environment

A quantitative study of the persuasive effect of a gamified app on cognitive and psycho-social variables

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Abstract

Human-induced climate change continues to have a disproportionate negative impact on people and the planet. The human dimension must be included to make a change to reduce the environmental challenges we are facing. As mobile digital technologies have developed, the use of gamification has emerged as a way to promote pro-environmental behavior. As the field is relatively new, the research on the topic is limited. By investigating the immediate impacts of a gamified mobile application intervention on cognitive and psycho-social variables that relates to responsible pro-environmental behavior as well as the interventions' persuasive effectiveness, this thesis contributes to this research gap. By analyzing data conducted through panel surveys, including a pre- and post-survey of the intervention, this thesis finds the tendency that people with low perceptions on the cognitive and psycho-social variables before the intervention are more likely to showcase an increased impact after the intervention than people who had high perceptions prior. Furthermore, the observed increased impact after the intervention is greater than the decreased impact throughout the variables. The most effective parts of the gamified intervention was in terms of raising peoples' awareness of the impact of their actions, their sense of pride in their own efforts which further suggests a stronger sense of responsibility for their actions, and finally in terms of persuading people to take easy actions such as discussing sustainability at work.

Keywords: gamified mobile application, sustainability, pro-environmental behavior, attitudes, behavior intent, locus of control, persuasion

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Background

In the recent IPCC (2022:9) AR6 report, it is assessed and stated that the risk of reaching or exceeding the 1.5°C global surface temperature goal in the near-term, meaning sometime during the years 2021-2040, is at least more than 50%, even in the lowest greenhouse gas emissions scenario. Although, it is further stated that in the very low greenhouse gas emissions scenario, it is "*more likely than not"* that global surface temperature would decline back to below 1.5°C toward the end of the 21st century, with a temporary overshoot of no more than 0.1°C above 1.5°C global warming." (IPCC 2022:9).

Human-induced climate change is continuously responsible for far-reaching negative impacts on both nature and people, beyond the bonds of natural climate variability (IPCC 2022:9). It is also assessed that these impacts are disproportionately affecting the most vulnerable people and systems, and that it has resulted in some irreversible impacts and pushed beyond certain abilities to adapt (IPCC 2022:9-10).

The climate crisis we are experiencing today has over the last 20-30 years been incited by the increasing consumption of economically wealthy people. Forthwith, the richest 10% of the world population are responsible for more than half of the cumulative carbon emissions (Oxfam 2020:2). Oxfam (2020:2) states that:

> *"It took about 140 years to use 750Gt of the global carbon budget, and just 25 years from 1990 to 2015 to use about the same again – over half of which linked to the consumption of just the richest 10% of people. The remainder will be entirely used up by 2030, without urgent action now."*

Whereas the richest 10% of the global population are found in every continent, more than half of the emissions they account for are associated with the consumption by people living in North America and the EU (Oxfam 2020:6). It is commonly said that change takes time, nevertheless the COVID-19 pandemic has shown a great example that it is possible for the richest in society to adopt lifestyle changes in favor of global interests (Oxfam 2020:2).

Due to the great environmental challenges we are facing, the human dimension must be included to make a change in sustainable development, especially human behavior (Klaniecki

et al. 2016:1). The understanding of human impact on the earth has led to multiple programs designed to shift human behavior to attempt to reduce their impact (Klaniecki et al. 2016:2).

Another element that in near history has altered modern ways of living is the development of mobile digital technologies, forming our lives in multiple senses such as how we interact with other people, as well as how we act as consumers (Ross 2018:44).

In the name of mobile digital technologies, games and smartphone applications (apps) have shown to be a promising tool to increase and promote sustainable behavior (Douglas & Brauer 2021:89, 92). Gamification, the concept of applying game design principles to non-gaming contexts, has been utilized to promote pro-environmental behavior and in contexts such as for example environmental education, energy reduction, and waste management (Douglas & Brauer 2021:89).

Gamification provides an environment where people naturally get motivated to engage with content that relates to a desired behavior change, and examples of gamification principles are the inclusion of levels and rewards, giving the users agency of their own actions, and clear progression paths with achievable goals (Douglas & Brauer 2021:89). Furthermore, apps that use gamification elements such as earning points for certain behaviors are often more appreciated by users than apps trying to change behaviors though solely providing information, and it is suggested that gamification has the potential for longer-term psychological engagement than for example behavior change methods like nudging (Douglas & Brauer 2021:92).

However, to understand what drives and predict human thoughts and behavior, it is essential to understand the impact of underlying drivers such as attitudes and how they guide our lives (Maio et al. 2019:4). Although, there seems to be an understanding that there is no definitive answer to the gap between attitudes, including knowledge and awareness, and behavior and action. For one, Kollmuss & Agyeman (2002:248) states that there is no one framework that can include all potentially relevant factors that drive behavior change, as such would be too complex and lose its meaning and practicality along the way. It is further stated by Steg & Vlek (2009) that the topic, and issue, will benefit from further interdisciplinary research and collaboration, as it is relevant for and relates to multiple fields and disciplines.

In light of this background it is of interest, and relevance, to investigate how and whether mobile applications including gamification elements can pursue people into shifting towards more sustainable actions and pro-environmental behavior. Thus, the focus of this thesis will be investigating the immediate impact on individual cognitive and psycho-social variables that underlie responsible environmental behavior, after having participated in a gamified mobile app intervention. The "immediate" effects refers to effects right after participating in the intervention. Specifically, this thesis will explore the perceptions of people in the "Global North", especially people located within the EU, in relation to the great association to consumption based emissions and its impact on the climate. The intervention in this case is an app where the users through gamified elements learn about climate change, sustainability, and its relation to human activities; and then the users are provided with tools and micro-assignments to decrease their own climate footprint. Furthermore, the sample for this thesis is not just any individual using the app, but instead employees at companies who have participated in the intervention in a joint initiative to engage in learning more and taking action for the climate.

Aim

While individuals arguably should not be solely held accountable for CO_2e emissions, it is important to recognize their part as consumers in the value chain and the powerful impact they hold, as well as their part in a larger system.

The aim of this thesis is twofold. First, it seeks to explore how an intervention through a mobile application including gamification elements can impact peoples' underlying factors to pro-environmental behavior. To understand this, the Model of Responsible Environmental Behavior will be used to interpret individual cognitive and psycho-social effects after participation in the intervention.

Second, this thesis seeks to understand the effects of participating in the intervention in terms of persuading people to shift their previous perceptions relating to the selected cognitive and psycho-social variables. To investigate this, the statistical data will be interpreted through a framework of attitude persuasion.

The resulting understanding will contribute to the knowledge gap of gamified mobile applications' potential to mediate people to shift towards more sustainable perceptions, actions, and pro-environmental behavior. Additionally, the initial understanding brought forward in this thesis can provide a springboard for future work in persuading people to change into more pro-environmental behavior in favor of reducing human activity stressors on the climate.

Research questions

In relation to the aim of this thesis, the guiding research questions are as follows:

- *What immediate impact after the intervention can be seen in terms of the themes:*
    - *Knowledge, awareness and concern*
    - *Behavior intent and "verbal" commitment*
    - *Locus of control and pride*
    - *Actual action*

- *How effective is the intervention in terms of persuading people to change their prior perceptions?*

Delimitations of the study

The delimitations of this study are presented here as to clearly frame what will be in the scope of this study and not. First of all, as this study contains panel survey data and seeks to investigate the immediate effects and shifts of an intervention, no focus will be put on assessing underlying differences between for example factors such as gender, age, socio-economic status, or living location.

Second, in order to answer the research question relating to the effects in terms of different themes, this study will not do any further statistical modeling to investigate underlying factors and drivers of the different effects. This delimitation is also related to the sample size in this study, which will be further discussed and described in the methods section.

Previous research

In this section presenting previous research, the focus is on other studies carried out through analyzing pro-environmental effects of people participating in gamified mobile applications or online platforms. Although some qualitative reviews on gamified technology as a motivator for pro-environmental attitudes and behavior exist, for example Ouariachi and colleagues' (2020) review on best practices for gamified approaches for education and pro-environmental behaviors, the focus is rather on previous investigations of actual interventions. In other words, this section targets previous research on pro-environmental effects and impacts of gamified interventions, rather than the potential of gamification in relation to pro-environmental engagement.

What becomes clear when searching for previous studies is that the existing research in the field of gamification interventions and pro-environmental behavior is limited (Geelen et al. 2012:106), lacking (Ouariachi et al. 2020:12), or even understudied (Morganti et al. 2017:96; Wemyss et al. 2018:2060). As this is the case, this section will include interventions specifically investigating energy saving behaviors, as it is part of pro-environmental behavior as a whole, and as the interventions have partial similarities to the intervention performed in this thesis.

I further acknowledge that this section is limited to the search and use of articles written in English, thus potentially existing studies conducted and written in other languages might be excluded or overlooked.

Relatively recently in 2017, Morganti and colleagues conducted a systematic review to present an overview of research on applied games as a way to engage people in pro-environmental behavior, specifically in relation to energy efficiency. They state that although the interest is increasing and initial attempts have been made, the existing research on the potential to engage people in pro-environmental behaviors, in their case energy efficiency specifically as mentioned, is very limited (Morganti et al. 2017:96). When referring to applied gaming, Morganti and colleagues (2017:96) indicate both gamification and serious games. Although the two concepts can be defined slightly differently, they both imply the use of significant game elements with the intention to change peoples' experiences and/or behaviors.

After applying their inclusion criteria in their systematic review, only 10 studies on applied gaming and its impact on energy efficiency behaviors were found (Morganti et al. 2017:95, 97). Further, in the analysis three target areas were found, including *environmental education*, *consumption awareness*, and *energy efficiency behaviors*. Additionally, in some of the studies the game elements applied included more than one of these targets, which were then considered *comprehensive interventions* (Morganti et al. 2017:97).

In relation to this thesis, the studies most relevant are those considered comprehensive interventions, as the intervention carried out in this thesis also includes elements of all the three identified targets. As will be further presented in the section for the intervention, it includes learning aspects about the environment and human activity impact as well as aspects of consumption awareness related to the user and behavior incentives.

The main finding in Morganti and colleagues' (2017:101) review is that applied gaming intervention can be executed in different ways and include different appealing and motivating aspects, and that it in fact can engage people in pro-environmental behaviors for energy efficiency. As for the comprehensive interventions specifically, it is stated that interventions both in apps and web platforms have been observed to be effective in increasing peoples' awareness and changing consumption habits (Morganti et al. 2017:101).

Two of the studies that were presented in the comprehensive interventions category and that had similar objectives to this thesis, were conducted by Geelen and colleagues (2012) and Wemyss and colleagues (2018), and will thus be further presented here.

Geelen and colleagues (2012) studied the online platform *Energy Battle*. The platform specifically targets energy consumption by providing information about the general energy consumption of household devices, making the consumption visible and rewarding savings throughout the game (Geelen et al. 2012:108). Further, the platform included visualization of energy consumption, tips about energy savings and a ranking scoreboard of all teams. It also included a game with building blocks, where the blocks could be bought with credits gained from the energy savings (Geelen et al. 2012:108).

In Geelen and colleagues' (2012) study, 20 student households in the Netherlands participated, and the data conducted and analyzed in the study were energy consumption data and an online questionnaire directly after the pilot of the game. As the questionnaire turned out to not provide sufficient insights, semi-structured interviews were conducted as a complement eight months after the participants had used the platform (Geelen et al. 2012:110).

Due to the small sample size and specific target group, Geelen and colleagues (2012:117) acknowledges that the generalizability of the study is limited in turns of drawing conclusions on energy consumption behavior in general. However, the study still contributes to the understanding of the role of gamification elements in motivating and enabling energy saving behavior (Geelen et al. 2012:117). Specifically, they found that the participants' energy saving was up to 30% during the game, and while some households' energy consumption increased again after finishing the intervention, the tendency showed that a slight majority stayed below the initial baseline level (Geelen et al. 2012:117-118). The main activities that the participants had reportedly undertaken mostly included cooking, media use, and actions related to light sources, and the results from the interviews revealed that some behaviors that had been motivated and repeated during the intervention had remained as new habits (Geelen et al. 2012:117-119). Such new habits were for example unplugging adapters, using less water when putting on a kettle, and switching off lights (Geelen et al. 2012:118-119) - which can be considered rather easy actions. To conclude, Geelen and colleagues' (2012) study showcased an example of how a gamified intervention can motivate people to save energy and engage in more pro-environmental behaviors.

More recently, Wemyss and colleagues (2018:2059) tested whether engaging households in competitive and collaborative gamified activities can motivate short-term electricity savings through behavior change, and whether there is a difference between competitive and collaborative activities in terms of effectiveness. They tested this through an intervention of using a gamified mobile app called *Social Power*, where 46 people living in Switzerland participated (Wemyss et al. 2018:2061). To investigate the effects of the intervention, Wemyss and colleagues (2018:2061) analyzed electricity consumption data from the households, and conducted surveys before and after the intervention to measure attitudes and self-reported behavior. The latter is similar to what is done in this thesis. Additionally,

Wemyss and colleagues (2018:2061) also incorporated a control group not partaking in the intervention, and compared the electricity consumption to historical consumptions.

Much like in this thesis' intervention, the *Social Power* app included learning elements consisting of activities and tips, individual feedback of energy progress, and social comparison feedback where the participants either could see the collaborative efforts or the competitive scores (Wemyss et al. 2018:2063). The participants were encouraged to interact though communication channels and they earned points for performing activities in real-life guided by the mobile app.

Wemyss and colleagues' (2018:2069) results show that both in comparison to historical measures and the control group, the *Social Power* intervention was effective in changing electricity consumption behavior. Furthermore, both the competitive and collaborative gamified approaches resulted in positive impacts, and Wemyss and colleagues (2018:2069) conclude that both structures are effective and suitable to engage people in energy savings, in the short-term.

In order to set a proper context to this thesis in a field that is previously stated to be limited, a recent study on the effects of interventions and psychological factors on pro-environmental behavior by Weimer (2019) will further be presented. The study doesn't include gamification principles per se, but studies the effects of an intervention where the participants learn and get feedback on pro-environmental behavior, which is considered relevant context to this thesis.

Weimer (2019:24) states that it is important to understand how underlying determinants to behavior such as attitudes, behavioral control, problem awareness, and personal moral norms, interacts and relates to each other. Weimer (2019) refers to a framework including the Theory of Planned Behavior and Value-Belief-Norm, and although another theoretical framework will be used in this thesis, similar theoretical concepts are applied.

Much like the other studies presented here, one of Weimer's (2019:26) aims was to reduce energy consumption in households through engaging participants in an intervention. In this intervention observable energy use was measured, and it was combined with self-reported measurement of underlying determinants of energy use. As this combination of procedures has barely been done before, it had been suggested by other researchers (Weimer 2019:26).

The intervention was implemented over eight weeks and was divided into different periods where the participants first responded to a pre-questionnaire, then they received information about climate, lifestyles, and human behavior (Weimer 2019:53-56). Then, the daily energy use was observed, alongside the participants receiving advice on different types of behavior, as well as keeping a diary of their energy use for two weeks. Following, the participants set their own goals (restricted/selected from options) for behavior change to reduce their energy consumption and supposedly changed their behavior in order to reach these, and then receiving complex feedback as well as parallel information about energy savings. Finally, after the eight week period of active intervention, the participants again filled out a survey about the intervention, and then followed a three month period of maintaining the measurements of energy consumption to see what happened when the participants in the experiment no longer received feedback, to be finalized with a post-questionnaire (Weimer 2019:56).

Apart from the experimental group, Weimer (2019) also had a control group. When the participants got information, were requested to set goals, and received feedback on their process, the control group only received information about energy savings. In short, the aim was to investigate the effects of feedback during the intervention, on household energy conservation. The results of Weimer's (2019:63) study showed that the experimental group had a slight tendency to reduce their energy consumption during the period for complex feedback. During the three month period of maintenance, the energy consumption levels for both the experimental group and control group remained almost the same, meaning that the intervention-related savings did not decline during the three months after the active intervention.

Due to the small sample size the study failed to find any statistically significant effects, however, the energy consumption pattern of the experimental group indicated to a small extent that during the motivation-increasing periods when complex feedback was provided, they had been slightly affected (Weimer 2019:63). Although, the energy consumption increased slightly during the three month period after the active intervention when feedback was not provided (Weimer 2019), similar to what was observed in the study by Geelen and colleagues (2012).

Finally, Weimer (2019:46) states that relatively little is known about the long-term impact of interventions and suggests that it is important for further studies to investigate whether behavior changes are maintained after a finished intervention.

In relation to this previous research, this thesis will contribute to the gap in the field of the potential for gamified mobile applications to shift peoples' perceptions and underlying cognitive and psycho-social factors related to pro-environmental behavior.

Theoretical framework

In this section, the theoretical framework selected for use in this study will be presented. First, the Model of Responsible Environmental Behavior will be presented, which includes a number of categories that when consistent tend to be followed by responsible pro-environmental behavior. The presentation of the categories is supported by additional research, and brief descriptions of how the framework will be used to analyze the data results in this study will be included. As will be further described, certain variables in this study will both be interpreted in relation to the categories they fulfill, but also in the sense of the results being the respondents' perceptions and beliefs. Thus, for some results, theoretical assumptions related to attitudes will also be applied.

Beside the Model of Responsible Environmental Behavior, theory on how people can be persuaded to change their attitudes is also selected and presented. As this thesis investigates the effectiveness of an intervention to shift people's perceptions on pro-environmental aspects, a framework on persuasion and attitude change is in its place.

In relation to the selected framework, the ideal type to potentially observe in the results is thus that the intervention has persuaded the respondents to showcase increased impact for the categories that tend to be followed by pro-environmental behavior.

A reminding remark here is that the intention of this thesis is to investigate the underlying categories that according to theory lead to responsible environmental behavior, as well as the effectiveness of an engaging technology intervention to persuade the shift.

Model of Responsible Environmental Behavior

Hines and colleagues (1987) presented The Model of Responsible Environmental Behavior after doing a meta-analysis of 128 studies on pro-environmental behavior. The model was developed on the basis of the earlier, and renowned, Theory of Planned Behavior (Kollmuss & Agyeman 2002:243). The model presents a number of variables that Hines and colleagues (1987:1) found to be related to, and predictors for, pro-environmental behavior. These variables were *knowledge of issue, knowledge of strategies for action, locus of control, attitudes, verbal commitment,* and *individual sense of responsibility* (Hines et al. 1987:1). According to the model, these variables will accumulate into a behavior intention, subsequently deriving a certain pro-environmental behavior (Hines et al. 1987:6-7).

This model and its defined variables will be used, supported by more recent definitions of the different concepts, to interpret the data in this study. This theory section will be presented in subheadings of the above mentioned variables presented in the model.

Apart from the mentioned variables, Hines and colleagues (1987:7) presented a final category called *situational factors*, external to the other variables however still relevant to recognize. In their words, these situational factors refer to economic constraints, social pressure, or individual options to choose different actions. These factors have the potential to either increase or decrease the other variables in the model (Hines et al. 1987:7). For example, if a certain choice is affordable to a person, they might choose this on the basis of economics, not necessarily for the environmental effects. Contrastingly, if the option is not affordable to the person although they have the attitudes to do it for the environment, it might still not be feasible and thus the behavior will not follow, in that notion.

Much like Hines and colleagues (1987), in this thesis I will not be further analyzing additional factors like such in the situational factors category, but rather focus on the cognitive and psycho-social variables. While the analysis will rest on the assumption that the observable effects in the data is due to the intervention, I recognize that other factors can play in as well, however these will not be further investigated in this thesis.

Knowledge of the issue and action strategies

Hines and colleagues (1987:3) found that people with greater knowledge about both environmental issues as well as what actions can be taken for these issues, tend to be more likely to engage in pro-environmental behavior than people with less knowledge on the issue. Thus, Hines and colleagues (1987:6) describes knowledge of an issue to be a prerequisite for action, and the simple notion that a person has to know about an issue to be able to intentionally act on it.

In addition to a person being aware and having knowledge of an environmental issue and a strategy for how to act on the issue, it is also necessary to have the skill of how to suitably apply the knowledge on the specific issue (Hines et al. 1986:6). Together these cognitive variables conclude a vital part of the model, and part of predicting responsible environmental behavior.

This part of the theory will mainly be used in understanding the results of the variables *ImpactKnowledge*, *ImpactAwareActions,* and *ImpactKnowledgeCo*. These variables measure how the respondents rate their own level of knowledge about environmental sustainability, their perceived awareness and knowledge of how their actions and choices affect the environment, and their level of knowledge about their companies' sustainability effort. Thus, the cognitive variables from the model of responsible environmental behavior will be applied in the analysis of the effect of the intervention in this thesis, as part of a broader understanding of these variables potentially predicting environmentally responsible behaviors. However, the above mentioned variables will not only be analyzed on the basis of the cognitive variables, but they will also be recognized and analyzed as the respondents' individual perceptions and beliefs. Thus for interpretation of the results, theories on attitude and attitude change, which will be presented further down, will also be applied.

Locus of control

Multiple studies have found that people's perceived locus of control has a consistent correlation with pro-environmental behavior and behavior intention (Weimer 2019:31; Hines et al. 1987:5). More specifically, people with an internal locus of control are found to often act more pro-environmentally than people with an external locus of control.

The construct of locus of control was developed by Rotter (1966), drawing from learning theory. In Rotter's (1966:1) words, a person who perceives reinforcement to be a result of their own actions or relatively permanent characteristics, this is a belief in internal control. Contrastingly, if a person believes that the reinforcement is more contingent on external factors such as luck, fate or powerful others than their own actions, this is a belief in external control.

Rotter (1966:1) further suggests that locus of control is important for understanding how people are likely to perceive personal control of reward to the same situation differently, due to personal differences as well as different learning processes and situations. When investigating the relation between locus and control and responsible environmental behavior in their meta-analysis, Hines and colleagues (1987:4) used data that explicitly measured people's locus of control, but also data coded as people's perceptions of their efficacy, in other words their perceptions of their own effectiveness in a given notion. They did this since the variables seemed to measure the same concept.

Reinforcement after a certain behavior, act, or event, strengthens an expectancy that this reinforcement will also follow in the future (Rotter 1966:2). Subsequently, Rotter (1966:2) states that an attitude, belief, or expectancy about the causal relationship of one's own behavior and its consequences can affect future behavioral choices in different life situations. In this study's intervention, the in-app visualization of CO_2e savings after completing a micro-assignment could potentially serve as a receipt of the consequences contingent upon the user's choice of actions.

The effects of the intervention in terms of locus of control will chiefly be analyzed from the variable ImpactLOC, where the respondents rate their perception of to what extent they agree or disagree to the statement "*I think we as a company can have a positive impact on the environment*". This statement refers to the individual as part of a company, thus in a set context instead of the broader less limited sense that would've been implied if the statement would've been referring to the individual person alone.

Attitudes

Attitudes influence our perception of the world, our thoughts and our actions - starting when we're young, attitudes are essential in guiding us how to understand what we should approach and what we should avoid (Maio et al. 2019:4).

Attitudes can be described as a global evaluation of an attitude object. The most influential model of attitude suggests that attitudes are accumulated evaluations consisting of cognitive, affective, and behavioral components (Maio et al. 2019:31). In this model, the *cognitive* component refers to beliefs, thoughts, and attributes associated with the object; *affective* refers to feelings or emotions related to the object; and *behavioral* refers to previous experiences and behaviors related to the object (Maio et al. 2019:31-32). While these components might seem similar, or even the same, research has provided that they are empirically distant. Still, they are often consistent towards a certain object and are not independent from each other, and while having a synergistic relation they can differ in valence and strength (Maio et al. 2019:32).

Much research has focused on the components cognitive and affective in particular and suggests that people differ reliably on the instance of whether they develop their attitudes predominantly based on their beliefs or feelings and emotions towards an attitude object (Maio et al. 2019:40). While some people's attitudes are chiefly derived from cognitive responses and other people's attitudes from affective responses, they can for some people also be equal. An essential takeaway of what these differences and their impact goes to show is that people respond differently to certain kinds of persuasion (Maio et al. 2019:40).

Not only do people differentiate in favorability of the attitude components, but it is also suggested that there are different personality variables that better predict people's attitudes. People who tend to enjoy and engage in activities including and requiring cognitive efforts are high on the trait *need for cognition* and their attitudes are thus often predicted and derived from their cognitive attitudes, as opposed to if they'd be higher on the trait *need for affect* where people tend to enjoy emotional experiences (Maio et al. 2019:40). It has further been stated that specifically people with high need for cognition are more likely to show correlations between their attitudes and behavior, theoretically derived since they are likely to

have carefully considered and thought about their attitudes, thus making them stronger (Maio et al. 2019:80).

If a person doesn't have a lot of knowledge about a certain attitude object, attitude change can occur if they analyze and think about their reasons for the relevant attitudes (Maio et al. 2019:98). Contrastingly, attitude change on the same basis and context is not as likely to occur if a person already has knowledge about the particular attitude object.

Attitudes can serve diverse functions and thus are propelled by additional underlying factors, such as expressing people's individual self-concept and central values (Maio et al. 2019:47). Different personality constructs of self-monitoring can be used for understanding attitude functions and thus drivers for people's attitudes. Self-monitoring in this sense refers to how some people change their behaviors to suit a certain situation (high self-monitoring), while others present themselves in the same manner in all situations (low self-monitoring) (Maio et al. 2019:48). The hypothesis being that people with high self-monitoring are likely influenced by internal attitudes that fulfill social-adjustive functions, while people with low self-monitoring likely are influenced by attitudes that fulfill value-expressive functions. Tested in experiments, results showed that underlying individual attitude functions determine what type of persuasion best works on different people (Maio et al. 2019:48). Further research also states that low self-monitors showcase stronger relation between attitudes and behavior, which again highlights that whether behavior can be predicted by attitudes is dependent on individual personality constructs (Maio et al. 2019:79).

Hines and colleagues (1987:4, 8) state that people with positive attitudes towards different aspects of the environment, as well as towards pro-environmental actions, tend to engage in pro-environmental behavior as opposed to people holding less positive attitudes.

One of the specific attitude variables that will be analyzed in this thesis is the sense of worry towards the effects of climate change. Schultz (2000:401) presents the concept of environmental concern as a part of a person's value system, meaning that people are concerned with environmental issues if they negatively affect something they value. For different people, this can incorporate different scopes and spaces, such as the self, people in general, or all living things.

Further Weimer and colleagues (2017:2569) concludes that multiple studies have suggested that a strong sense of environmental concern increases a person's likelihood for acting pro-environmentally. However, worrying for the climate and consequences of climate change in itself doesn't always predict a pro-environmental behavior, certainly not necessarily if the specific behavior is highly valued in itself. For example, as presented by Kollmuss & Agyeman (2002:242) a person might feel strong concern for the environment, while still driving a car. This can in turn explain how certain attitudes, here concern, don't always correlate with a certain behavior, here driving a car in spite of the consequences it has on the environment. To conclude, while concern for the environment has been found to increase the likelihood of pro-environmental behavior, when measuring the relation between attitudes and certain behavior it is important to measure attitudes and certain behavior that is closer related than as in the example, environmental concern and driving.

The theory on attitudes will for one be used to interpret the data on the respondents' sense of environmental concern in the notion of worry for the consequences of climate change. However, as previously mentioned, it will also be used to interpret the data for other variables, related to the perspective that the self-reported surveys provide the respondents' perceptions on the different factors and categories. Thus, by applying the theory of function and factors of the basis of attitudes, the eventual shifts in the variables after the intervention will be better interpreted.

Verbal commitment

Hines and colleagues (1987:5, 6) state that people who express an intent to act in a certain matter are more likely to perform correlating behavior than people who do not express the same intent. As phrased by Kollmuss & Agyeman (2002:243), verbal commitment refers to a person's communicated willingness to act on something. Verbal commitment refers to the expressed intent, just like Hines and colleagues (1987:5), I will not be analyzing *verbal* commitment per se, but rather the self-reported intention for trying to live more sustainably as well as self-reported commitment in terms of willingness to change in favor of the environment. The reason for this is that the method of using a survey allows for investigating self-reported commitment, not an observed verbal expression of the commitment.

In their meta-analysis, Hines and colleagues (1987:3) found verbal commitment to have the highest correlation to pro-environmental behavior than all the other variable categories. In Marcinkowski & Reid's (2019:463) paraphrasing of the study, they use the terminology of verbal commitment and intention interchangeably. In an attitude-behavior relationship, Marcinkowski & Reid (2019:464) further highlight the function of behavioral intentions as a mediator between the two. Similar to the core of Hines and colleagues' (1987) model, where the cognitive and psyco-social variables together add up to intentions that in turn tend to predict a certain behavior.

As mentioned previously, this part of the theory will be used in this thesis to interpret the results of the variables *ImpactWill* and *ImpactTrying*, as to investigate the effects of the intervention in terms of the participants' stated commitment.

Individual sense of responsibility

Hines and colleagues (1987:5) found that people who hold some degree of personal responsibility for the environment were more likely to engage in pro-environmental behavior than people who don't feel the same responsibility. In this thesis, the notion of responsibility will be derived from the measure of the respondents' sense of pride, which also connects back to perceptions of locus of control.

In the context of pro-environmental behavior, Antonetti & Maklan (2014) states that people who believe that their consumption choices affect the environment are more likely to behave sustainably. Antonetti & Maklan (2014:126) states that pride and guilt, as self-conscious emotions, mediate in people's perception of the effectiveness of their consumption. Further, they demonstrate that feelings of guilt and pride are important since they affect perceived consumer effectiveness, since these emotions affect people's perceptions of agency (Antonetti & Maklan 2014:117), in other words shifting the beliefs of the impact of their own actions.

Feeling guilt or pride can help people see themselves, as consumers, as the cause of significant sustainability outcomes. Thus, experiences of pride and guilt provide evaluation on previous behavior and convince people of their effectiveness as consumers (Antonetti & Maklan 2014:129). This in turn affects people's internal use of neutralization techniques, their feelings of guilt or pride making it harder to rationalize away responsibility for the outcome

of their actions (Antonetti & Maklan 2014:117). Consequently, this persuades people to recognize their impact on sustainability outcomes through their actions, and the responsibility that is then connected to themselves.

In a recent meta-study, Shipley & van Riper (2022:9) finds that both pride and guilt have an influence on pro-environmental behavior in experimental studies, acknowledging and contrasting previous studies suggesting that either pride or guilt are the stronger driver. While the prospect of *anticipated* pride can have a "pull" effect and stronger correlation to certain pro-environmental behaviors than *anticipated* guilt, *experienced* guilt can instead have a stronger relation to certain behaviors than *experienced* pride (Shipley & van Riper 2022:9). They further find that pride has a stronger relation to intended behavior than to observed behavior, explaining that pride encourages people to keep up current behavior that elicits pride since people generally try to attain positive emotions (Shipley & van Riper 2022:9).

While pride is often put in contrast to guilt, this study will focus solely on inferences related to pride. This part of the theory will be utilized to interpret the results from the variables *ImpactPride* and *ImpactPrideCo*, measuring the respondents' perception of pride of their own sustainability efforts as well as sense of pride towards their employer for engaging them in taking action. The extent of the respondent's sense of pride and the eventual effect of the intervention can thus be understood in the sense of the respondents acknowledging their own responsibility for their actions, as well as the perception of their own actions' effectiveness.

Persuasion to change

The theory on persuasion of attitudes will be used as an overarching guideline to understand the intervention's effectiveness in persuading the participants to change their perceptions towards the category of variables that ideally is followed by responsible pro-environmental behavior. In other words, it will be applied to interpret the effectiveness of the gamification elements of the mobile app intervention to pursue a shift in the participants' cognitive and psycho-social variables. It will also be applied to interpret the results of the index variable *ImpactActualAction*, this being the only measure of self-reported action, here related to the participants' work life.

Much of previous research has focused on the role of cognitions in persuasion and how cognitive information about an attitude object affects attitudes towards it (Maio et al. 2019:116). In the Yale Model of persuasion, it is suggested that in order for a message to change people's attitudes, it needs to include an incentive for the change (Maio et al. 2019:117). It further states that it is important to understand how this incentive is influenced by the persuasive source (who), the actual content (what) of the message, and the receiving audience (whom). In subsequent theories, it is also suggested that the effects of cognitive content rests on whether the message provides powerful enough motives to change, which can also be influenced by the just mentioned factors, as well as how the information is presented (Maio et al. 2019:118). Subsequently broken down into further stages (Maio et al. 2019:118):

> "[...] a successful message must be presented (presentation stage) and then draw attention (attention stage). Next, it must be understood (comprehension stage), and change the recipient's attitude (yielding stage). Finally, people must remember their new attitude at a later time (retention stage), so that the new attitude can actually influence the behavior (behavior stage)"

However, it is not always that all these separate stages are successful at the same time, in particular the yielding and behavior stage, which decreases the chances of a successful impact on attitude change (Maio et al. 2019:119). It is stated that strong attitudes are harder to change, while also more likely to predict a certain behavior (Maio et al. 2019:116).

Regarding cognitive responses to a message, potential attitude change is also dependent on whether a person has a positive or negative response to the message. These cognitive responses are a function of people's beliefs prior to receiving the message, the content of the message itself, and other factors (Maio et al. 2019:120). Further theories also suggest that beliefs are core elements of people's attitudes, and to change attitudes, these salient and primary beliefs should be central to the persuasion to change (Maio et al. 2019:121).

Methodology

In this section, the method and process for analysis will be presented. The method includes a description of the intervention through the usage of an app, and the pre- and post-surveys before and after the intervention. The analysis process includes both the statistical analysis of the data performed in SPSS as well as the operationalization and interpretation of the statistical results in relation to the selected theory. Additionally, the sample, limitations, and ethical considerations for the study will be presented.

The intervention

What is referred to as the intervention in this research is an app provided by the Swedish fintech and impact innovation company Deedster. While the company provides different services, the intervention in this case is a challenge in the app, paid business model based, that companies can purchase to engage their employees to learn and take action for the climate. The service is available to companies of any size that want to engage their employees learning and doing more for the climate and environmental sustainability. The short term intention of using the app is to engage and empower more people to take action for the climate, and the long term goal is to shift people's attitudes and behavior towards more sustainable lifestyles.

In the app, the users get to calculate their own climate change footprint by self-reporting their lifestyle and consumer behavior in terms of travel, housing, food, shopping, and commuting. Every company using the service goes through their own so-called challenge for a set period of time (competing/participating within the company, not against other companies). In the challenge, the users get to learn about different topics related to climate change and human activity's impact on it. The learning element is gamified into a quiz set-up, consisting of different stations touching on different topics including three questions with multiple choice answers. After answering a question, the right answer together with additional information is provided. While the core of the service are standard stations, the service also offers participating companies to ask for tailored content relating to their own business or policies.

When a quiz-station is finished, the user is provided with 1-3 micro-assignments that they can either save or archive for later. These micro-assignments are related to the topic of the

quiz-station and every user is provided with assignments that are tweaked to be both suitable and perceived as easily accessible for the specific user depending on their own self-reported climate footprint. For example, a user who has declared that they eat meat can be provided with a micro-assignment to try a vegetarian meal for a change (or a habit, eating vegetarian lunch), while a user who has declared that they eat vegetarian can be provided an assignment to try a vegan meal. Another example is that a person who has declared that they take the car to work can get an assignment to go to work by public transport, or if a user that usually goes by public transport of work can get an assignment to try going part of the way by bike. A final example to provide an image of the high and low spectrum of micro-assignments is that the users can be encouraged to make sure the tap is turned off when washing their teeth or to bring a bag with them when grocery shopping instead of buying a new one (to encourage reuse of resources and reduce waste), or they can be asked to check out their investments/pensions/insurances to make sure it doesn't contribute to environmentally destructive projects, and if so change into one that contributes to green innovation.

When a user has completed one of these micro-assignments, they can check it off. Some of the micro-assignments can also be checked off once every day, creating a habit tracker and encouraging the user to uphold a green habit. The micro-assignments either have a CO_2e reduction stamp or impact points (impacts that cannot necessarily directly be connected to saved/reduced CO_2e, but still have a positive impact). The savings and earned points are visualized as the user progresses, which is another element of gamification.

Another element of gamification to motivate and encourage the users to action is that they are divided into competing teams. The results are presented on a scoreboard visible to everyone (within the company and its participants), and the teams can either compete in terms of doing the most micro-assignments, or by the calculated saved CO_2e emissions from doing the micro-assignments.

The structure and concept of the app is developed in collaboration and supported by the partners WWF, Gold Standard, and Sustainalytics. Additionally, Deedster is partnering with multiple impact networks and organizations, including Fossil Free Sweden, Exponential Roadmap Initiative, Count Us In, and Race to Zero. Finally, Deedster has also collaborated with Beteendelabbet [the Behavior Lab - behavior agency], where they have reviewed the structure of the service.

The survey

The method utilized in this study was panel surveys distributed online, one pre-survey at the start of the intervention and one post-survey after finishing. In order to analyze effects over time, a panel survey is directed to the same people during the duration of the investigation (Eliasson 2013:145). In this thesis, the pre- and post-surveys include the same questions, which enables the possibility to measure and investigate the immediate effect after participating in the intervention. The questions in the survey were developed in collaboration between me and Deedster, the company providing the gamified intervention, during my internship with them autumn of 2021. The intention with the surveys was both for the company to be able to evaluate and further develop the user experience, and for further research like my study to draw from. The cohesive list of questions posed in the surveys can be seen in Appendix B.

The surveys were distributed by Deedster to the sample (to be elaborated on further down) through the app in which the intervention took place. The conducted survey data were then provided to me by the company in March 2022.

The first step of handling the empirical material was to sort it into panel data, which meant sorting out the individual respondents who had participated in both the pre- and post-survey to be able to measure and analyze change over time. After sorting the material into panel data, the next step was to merge the data from the pre- and post-survey in an SPSS spreadsheet.

Process of sorting the data

In order to get panel data, meaning being able to assess the same individual's answers from one time period to a later one, I first had to sort the cumulative data. First of all, I sorted the data by IP addresses as the distinguishing variable appearing in both the pre- and post-survey data. Doing this, I first had to clear out all the IP address duplicates, since I could not make sure that duplicates would correctly be matched in the pre- and post-survey data in the merging stage. After manually sorting this out from my two data sheets in SPSS, I renamed all variables (see Appendix B) to match the same questions in the pre- and post-survey. For example, questions about gender and age only appeared in the pre-survey and thus I named

the variables Gender_Pre and Age_Pre. An example on renaming and sorting the questions that appeared in both surveys is the first question "*My knowledge of environmental sustainability is…*" that I renamed to q0001_Pre, respectively q0001_Post, to easily distinguish which variables were the same pre and post in my eventually merged data sheet.

When I had my finished clean pre- and post-data sheets I did the following steps to merge and filter the data:

Step 1: I identified two variables that existed in every row for both data files. In this case, that was CollecorID_Pre and CollectorID_Post.

Step 2: Ready to merge the data. In the Pre-data sheet I used the commando combination Data > Merge files > Add variables. I chose 'add variables' instead of 'add cases' since my intention was to add more variables, meaning merging the pre- and post-variables, as opposed to adding more cases, for example more respondents. When choosing the 'add variables' option, a pop-up box appears suggesting the merge by the one key value that exists in both files, here being IP address. Since my intention was to merge the files based on IP addresses, this was the only variable I did not rename prior to the merging stage, since the merging value needs to have the same name in both data files.

Step 3: Ready to filter the merged data. I created a filter in SPSS for the merged data sheet by using the previously identified variables that appear for all rows in both files - CollectorID_Pre and CollectorID_Post. The filter input used was NMISS(CollectorID_Pre) < 1 & NMISS(CollectorID_Post) < 1.

Step 4: When filtering, I could either choose to filter out unselected cases, meaning that all cases that did not meet the filter requirements will still be in the data sheet although hidden, or delete unselected cases, thus only leaving my filtered data in the sheet.

After cleaning, merging, and filtering the data, I ended up with 117 individual cases. More on this in the section on *Sample*.

Process of creating new variables

The following steps were taken to create new variables for the purpose of statistically analyzing the impact of the intervention. The cohesive list of all the new variables can be seen in Appendix C.

Step 1: To analyze the immediate effect of the intervention, new variables were created. This was done through Transform → Compute variable → input (q_Post) - (q_Pre). This new variable shows the value of the aggregated impact for a specific variable.

Step 2: To analyze the individual impact, more specifically where and between which steps of value that the effect has taken place, I first ran a frequency analysis on the q_Pre to see on which value the accumulated responses had started. If this was for example on value 2, *disagree*, this directed me to where the individual analysis should begin.

Step 3: Then, to investigate the effect from every individual value, new variables depending on the Pre values were created. This was made through the same process as step 1, but with an added if condition. The if condition was (Pre=x) & (Post>=1). These new variables then reveal for every aggregated pre-value, if the individual respondents have stayed on the same value, or if their values have decreased or increased.

Step 4: For certain variables that measure similar factors, I created indexes and then new impact variables. To first test the original variables' reliability and whether they were compatible for an index, I ran a Chronbach's Alpha test. This was done through Analyze → Reliability test → input the relevant variables that I wanted to analyze, and with the standard setting Alpha. The Cronbach's Alpha value should be 0.7 or above to indicate reliability between the variables. Out of the four indexes I initially intended to create (all consisting of two variables for each index), two proved compatible after the test.

Step 5: When creating the new impact variables consisting of indexes, I first created indexes for the two relevant variables, the pre- and post-variables separately. This was done through Transform → Compute variable → input (qx_Pre/Post + qy_Pre/Post)/2. Then, the new impact variable was created just like in step 1, and then following the rest of the steps to investigate the individual effect of the indexes as well.

Operationalization of theory

The process of operationalization includes breaking down the aim and questions of the research in order to formulate concrete and measurable variables (Eliasson 2013:47). Thus, this section describes the thought and process behind structuring the abstract data into measurable variables in relation to the selected theory of this study.

The aim is to investigate the effects of the intervention in terms of a number of selected cognitive and psycho-social variables related to pro-environmental behavior as well as the persuasive effect of the intervention, relating to the selected model of responsible environmental behavior (Hines et al. 1987) and theory on persuasion to change (Maio et al. 2019). Thus, the questions posed in the survey must relate to the cognitive and psycho-social variables to be measured. The cognitive variables are knowledge and awareness of action strategies, and the psycho-social variables are locus of control, attitudes, verbal commitment, and individual sense of responsibility.

The questions of the survey were posed as statements for the respondents to assess themselves on an agreement scale ranging between value 1 through 6. See the original questions of the survey in Table 1 below.

No.	Name Pre	Name Post	Statement	Response scale
1.	q0001_Pre	q0001_Post	My knowledge of environmental sustainability is	Extremely Low, Very Low, Somewhat Low, Somewhat High, Very High, Extremely High 1-6
2.	q0002_Pre	q0002_Post	I worry about the effects of climate change	Strongly Disagree, Disagree, Somewhat Disagree, Somewhat Agree, Agree, Strongly Agree 1-6
3.	q0003_Pre	q0003_Post	I'm aware of how my choices affect the environment/climate	Strongly Disagree/Agree 1-6
4.	q0004_Pre	q0004_Post	I'm willing to change my behavior for the good of our environment/climate	Strongly Disagree/Agree 1-6
5.	q0005_Pre	q0005_Post	I know what our company's sustainability efforts are	Strongly Disagree/Agree 1-6
6.	q0006_Pre	q0006_Post	I'm proud that my employer engages its employees in climate and sustainability	Strongly Disagree/Agree 1-6
7.	q0007_Pre	q0007_Post	I talk about sustainability and climate with my colleagues	Strongly Disagree/Agree 1-6

8.	q0008_Pre	q0008_Post	I'm taking sustainability into account in my work	Strongly Disagree/Agree 1-6
9.	q0009_Pre	q0009_Post	I think we as a company can have a positive impact on the environment	Strongly Disagree/Agree 1-6
10.	q0010_Pre	q0010_Post	I have knowledge of how my actions impact the environment	Strongly Disagree/Agree 1-6
11.	q0011_Pre	q0011_Post	I'm proud of my personal sustainability efforts	Strongly Disagree/Agree 1-6
12.	q0012_Pre	q0012_Post	I'm actively trying to live a more sustainable life	Strongly Disagree/Agree 1-6

Table 1. Original variables as presented in the surveys

To measure the cognitive variables, questions one and five were posed referring to knowledge about environmental sustainability, and the participants' employer's sustainability efforts. Additionally, question three and ten refer to the participants' knowledge and awareness of how their own actions and choices affect the environment/climate, and the variables proved through a Chronbach's Alpha test to be compatible measuring similar things they were recreated as an index (see all new variables in Appendix C).

Question two refers to worrying about the effects of climate change and thus allows for measuring an important attitude in relation to pro-environmental behavior. Additionally, all questions can be perceived as the participants perceptions and beliefs, thus as attitudes, as mentioned previously in the theoretical framework. Thus, the effect of persuasion can also be measured by the increase or decrease of the different variables after the intervention.

Question four and twelve refers to willingness to change behavior in favor of the climate, and the effort of trying to live more sustainably, and are thus the measurement of intention and commitment.

Question six and eleven refers to the sense of pride of one's own efforts and sense of pride of the employer, which thus allows for measuring pride as an emotion related to the participants' sense of responsibility for their and other's actions. Further, question nine refers to the participant's belief that they together with their company can have a positive impact on the climate, and thus allows a measurement for perceived locus of control.

Finally, questions seven and eight refers to the action of talking about sustainability with colleagues, and the perception of taking sustainability into account at work, which thus enables measuring of taking actual action, although considerably quite easy actions.

Sample

Drawing from the sampling process as described by Rai & Thapa (2015:3-4), I have identified the population of interest for this thesis, specified a sampling frame, and from there decided on a sampling method and determined the sample size, which will be presented here.

The population for this thesis is all employees, in other words working adults, who have been engaged in the Deedster challenge (the intervention) by their employer. To frame this rather large sample, the specification is employees participating in the intervention sometime during the time period November 2021 and March 2022. This time period is set from the first time the pre-survey was launched, and in relation to the time scope for this thesis for me to be able to handle the conducted data in time.

For the sampling method, when utilizing panel survey data it refers to following individuals over time and the sample can either be a probability or non-probability sample (Trost & Hultåker 2016:36). For this thesis, the sample method is non-probability, also called non-random. A non-probability sample method can be used when other considerations than the probability of which units can enter the sample is more relevant for the study, such as for example the intention of the sampler (Rai & Thapa 2015:4). As the intention of this thesis is to investigate the immediate effects of an gamified mobile app intervention on cognitive and psycho-social variables, and following the same people over time, it is thus more relevant to have a non-probability sample than a random sample.

More specifically, this thesis utilizes a purposive sampling method. When utilizing a purposive sampling method, the size of the sample being investigated is often rather small in comparison to when utilizing probability sample techniques (Rai & Thapa 2015:5). Furthermore, a purposive sample is not a representative subset of a larger population, as it is utilized to serve a specific purpose (Rai & Thapa 2015:6). However, while non-probability samples are not representative for the whole population the way a probability sample is designed to be, applying analytical generalization of the results to a theory allows the possibility to reveal general tendencies that can be expected to say something substantial about related cases in the population as well (Esaiasson et al. 2017:159).

A purposive sample relies on the subjective judgment of the researcher to make decisions of which individuals to be included in the sample based on a variety of criteria (Rai & Thapa 2015:5). The criteria to be included in the sample of this thesis is the people who have responded to both the pre- and post-survey, again relating to the use of panel survey data to enable investigation of the immediate impacts after the intervention. In other words, apart from the prior considerations made for the population and sample frame, the purposive sample criteria is people who were willing to respond to both surveys.

In total 117 people who participated in the intervention incentivised by their employer chose to respond to both the pre- and the post-survey, and were thus sampled to this thesis. During the time period, six different companies and their employees participated in the intervention for 3-5 weeks. The majority did a minimum of 35 standard quiz stations, and some additional stations with tailored content relating to their specific companies' work. See Table 2 below for a more detailed description of the setup for the different participants.

	No. of participants in sorted data	Duration of intervention	Content
Company 1	8	**4 weeks** (+ 1 day)	**39 standard stations** + 1 tailored deed
Company 2	15	**3 weeks** (+ 1 day)	**16 standard stations** + 5 tailored
Company 3	3	**3 weeks** (+ 1 day)	**37 standard stations** + 5 COP 26 spec + 3 tailored
Company 4	46	**4 weeks** (+ 3 days)	**35 standard stations** + 5 tailored
Company 5	19	**5 weeks**	**35 standard stations** + 5 tailored
Company 6	26	**4 weeks** (+ 3 days)	**35 standard stations** + 5 tailored

Table 2. Overview of intervention duration and content grouped by company

Ethical considerations

Participation in answering the survey was optional and voluntary to all users, and the intention of the survey was described in a pretext before responding. Furthermore, the term and conditions that users accept when using the app also states that activities in the app can be used to evaluate the app as well as for further research purposes.

Regarding me accessing and utilizing the collected data for research purposes, it has been approved by the founder responsible for legal matters at Deedster.

Furthermore, all data is anonymized and although the data was sorted into panels to be able to analyze individual effects, it will not be possible to connect it back to any specific individual. Additionally, none of the companies with employees who responded to the survey is named.

Limitations

Due to the sample size in this study, the possibility for generalizability of the results are limited. Although, it is not uncommon to encounter fallouts when working with panel data (Trost & Hultåker, 2016:37), as is the reason for the final sample size in this study as one of the sample criteria is respondents who participated in both the pre- and post-survey. Furthermore, as mentioned previously purposive sampling is not directly representative of the total population (Rai & Thapa 2015:6). Although by applying theory to generalize the statistical results it is possible to suggest tentative tendencies that could be generalizable to the related, or a similar, population (Esaiasson 2017:159), which is done in this thesis.

Another potential limitation is that all interventions did not look entirely the same. Out of the sample, 15% of the respondents participated in the intervention for three weeks, while the remaining 85% participated in the intervention for between four to five weeks. All of the participating groups were exposed to at least 35 stations of standard content during the intervention (some of the groups had additional standard content, and some had additional tailored content related to their work), except for one participating group/company (13%) that had 16 stations of standard content and additional tailored content. Altogether, the participants were exposed to the intervention between three to five weeks, and all of them had at least 16 stations of the same standard content, and 87% of the participants had at least 35 stations of the same standard content. Even though the intervention did not look identical for all the participants, for the purpose of my analysis I will treat it as such, since the option to tailor the content is part of the Deedster service.

Results

Here, the statistical results will be presented under the themes *Knowledge, awareness and concern, Behavior intent and "verbal" commitment, Locus of control and pride,* and *Actual action*. These results will later be analyzed and interpreted in the following Results and Discussion section under the same themes.

The results for every variable will be presented in terms of the aggregated results and the panel results separately. The aggregated results are the overall results of the impact, meaning how the respondents either stayed on the same value after the intervention as before, increased their value after the intervention, or how it recreased. The panel results then reveal where the different shifts departed from within the range of values the respondents declared in the pre-survey. When "groups" are referred to in this section, this means the stream of respondents within the variable that started on the same value in the pre-survey.

All percentages presented are related to the total 100% of the sample, meaning that for example if an increase of 20% within one of the groups are presented, this is 20% of the total sample of 117 respondents.

All tables referred to in this section can be seen in Appendix A.

Knowledge, awareness & concern

In this subsection, results from the variables *ImpactKnowledge, ImpactWorry, ImpactAwareActions,* and *ImpactKnowledgeCo* are presented.

To start off with the variable ImpactKnowledge, the statement *"My knowledge of environmental sustainability is"* was asked and the response options ranged from (1) *Extremely low* to (6) *Extremely high*. In other words, values between 1-3 meant leaning towards little/less knowledge, and values between 4-6 meant leaning towards high/higher knowledge.

The aggregated result shows that the majority of the respondents stayed on the same value before and after the intervention, accounting for 52.1%. The cumulative result of respondents

having an increased impact after the intervention (>0) however accounts for 43.6%, while the respondents showcasing a decreased impact (<0) accounts for 4.3%. In total, the respondents staying on the same level or increasing their values after the intervention together accounts for 95.7%.

On the individual level, the majority of the respondents in this variable are found in the group starting on value 4. Here, the respondents predominantly stayed on the same value after the intervention, accounting for 35.9%. However, 15.4% of the respondents made one increasing step, and one respondent accounting for 0.9% increased two steps. In this group, 1.7% of the respondents decreased one step.

In the groups where respondents started on the values 1, 2, and 3, no respondents had a decreased impact after the intervention. In the groups starting on value 1 and 2, respondents only made increasing steps, while in group 3, 11.1% of the respondents stayed on the same value after the intervention. However, in this group respondents predominantly had an increased impact, where 19.7% increased their value one step and 4.3% of the respondents increased their value two steps.

The highest increased impact in terms of increased steps is found in the group where one respondent started on value 1. This respondent, 0.9%, increased their value three steps. In the cumulative result, no respondent in this variable had a decreased impact greater than one step. The decreased steps are found in the groups where respondents started on value 4 and 5, and the greatest accumulation of decreased steps is found in the group starting on value 5, accounting for 2.6%.

Next is the variable ImpactWorry, where the statement *"I worry about the effects of climate change"* was asked and the possible responses ranged from (1) Strongly disagree to (6) Strongly agree. In other words meaning that responses on value 1-3 leans towards disagreeing and responses on value 4-6 leans toward agreeing.

The aggregated result shows that the majority of the respondents, 59.8%, have taken no steps in either direction after the intervention. However, 26.5% of the respondents have made increasing steps (>0) after the intervention, as opposed to 13.7% that have made decreasing

steps (<0). The majority of the respondents on aggregated level have thus either stayed on the same value or increased their value after the intervention, accounting for 86.3% (>=0).

On the individual level, most respondents started on either value 5, *Agree*, or value 6, *Strongly Agree*. The largest cumulative increased impact in terms of percentage is respondents starting on value 5 and increasing one step, accounting for 13.7%. In terms of taking the most increasing steps, this was one respondent starting on value 3 and making three increasing steps, and two respondents starting on value 4 making two increasing steps. In terms of decreasing steps, only respondents who started on value 4 or 5 accounted for these. The most cumulative decrease was one step, accounted for by 7.7% who started on value 6. The largest decrease was four steps, accounted for by one respondent starting on value 6 and one on value 5.

The third variable is ImpactAwareActions, an index where the statements "*I'm aware of how my choices affect the environment/climate"* and *"I have knowledge of how my actions impact the environment"* were posed. For both statements, the response options ranged from (1) Strongly disagree to (6) Strongly agree. In other words, responses between value 1-3 meant leaning towards disagreeing, and responses between 4-6 meant leaning towards agreeing.

The aggregated results show that the respondents staying on the same value as before the intervention accounts for 35% of the cumulative result. The respondents who have made increasing steps however account for a total of 45.3% (>0), while the respondents who have made decreasing steps accounts for 18.9% (<0) in total. Thus, a total of 80.3% respondents have stayed on the same value or increased their value after the intervention.

Looking at the individual level, most respondents are found in the group starting on value 5, where the majority within the group stayed on the same value accounting for 16.2%, while an accumulation of 5.2% of the respondents accounted for an increased impact (0.5 and 1 step). However, an accumulation of 8.6% of the respondents accounted for a decreased impact (0.5 and 2 steps).

In the groups starting on value 4, 4.5, and 5.5, the accumulated respondents making increased steps are predominant to the respondents staying on the same value. However, in the groups starting on the values 5.5 and 3.5, the number and percentage of respondents making

increased and decreased steps were the same. The largest increased impact is seen in the group starting on value 4 where 3.2% of the respondents made two increased steps, closely followed by the group starting on value 4.5 where 6.8% of the respondents increased 1.5 steps, respectively in the group starting on value 3.5 where one respondent, 0.9%, also made 1.5 increasing steps.

The final variable in this subsection is ImpactKnowledgeCo, where the statement *"I know what our company's sustainability efforts are"* was posed, and the response options ranged between (1) Strongly disagree to (6) Strongly agree.

The aggregated result shows that the majority of the respondents stayed on the same value as before the intervention and accounts for 58.1% of the cumulative result. The respondents who have made increasing steps account for a total of 34.2% (>0), while the respondents who have made decreasing steps account for 7.7% (<0) in total. A total of 92.3% respondents have stayed on the same value or increased their value after the intervention.

Looking at the individual level, the majority of the respondents are found in the group starting on value 5, the greater number of respondents staying on the same value after the intervention, accounting for 27.4%, followed by 11.1% increasing one step. In the group where the respondents started on value 4, the total increased impact accounted for 16.2% and were predominant to the respondents staying on the same value, accounting for 14.5%. In the groups where respondents started on the values 1, 2, and 3, all respondents showcased an increased impact, in other words no respondents showcased decreased impact or staying on the same value within these groups. These groups together accounted for 7.1% of the cumulative result. In addition, the one respondent that started on value 1 is an outlier in contrast to the other groups making a five step increase, meaning that this one respondent started on the lowest value, 1, and ended on the highest, 6, after the intervention.

Behavior intent & “verbal commitment”

In this section, results from the variables *ImpactWill* and *ImpactTrying* are presented.

To start off with the variable ImpactWill, the aggregated result shows that the majority of the respondents stayed on the same value as before the intervention and accounts for 65.8% of

the cumulative result. The respondents who have made increasing steps account for a total of 19.7% (>0), and the respondents who have made decreasing steps account for 14.6% (<0) in total. A total of 85.5% respondents have stayed on the same value or increased their value after the intervention.

The individual results show that the most cumulative results are found in the group where respondents started on value 5. While the majority of the respondents within this group stayed on the same value after the intervention, the largest increase impact is one step, accounted for by 10 respondents, 8.5%. However, this is closely followed by the total number of respondents that accounted for a decreased impact, seven respondents, 6%, accounting for a one step decrease, and one respondent, 0.9%, accounting for a four step decrease. The only group in which the respondents having an increased impact of value accounted for a slight majority over the respondents staying on the same value, was in the group where the respondents started on value 4. Here, the respondents showcasing an increased impact accounts for 11.1%, as opposed to 10.3% staying on the same value. In all other groups, the respondents who stayed on the same value after the intervention held a majority within the groups, even when adding both increased and decreased impact together.

Notable within this variable is that the respondents all started on the higher half of the values, meaning that the groups ranged from value 4 *Somewhat agree* to value 6 *Strongly agree*. Like mentioned above, only very slight effects can be seen within the separate groups.

For the next variable, ImpactTrying, the aggregated result shows that the majority of the respondents stayed on the same value as before the intervention and accounts for 51.3% of the cumulative result. The respondents who have made increasing steps account for a total of 39.4% (>0), and the respondents who have made decreasing steps account for 9.4% (<0) in total. A total of 90.7% respondents have stayed on the same value or increased their value after the intervention.

The individual results in turn show that most of the respondents are found in the groups starting on value 4 and 5. In the group of respondents starting on value 4, 13.7% of the respondents stayed on the same value, while 18.8% increased one step and 5.1% increased two steps. Thus, in this group the majority showcase an increased impact. In the group of respondents starting on value 5, 23.1% stayed on the same value and 10.3% increased one

step, while 5.1% decreased one step. In other words, a variety of effects can be seen within this group, although the majority remained on the same value after the intervention.

In the group of respondents starting on value 3, the cumulative majority of the group made increasing steps accounting for 5.2%, including one outlier (0.9%) making three increasing steps. In the last group where the respondents started on value 6, the majority accounting for 12.8% stayed on the same value, while an accumulated total of 3.5% made decreasing steps, including one outlier (0.9%) showcasing four decreasing steps.

Locus of control & pride

In this section, results from the variables *ImpactPrideCo*, *ImpactLOC*, and *ImpactPrideSelf* are presented.

Starting off with the variable ImpactPrideCo, the aggregated result shows that the majority of the respondents stayed on the same value as before the intervention and accounted for 70.1% of the cumulative result. The respondents who have made increasing steps account for a total of 18.8% (>0), and the respondents who have made decreasing steps account for 11.1% (<0) in total. A total of 88.9% respondents have stayed on the same value or increased their value after the intervention.

The individual results show that the majority of the respondents are found in the last group, starting on value 6. This means that the majority of the respondents declared the highest value before the intervention, that they *strongly agree* that they are proud of their employer/company for engaging them in climate and sustainability. Predominantly, the respondents in this group also stayed on the same value after the intervention, accounting for 47% of the total result. Although, 6% made one decreasing step, and 1.7% made two decreasing steps.

The second group where the most respondents are found start on value 5. While the majority stayed at the same value, 20.5%, it is followed by 13.7% making an increasing step. In the remaining groups, starting on value 3 and 4, all respondents either stayed on the same value or showcase increased impact.

For the next variable, ImpactLOC, the aggregated result shows that the majority of the respondents stayed on the same value as before the intervention and accounts for 59.8% of the cumulative result. The respondents who have made increasing steps account for a total of 24.8% (>0), and the respondents who have made decreasing steps account for 15.4% (<0) in total. A total of 84.6% respondents have stayed on the same value or increased their value after the intervention.

The individual results in turn show that the majority of the respondents are found in the group starting on value 6, meaning that they declared the highest value before the intervention, thus they *strongly agree* that they believe they as a company can have a positive impact on the environment. Out of this group, 8.5% made one decreasing step after the intervention, and 1.7% made two decreasing steps.

The second largest accumulated group of respondents is the group starting on value 5. Here, 15.4% stayed on the same value, while 17.1% increased one step after the intervention. Contrasting, a total of 5.2% of the respondents made decreasing steps, including one outlier (0.9%) decreasing four steps.

In the remaining groups starting on value 3 and 4, no respondents showcased decreased impact. Only one respondent started on value 3 and showcased one increased step after the intervention. Among the group starting on value 4, 4.3% stayed on the same value and the remaining 6.8% showcase increased impact.

In the final variable in this section, ImpactPrideSelf, the aggregated result shows that in total, 40.2% of the respondents stayed on the same value as before the intervention, closely followed by respondents increasing their value with one step accounting for 39.3%. The accumulated respondents who have made increasing steps account for a total of 48.7% (>0), thus the increased impact is predominant to the respondents staying on the same value. The respondents who have made decreasing steps account for 11.2% (<0) in total. A total of 88.9% respondents have stayed on the same value or increased their value after the intervention.

The individual results in turn show that the majority of the respondents are found in the group starting on value 4, meaning that they *somewhat agree* that they are proud of their own sustainability efforts. In this group, no respondents made decreasing steps. In total, 22.2% of the respondents stayed on the same value, while 24.8% made one increasing step and 6% made two increasing steps. In the second largest group, where respondents started on value 5, 8,5% stayed on the same value while 9.4% increased one step. In total 6.9% of the respondents within this group showcase a decreased impact, including one outlier (0.9%) decreasing three steps.

In the groups starting on the lower values, 2 and 3, no decreased impact is revealed in the results. In the group starting on value 2, one respondent stayed on the same value and one respondent increased on step after the intervention. In the group starting on value 3 however, 3.4% stayed on the same value while the remaining 7.7% in this group showcased increased impact.

"Actual action"

In this section, the result from the index variable ImpactActionWork is presented.

Out of the aggregated result, 24.8% of the respondents stayed on the same value as before the intervention. The respondents who have made increasing steps account for a total of 56.5% (>0), meaning that the majority of the respondents have made increasing steps. The respondents who have made decreasing steps account for 18.2% (<0) in total. A total of 81.3% respondents have stayed on the same value or increased their value after the intervention.

The individual results show that the majority of respondents per are found in the group starting on value 5. In this group, 7.7% stayed on the same value after the intervention. However, 6% of the respondents increased 0.5 steps, and 4.3% increased one step, together accounting for 10.3% of increased steps. Contrasting, 5.1% made 0.5 decreasing steps, and 1.7% decreased one step, together accounting for 6.8%.

In the groups where respondents started on value 2, 2.5, and 4, no one made decreasing steps, and the majority of the respondents in these groups made >=0.5 increasing steps. In the

groups starting on value 4, 4.5, and 5.5, respondents making specific increased steps were predominant to respondents staying on the same value.

The largest cumulative result of increasing steps are found in the group where respondents started on value 4, in total accounting for 17.1% of increased impact. In contrast, the largest cumulative result of decreased steps are found in the group where respondents started on value 5, in total accounting for 6.8% of decreased impact.

Analysis and discussion

In this section, the analysis of the results and interpretation related to previously presented theory is presented. The interpretation is also interwoven with discussion of what it implies in the broader scope of things.

I acknowledge that the intervention is not completed in a vacuum, separate from external factors, and as previously mentioned situational factors will not be analyzed or investigated here. The underlying assumption for the interpretation and inferences drawn here are that the revealed impacts are brought on by the intervention.

Knowledge, awareness & concern

To start off with the first variable ImpactKnowledge, drawing from the theory on attitudes by Maio and colleagues (2019), what is being measured can be understood as a cognitive component in the shaping of individual attitudes. Here, the respondents then assess what they think and believe about the attributes of environmental sustainability. More specifically, the variable measures people's perceptions of their own knowledge about environmental sustainability, asserting themselves on a scale from extremely low to extremely high. Important to remember is that this scale does not suggest an absolute level of the respondents' knowledge, but rather shows how they appraise their own cognitive understandings and beliefs of environmental sustainability as the attitude object in this instance. While the largest stream, and majority, of the respondents declared that their knowledge was somewhat high (value 4) before the intervention, drawing from the theory on persuasion as described by Maio and colleagues (2019) the persuasive effect of the message of the intervention has evidently shifted 43.6% of the respondents into increasing their assessment (with the

assumption that it was the intervention that propelled the shift, instead of external factors occurring during the same timeframe). The observable increased impact is in line the observations made in the previous research by Geelen and colleagues (2012) and Wemyss and colleagues (2018).

Inferring from the theory stating that a person's attitudes may be more prone to change if the person don't have extensive knowledge prior to analyzing and thinking more about it (Maio et al. 2019), it might not be a surprise that the respondents starting on the lower values 1-3 didn't showcase any decreased impact after the intervention, but rather predominantly an increased impact. This increase in knowledge also suggests a positive impact in terms of Hines and colleagues (1987) theory on cognitive variables, boding well for the ideal type likely leading to pro-environmental behavior.

This variable is also the one that reveals the lowest percentage of aggregated decreased impact. The results for the groups starting on the higher values follow theory as well, namely that it is harder to change attitudes and beliefs that a person is well convinced of (Maio et al. 2019), in the sense that for these values, 4-5 the people predominantly stayed on the same value as before the intervention. However, it can still be stated that even for the people starting on these values, the intervention did enable a slight shift, and among these primarily in the sense of increased impact.

While a similar interpretation could be made for the next variable, ImpactWorry, as for the previous one, ImpactKnowledge, in terms of the cognitive component, worry as a factor can also be seen as a feeling or emotion towards an attitude object. Thus, this variable could be understood in terms of an affective attitude component as described by Maio and colleagues (2019). In this case, the attitude object is climate change, and the variable measures how the respondents assert themselves on a scale of worry about the effects or consequences of it. Since the response range varies between the values 3-6, the results show that the respondents that worry the least “only” somewhat disagree (value 3). Additionally, this stream of respondents are a small minority, the rest of the respondents are predominantly found between somewhat agreeing to be worried, to strongly agreeing that they worry. In other words, a great majority of the respondents are concerned about the effects of climate change, both before the intervention and slightly increased after the intervention, but the strength differs interpersonally. Further drawing from theory on environmental concern as described

by Schultz (2000), it can then be inferred that the respondents in general hold value for certain things that can be affected by climate change, and thus, they worry about the consequences of it.

It is relevant to point out here that the intention of the intervention is not to make people worried, but rather to encourage and empower people into understanding and doing what they can to reduce their own climate footprint. Learning more and being more exposed to information about an issue, in this case climate change, can of course have the potential to elevate concern when the criticality of the issue is better understood. In the same sense, learning more about what can be done can also potentially reduce worry. As the results for this variable shows, after the intervention 26.5% declared that they worried more than they did before, and 13.7% declared that they worried less, while the rest, the majority, was still on the same level of assessed worry. While the intention might not be to worry the respondents, this can be seen as a sub-consequence to the intention of shifting other attitudes. Although a strong sense of environmental concern is often correlating to pro-environmental behavior as stated by Weimer (2017), value and concern for other things than the environment could be behind the relatively low observed impact if inferring from the statements by Kollmuss & Agyeman (2002). However, this possibility cannot be concluded from the data.

The next variable, ImpactAwareActions, is an index measuring both the respondents' perceptions on how aware they are of how their choices affect the environment, and how much knowledge they have about how their actions impact the environment. Much like the variable ImpactKnowledge, this variable can be interpreted as measuring a cognitive component - how the respondents perceive their awareness of their own actions and subsequent consequences. The results show that in this instance, more of the respondents (45.3%) declare that their beliefs of their understanding have increased after the intervention, than the amount of respondents that stayed on the same level (35%). It can be interpreted that after going through the intervention, considering and learning about how different actions and choices affect the environment, has persuaded an increased shift for 45.3% of the respondents.

Relevant to note however, is that a relatively great amount of the respondents (18.9%) declared a decreased impact after the intervention. As seen in the table (see Appendix A, Table 3a) and mentioned above, especially among those who before the intervention declared

rather high values, in other words those who perceived their knowledge and awareness of the consequences of their choices and actions to be quite high. While the explicit reason for this can't be explained from the information in this variable alone, it can still be suggested drawing from theory described by Maio and colleagues (2019) that after learning more, these respondents have considered and reassessed their beliefs. While the result declares a decreased impact, this could in fact be a positive thing, namely that the respondents have understood that there is more to know about how their actions impact the environment. Considering this in relation to the results in the ImpactKnowledge variable where an accumulated amount of 95.7% of the respondents declared that they either stayed on the same level of knowledge before the intervention or increased their knowledge, this could be a plausible inference.

Much like the variable ImpactKnowledge, the final variable in this section, ImpactKnowledgeCo, also measures the respondents' perceived knowledge. Although, the attitude object of this variable is more specific, namely knowledge about the respondents' companies' sustainability efforts. In contrast, in this variable more respondents stayed on the same value after the intervention, less respondents showcased an increased impact, and more respondents showcased a decreased impact, as in the ImpactKnowledge variable. However, in this variable, ImpactKnowledgeCo, the majority of the respondents started on the higher values, while the majority started in the mid values in ImpactKnowledge.

The results show that the tendency, in accordance with theory as described by Maio and colleagues (2019), is that people with less knowledge about an attitude subject are more prone to changing their attitudes after considering and learning more about it, in contrast to people doing the same but holding more (perceived) knowledge prior to the intervention. This can be inferred by looking at the lowest values 1-3, where all respondents, although few, showcased increased impact after the intervention. The largest stream of people increasing their steps are found among the people starting on the values 4 and 5, but relevant to note here is exactly the notion that more people started on these values before the intervention than on the lower values. In other words, the respondents starting on value 1-3 showcased 100% increased impact (difference in strength internally), while the people starting on value 4 internally showcased an increase of 51.4% and on value 5, 27.7% of the respondents showcased an increased impact internally in the group. In the group starting on value 6 of course no respondents showcased an increased impact since it's the highest value, however,

this is where the greatest stream of decreased impact is found (although not greater than the percentage of respondents who stayed on the same value).

Behavior intent & “verbal commitment”

The variable ImpactWill measures how people perceive their willingness to change their behavior in favor of the environment. In a sense, this can be interpreted as an implicit behavior intent or "verbal" commitment. Drawing from Hines and colleagues’ (1987) theory, expressing behavior intent and/or commitments in favor of the relevant attitude object, here the environment, makes it more likely to derive a certain pro-environmental behavior. Since the intention of the intervention is to encourage and enable people to act better in favor of the climate, it would of course be desired that the respondents’ will to change in favor of the climate should showcase an increased impact. Despite this, the result reveals that the percentage of respondents that showcased this is only 5.1 percentage points greater than the amount of respondents showcasing a decreased impact. This is the slightest difference between the accumulated percentage of increased and decreased impact among all the variables in this thesis’ results.

Drawing from Weimer’s (2017) statement again, there could be a correlation between the decreased impact for this variable and the decrease in the variable ImpactWorry (the decrease only differs with 0.9 percentage points), seeing as higher concern often correlates with plausible behavior intention. However, without further modeling and statistical analyzes, this correlation between the variables can’t be suggested for sure.

Furthermore, while the results can’t explicitly reveal why 14.6% of the respondents declared a decreased impact, it could in relation to theory as described by Kollmuss & Agyeman (2002) be suggested that a possible reason for the decrease is that after learning about different ways to reduce their climate footprint, they either have other things that they value more than changing in favor of the climate, or that they perceive certain actions to be difficult in relation to their own capabilities.

Nonetheless, it is relevant to mention that the responses range between values 4-6, meaning that the respondents started on the higher values and to a certain extent agree that they are willing to change in favor of the climate. Drawing from theory as presented by Maio and

colleagues (2019), that about half of the respondents started on values 5 and 6 and also stayed there might not be that surprising since these values suggest a rather strong perception of their willingness. Again, the fact that the most increased impact within the range can be seen in the group starting on value 4, even though fewer respondents are found in this group, further support the tendency.

The next variable, ImpactTrying, measures to what extent the respondents agree with the statement "I'm actively trying to live a more sustainable life". Much like the variable ImpactWill, this can both be analyzed as a "verbal" commitment and intention for a certain behavior - here to try to live a more sustainable life. While half of the respondents stayed on the same value as before the intervention, again among the groups starting on the higher values as tendency has previously shown, about two fifths of the respondents showcased an increased impact. Evidently, the message of the intervention has persuaded a relatively large part of the respondents to shift into an increased impact, here meaning that they believe that they are trying to live more sustainably.

According to Hines and colleagues' (1987) theory, the expressed commitment is one of the most predicting factors of a correlated, here pro-environmental, behavior. Thus, the fact that 39.4% of the respondents showcased increased impact and that 51.3% stayed on the same value, the majority of them on the higher half of the scale, can be considered rather positive results in terms of likelihood to derive a desired pro-environmental behavior long term. The same can be partly said for the result from ImpactWill – although the observed increased impact isn't that great which means that the intervention wasn't as effective in this regard, the fact that all respondents are found on the higher half of the scale bodes well for future pro-environmental behavior inferring with the ideal type of Hines and colleagues' (1987) model on responsible environmental behavior.

Locus of control & pride

For the variable ImpactLOC, measures to what extent the respondents believe that they, through their actions and as part of a unity (here, the company they're employed at), can have a positive impact on the environment. To reiterate to theory on locus of control as presented by Rotter (1966), a person who believes that their actions can have a positive impact on something has an internal locus of control, whereas a person who does not think that their

actions and choices have an impact but rather that powerful others or elements outside of their control matters more, have an external locus of control. With this background, respondents scoring on the lower half (value 1-3) in this specific variable - suggesting that they do not believe that they and their company can have a positive impact on the environment - would lean towards external locus of control. Respondents scoring on the higher half (value 4-6) would contrastingly lean towards perceived internal locus of control.

On this premise, the result shows that only one person assessed themselves on the lower values (value 3) before the intervention, and this same person increased to value 4 after the intervention, bridging over into the higher half of the values and thus leaning into an internal locus of control. Except for this individual, all of the other respondents are found in the top half. As it is, 50% of all the respondents started on the highest value before the intervention, suggesting that they hold an internal locus of control. Just like the tendency that has been showcased in the previous variables, most of the increase can be observed from the lower values, as well as that the increased impact is predominant to the decreased impact. The largest number of people staying on the same value is also found among the respondents who started on the highest value 6, suggesting both that they hold an internal locus of control, and that their beliefs are strong enough as to not be changed into a decreased shift after the intervention.

As stated by both Weimer (2019) and Hines and colleagues (1987), people inhibiting an internal locus of control are often found to both lean towards more pro-environmental behavior as well as intentions for pro-environmental behavior. Thus, the indication of the results bodes well in terms of pro-environmental intentions and openness to pro-environmental actions, that the respondents are for one almost exclusively leaning towards internal locus of control, and second that a fourth of the respondents also showcase an increased impact on internal locus of control after the intervention.

As for the variable ImpactPrideSelf measures to what extent the respondents are proud of their own sustainability efforts. The results show that the variables measuring the respondents sense of pride in their own efforts, and sense of pride towards their employer for engaging them in taking action for the environment differs a great deal. In this variable, ImpactPrideSelf, the second highest increase among all variables is found. Inferring in relation to the theory on guilt as described by Antonetti & Maklan (2014), this increase in the

participants' sense of pride for their actions also suggests a stronger sense of responsibility for these actions. Additionally, the cumulative percent of increased impact is greater than the percentage of respondents staying on the same value after the intervention. Evidently, the gamified elements of the intervention have persuaded a shift in the respondents sense of pride in their own sustainability efforts.

The fact that this is the variable where the second greatest percentage of increased impact is found, is rather promising results in relation to the ideal type of the model of responsible environmental behavior as presented by Hines and colleagues (1987). This suggests that the intervention has been relatively effective in terms of persuading the participants' sense of pride in their own actions, which further means that they most likely recognise the effect of their actions and thus the responsibility that is reliant entirely upon themselves, inferring from Antonetti & Maklan's (2014) theory. Although this result does not reveal anything about the respondents' actual actions, the increased sense of pride for close to half of the respondents is positive in relation to the ideal type presented in the theory.

For the final variable in this section, ImpactPrideCo, it is relevant to note that more than half of the respondents started on the highest value possible, in other words the majority of the people started off with the belief that they strongly agreed that they are proud of their employer for engaging them in the climate and sustainability. While the intervention is incentivised by the respondents' employer, the learnings and micro-assignments/actions affect the respondents' personal lives outside of work as well. What the variable measures is the respondents' sense of pride regarding their employer's incentives. This refers to a sense of pride external to themselves, toward an actor in a sort of powerful position. Thus, it might be relevant to consider the respondents stance in this matter as through the lens of theory on self-monitoring as described by Maio and colleagues (2019), meaning that this might be a situation where a person wants to align with what they think is expected of them. Even if there might be a slight bias to this, the declaration of strong beliefs in itself is not a negative thing, but probably rather a good thing since it can plausibly be derived that the respondents are then not opposed to the intervention but rather open to the opportunities provided by the intervention.

Also relevant to mention is that this is the variable with the least internal shift among all the variables presented here. It has the highest number of respondents staying on the same value

after the intervention (70.1%), and the difference between the number of people with increased impact (slight majority) and those with decreased impact is relatively low (7.7 percentage points, in other words about nine respondents). Again interpreting in relation to theory presented by Maio and colleagues (2019), the result is not that surprising since the tendency is that people who are already strongly convinced by their attitudes and have easy access to them are less likely to be pursued into an attitude shift.

"Actual action"

The variable ImpactActionWork is an index that measures both the impact of to what extent the respondents think they talk about climate and sustainability with their colleagues, and to what extent they perceive that they themselves take sustainability into account in their work. In this variable, the highest accumulated percentage of increased impact is found, showcasing an increased impact for more than half of the respondents. This finding of the great increase in terms of engaging in these simple actions is also in line with the findings of Geelen and colleagues (2012) that simple actions encouraged by the interventions were observed to remain. It is also supported by the previous research by Wemyss and colleagues (2018) and Weimer (2019) that the intervention turned out to have observable increased impact in terms of new behavior.

The specific actions of which the respondents' perception is measured can be considered rather easy to execute. Since the colleagues at different companies participate in the intervention and some of the micro-assignments incentivize the respondents to talk about and discuss certain topics, the intervention can encourage the respondents to easily "break the ice" on these specific actions. Drawing from the result and inference with theory on persuasion as presented by Maio and colleagues (2019), it is evident that the immediate effect to the message of the intervention has to a great part persuaded the respondents to increase these simple actions, or at least how they perceive their own efforts.

Conclusion

Here, the final conclusions relating back to the research questions will be presented. First, the conclusions that are observed for all variables in terms of effectiveness of persuasion will be presented, followed by the conclusions for the separate themes in the research questions.

The results of all variables reveal the general tendency that people who assess themselves on a low value before the intervention are more likely to showcase increased impact afterwards, while people who start on high values are more likely to not be persuaded to change their minds (with the exception of a few outliers). This conclusion follows well in line with presented theory. This suggests that it's relevant to match content (of the message) to the level of the individual to enable persuasion - which could require tailoring, as one size might not fit all.

Further, in all instances, the observed increased impact after the intervention is greater than the decreased impact. However, the variance in relation between increase, decrease, and staying on the same value varies for the different variables. In other words, in all instances the intervention brought more increased impact than decreased, although some perceptions toward certain attitude objects were easier to pursue than others - also relating to theory, however it is not possible to determine why certain factors were easier to change than others without further data.

Finally, out of the ten variables, the percentage of people staying on the same variable after the intervention is in majority in seven of these, meaning that more than 50% of the respondents stayed on the same value after the intervention in seven of the variables. In the remaining three variables, the percentage of respondents showcasing increased impact was the greatest. These were the variables measuring the awareness of actions and choices on the environment, taking action in the workplace, and the sense of pride in one's efforts. However it did not hold the total majority (slightly less than 50% of the respondents) except for in one case, namely when measuring the impact on people taking action in terms of talking about sustainability and taking it into account in their work and workspace.

Knowledge, awareness and concern:

After the intervention, 43.6% of the respondents showcased that their perceived knowledge about environmental sustainability had increased after the intervention. The number of people who perceived their awareness of the consequences of their own actions to have increased after the intervention was even slightly higher at 45.3%, however the percentage of people who perceived said awareness to have decreased was relatively large at 18.9%. It is interpreted that the effect of the intervention has persuaded the respondents to consider their own knowledge and awareness of action, for some hightening it, and for a slight minority made them reconsider their beliefs prior to the intervention. While the intervention cannot make the respondents know less than they did prior to it, the engaging element to it has been observed to persuade them to reconsider their prior cognitive beliefs.

While the lowest percentage of increased impact within this theme was observed regarding the respondents' perception of worry about the effects of climate change, there is a relevant distinction between discussing increased or decreased impact, and the effectiveness of the intervention. Namely, as the variable ImpactWorry showcases the lowest percentage of increased impact (26.5%), it also showcases a rather high decrease in relation to the increase (13.7%) - this is still evidence of some sort of effect. Again, the intention of the intervention is not to worry the respondents but rather to encourage and empower them, although theory suggests that a certain extent of concern often correlates with being more likely to behave pro-environmentally.

Behavior intent and verbal commitment:

The greatest effect showcased in this theme is for people assessing that they're actively trying to live more sustainably after the intervention, in other words 39.4% of the respondents have been persuaded to change their perceptions after the intervention.

The least effect is observed regarding the respondents' willingness to change their behavior in favor of the climate. Although, all respondents started on the higher half of the values (4-6), meaning they were rather convinced already before the intervention that they were willing to change in favor of the climate. In other words, it is inferred here that the respondents' where already convinced enough of their beliefs that the elements of the message of the intervention did not pursue that much of a shift. Thus, the elements of the intervention evidently persuaded a greater observable shift regarding other attitude factors,

than it did with willingness in particular since the beliefs prior to the intervention were already rather high in this notion.

Locus of control and pride:

Since a core intention with the intervention is to encourage and empower the respondents to understand and see what they can do to reduce their own climate footprint, it is considered a positive result that close to half of the respondents showcased increased impact after the intervention in terms of being proud of their own sustainability efforts. Evidently, participating in the intervention has persuaded a rather large part of the respondents' pride towards their own efforts, which likely has strengthened their sense of responsibility for their actions as well as acknowledgement of the effectiveness of them.

In rather stark contrast, regarding the notion of pride towards the respondents' employers for the engagement, not as much variance is observed. Although, considerably more respondents started on the higher values within this variable than regarding pride of their own efforts. More specifically, more than half of the respondents are found in the group starting on the highest possible value, and relating to the tendency it is thus hardly surprising that not much observable effect is seen. Again, relating to intentions of the intervention it is also a positive remark that the pride didn't decrease remarkably.

Regarding the respondents' perception of locus of control, the intervention did not have that great of a persuasive effect in terms of internal shifts. However, the tendency shows that the respondents all found themselves on the specter of internal locus of control, which suggests here that they as a part of their company as a unity can have a positive effect on the environment through their actions, and this notion didn't change remarkably after the intervention. Which, in itself is positive, since the perception of being in control of consequences in this sense often correlates with responsible pro-environmental behavior in theory.

Actual action:

Within this theme, there's only one variable, an index, however this is the variable showcasing the largest percentage of increased impact at 56.5%. This means that an immediate effect of the intervention is that more than half of the respondents consider

themselves to be acting more for the climate at work, in terms of discussing it with others and taking it into account when performing their work.

Relating to theory, the rather high percentage of increased impact suggests that the specific actions that the respondents were asked to assess their beliefs of, is found by the respondents to be rather easy to do. It can also be derived that this type of intervention can enable a good start for discussion, and for people to start considering sustainability in their work life. Thus, the intervention is considered effective in terms of persuading people into making these easy pro-environmental actions.

Suggestions for future research

In this final section, I present a selection of suggestions for further research. The suggestions are in line with how to potentially widen the scope of the research topic, and how to enable more complex and potentially deeper understandings of it.

First of all, if doing a similar study of the same type of intervention, it would be of relevance to include a control group to be able more clearly define what changes are effects of the intervention. This opposed a control group within a similar context, however not receiving and participating in the same engaging intervention.

Further, I suggest two directions of follow-up studies. For one, a study including a follow-up survey a couple of months after the end of the intervention. Doing a further study to investigate the data from a follow-up survey would provide an understanding of the long term effects on cognitive and psycho-social variable shift, of an intervention like the one presented here. A gap in the understanding of the long-term effects of interventions like these is still present and pressing as suggested by previous research (Weimer 2019).

Second, since the increased impact for all variables varied between 18.8% to 56.5%, it would be relevant to do a follow-up study, also after a period of time, with focus on minority influence. With the same participants that participated in the intervention, and since they work together (work groups from six different companies), they will remain in the same context. Thus, it would be of interest to see how and whether their increased impact has come through in acts, verbally or otherwise expressed, or though other practices, and whether these

in turn has and/or can influence the participants that did not show the same, or as much, increased impact directly after the intervention.

Another line of further research would be to utilize additional methods to attain triangulation and investigate a more complex understanding of the topic and results, through multiple perspectives. A specific suggestion here would be to utilize deep diving interviews with the participants parallel to the intervention, as to conduct further data and context about the shifts and beliefs. For example, this could provide a better understanding of why certain increases or decreases happened and the thoughts behind it.

A final suggested approach to advance further research on this topic would be to connect the dots between the attitudes and other factors presented in this thesis, to additional variables of specific pro-environmental behaviors. For example, to investigate to what extent these attitude factors are underlying drivers of certain pro-environmental behaviors, and what factors are stronger predictors, mediators, and/or drivers towards desired behaviors than others.

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Appendix A: Tables of variables

Knowledge, awareness & concern

Aggregated impact knowledge (01_Post-01_Pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-1	5	4,3	4,3	4,3
	0	61	52,1	52,1	56,4
	1	42	35,9	35,9	92,3
	2	8	6,8	6,8	99,1
	3	1	,9	,9	100,0
	Total	117	100,0	100,0	

Table 1a) ImpactKnowledge, aggregated result

Variables and description	If condition	Step/s	Freq.	Perc. (%)
ImpactKnowledge	Pre=1 & Post>=1	3	1	0,9
		Missing	116	99,1
(q0001_Post - q0001_Pre) *"My knowledge of environmental sustainability is"*				
	Pre=2 & Post>=1	1	1	0,9
		2	2	1,7
Self-assesed experience of knowledge about environmental sustainability		Missing	114	97,4
	Pre=3 & Post>=1	0	13	11,1
		1	23	19,7
		2	5	4,3
		Missing	76	65
	Pre=4 & Post>=1	−1	2	1,7
		0	42	35,9
		1	18	15,4
		2	1	0,9
		Missing	54	46,2
	Pre=5 & Post>=1	−1	3	2,6
		0	5	4,3
		Missing	109	93,2

	Pre=6 & Post>=1	0	1	0,9
		Missing	116	99,1

Table 1b) ImpactKnowledge, panel results

Aggregated impact worry (02_Post - 02_Pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-4	2	1,7	1,7	1,7
	-2	1	,9	,9	2,6
	-1	13	11,1	11,1	13,7
	0	70	59,8	59,8	73,5
	1	28	23,9	23,9	97,4
	2	2	1,7	1,7	99,1
	3	1	,9	,9	100,0
	Total	117	100,0	100,0	

Table 2a) ImpactWorry, aggregated results

Variables and description	If condition	Step/s	Freq.	Perc. (%)
ImpactWorry	Pre=3 & Post>=1	0	1	0,9
		1	2	1,7
(q0002_Post - q0002_Pre) *"I worry about the effects of climate change"*		3	1	0,9
		Missing	113	96,6
Self-assessed worry/concern - attitude				
	Pre=4 & Post>=1	0	9	7,7
		1	**10**	8,5
		2	**2**	1,7
		Missing	96	82,1
	Pre=5 & Post >=1	−4	**1**	0,9
		−1	4	3,4
		0	**23**	19,7
		1	**16**	13,7
		Missing	73	62,4
	Pre=6 & Post>=1	−4	**1**	0,9
		−2	1	0,9

		−1	9	7,7
		0	**37**	31,6
		Missing	69	59

Table 2b) ImpactWorry, panel results

Aggregated impact from awareness of actions index (003 & 010))

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2,00	1	,9	,9	,9
	-1,50	1	,9	,9	1,7
	-,50	20	17,1	17,2	19,0
	,00	41	35,0	35,3	54,3
	,50	23	19,7	19,8	74,1
	1,00	15	12,8	12,9	87,1
	1,50	11	9,4	9,5	96,6
	2,00	4	3,4	3,4	100,0
	Total	116	99,1	100,0	
Missing	System	1	,9		
Total		117	100,0		

Table 3a) ImpactAwareActions, aggregated result

Variables and description	If condition	Step/s	Freq.	Perc. (%)
ImpactAwareActions	Pre=3,5 & Post>=1	−1,5	1	0,9
(Index of q0003 & q0010)		0,5	1	0,9
(Index_Post - Index_Pre)		1,5	1	0,9
"I'm aware of how my choices affect the environment/climate" & "I have knowledge of how my actions impact the environment"		Missing	114	97,4
Self-assessed awareness of how actions and choices affect and impact the environment	Pre=4 & Post>=1	0	5	4,3
		0,5	**7**	6
		1	**7**	6
		1,5	2	1,7
		2	4	3,4
		Missing	92	78,6
	Pre=4,5 & Post>=1	−0,5	3	2,6

		0	2	1,7
		0,5	**5**	4,3
		1	**5**	4,3
		1,5	**8**	6,8
		Missing	94	80,3
	Pre=5 & Post>=1	−2	1	0,9
		−0,5	9	7,7
		0	**19**	16,2
		0,5	3	2,6
		1	3	2,6
		Missing	82	70,1
	Pre=5,5 & Post>=1	−0,5	7	6
		0	5	4,3
		0,5	7	6
		Missing	98	83,8
	Pre=6 & Post>=1	−0,5	1	0,9
		0	10	8,5
		Missing	106	90,6

Table 3b) ImpactAwareActions, panel result

Aggregated impact on knowledge about company efforts (05_Post-05_Pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	2	1,7	1,7	1,7
	-1	7	6,0	6,0	7,7
	0	68	58,1	58,1	65,8
	1	28	23,9	23,9	89,7
	2	10	8,5	8,5	98,3
	3	1	,9	,9	99,1
	5	1	,9	,9	100,0
	Total	117	100,0	100,0	

Table 5a) ImpactKnowledgeCo, aggregated result

Variables and description	If condition	Step/s	Freq.	Perc. (%)
ImpactKnowledgeCo (q0005_Post - q0005_Pre) *"I know what our company's sustainability efforts are"*	Pre=1 & Post>=1	5	**1**	0,9
		Missing	116	99,1
	Pre=2 & Post>=1	1	**1**	0,9
		2	**1**	0,9
		Missing	115	98,3
	Pre=3 & Post>=1	1	**1**	0,9
		2	**3**	2,6
		3	**1**	0,9
		Missing	112	95,7
	Pre=4 & Post>=1	−2	1	0,9
		0	**17**	14,5
		1	**13**	11,1
		2	**6**	5,1
		Missing	80	68,4
	Pre=5 & Post>=1	−1	2	1,7
		0	**32**	27,4
		1	**13**	11,1
		Missing	70	59,8
	Pre=6 & Post>=1	−2	1	0,9
		−1	5	4,3
		0	19	16,2
		Missing	92	78,6

Table 5b) ImpactKnowledgeCo, panel result

Behavior intent & “verbal commitment”

Aggregated impact of willingness to change behavior (04_Post - 04_Pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-4	1	,9	,9	,9
	-2	2	1,7	1,7	2,6
	-1	14	12,0	12,0	14,5
	0	77	65,8	65,8	80,3
	1	18	15,4	15,4	95,7
	2	5	4,3	4,3	100,0
	Total	117	100,0	100,0	

Table 4a) ImpactWill, aggregated result

Variables and description	If condition	Step/s	Freq.	Perc. (%)
ImpactWill	Pre=4 & Post>=1	0	12	10,3
		1	8	6,8
(q0004_Post - q0004_Pre) *"I'm willing to change my behaviour for the good of our environment/climate"*		2	5	4,3
		Missing	92	78,6
Self-assessed willingness to change behavior in favor of the climate - attitude/behavior intent				
	Pre=5 & Post>=1	−4	**1**	0,9
		−1	**7**	6
		0	**39**	33,3
		1	**10**	8,5
		Missing	60	51,3
	Pre=6 & Post>=1	−2	2	1,7
		−1	7	6
		0	**26**	22,2
		Missing	82	70,1

Table 4b) ImpactWill, panel result

Aggregated impact on trying to live/act sustainably (012_Post-012_Pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-4	1	,9	,9	,9
	-1	10	8,5	8,5	9,4
	0	60	51,3	51,3	60,7
	1	36	30,8	30,8	91,5
	2	9	7,7	7,7	99,1
	3	1	,9	,9	100,0
	Total	117	100,0	100,0	

Table 10a) ImpactTrying, aggregated result

Variables and description	If condition	Step/s	Freq.	Perc. (%)
ImpactTrying (q0012_Post - q0012_Pre) *"I'm actively trying to live a more sustainable life"* *Self-assessed extent of trying to live/act sustainably - behavior intent?*	Pre=3 & Post>=1	−1	1	0,9
		0	2	1,7
		1	2	1,7
		2	3	2,6
		3	1	0,9
		Missing	108	92,3
	Pre=4 & Post>=1	0	**16**	13,7
		1	**22**	18,8
		2	**6**	5,1
		Missing	73	62,4
	Pre=5 & Post>=1	−1	6	5,1
		0	**27**	23,1
		1	**12**	10,3
		Missing	72	61,5
	Pre=6 & Post>=1	−4	1	0,9
		−1	3	2,6
		0	15	12,8
		Missing	98	83,8

Table 10b) ImpactTrying, panel result

Aggregated impact of pride concerning employer engagement (06_Post-06_Pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2,00	2	1,7	1,7	1,7
	-1,00	11	9,4	9,4	11,1
	,00	82	70,1	70,1	81,2
	1,00	19	16,2	16,2	97,4
	2,00	3	2,6	2,6	100,0
	Total	117	100,0	100,0	

Table 6a) ImpactPrideCo, aggregated result

Variables and description	If condition	Step/s	Freq.	Perc. (%)
ImpactPrideCompany (q0006_Post - q0006_Pre) *"I'm proud that my employer engages its employees in climate and sustainability"* *Self-assessed sense of pride of one's company/employer - attitude*	Pre=3 & Post>=1	2	**2**	1,7
		Missing	115	98,3
	Pre=4 & Post>=1	0	3	2,6
		1	3	2,6
		2	1	0,9
		Missing	110	94
	Pre=5 & Post>=1	−1	4	3,4
		0	**24**	20,5
		1	**16**	13,7
		Missing	73	62,4
	Pre=6 & Post>=1	−2	2	1,7
		−1	7	6
		0	**55**	47
		Missing	53	45,3

Table 6b) ImpactPrideCo, panel result

Aggregated impact on Locus of Control (09_Post - 09_Pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-4	1	,9	,9	,9
	-2	2	1,7	1,7	2,6
	-1	15	12,8	12,8	15,4
	0	70	59,8	59,8	75,2
	1	27	23,1	23,1	98,3
	2	2	1,7	1,7	100,0
	Total	117	100,0	100,0	

Table 8a) ImpactLOC, aggregated result

Variables and description	If condition	Step/s	Freq.	Perc. (%)
ImpactLOC (q0009_Post - q0009_Pre) *"I think we as a company can have a positive impact on the environment"* *Extent of one's belief that they and their company can have a positive impact - locus of control*	Pre=3 & Post>=1	1	1	0,9
		Missing	116	99,1
	Pre=4 & Post>=1	0	5	4,3
		1	6	5,1
		2	2	1,7
		Missing	104	88,9
	Pre=5 & Post>=1	−4	**1**	0,9
		−1	**5**	4,3
		0	**18**	15,4
		1	**20**	17,1
		Missing	73	62,4
	Pre=6 & Post>=1	−2	**2**	1,7
		−1	**10**	8,5
		0	**47**	40,2
		Missing	58	49,6

Table 8b) ImpactLOC, panel result

Aggregated impact pride concerning own efforts (011_Post-011_Pre)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-3	1	,9	,9	,9
	-1	12	10,3	10,3	11,1
	0	47	40,2	40,2	51,3
	1	46	39,3	39,3	90,6
	2	11	9,4	9,4	100,0
	Total	117	100,0	100,0	

Table 9a) ImpactPrideSelf, aggregated result

Variables and description	If condition	Step/s	Freq.	Perc. (%)
ImpactPrideSelf	Pre=2 & Post>=1	0	1	0,9
		1	1	0,9
(q0011_Post - q0011_Pre) *"I'm proud of my personal sustainability efforts"*		Missing	115	98,3
Self-assessed pride of one's own efforts - attitude	Pre=3 & Post>=1	0	4	3,4
		1	5	4,3
		2	4	3,4
		Missing	104	88,9
	Pre=4 & Post>=1	0	**26**	22,2
		1	**29**	24,8
		2	**7**	6
		Missing	55	47
	Pre=5 & Post>=1	−3	**1**	0,9
		−1	**7**	6
		0	**10**	8,5
		1	**11**	9,4
		Missing	88	75,2
	Pre=6 & Post>=1	−1	5	4,3
		0	6	5,1
		Missing	106	90,6

Table 9b) ImpactPrideSelf,

“Actual action”

Aggregate impact of index action at work

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-1,50	1	,9	,9	,9
	-1,00	6	5,1	5,2	6,0
	-,50	14	12,0	12,1	18,1
	,00	29	24,8	25,0	43,1
	,50	29	24,8	25,0	68,1
	1,00	19	16,2	16,4	84,5
	1,50	11	9,4	9,5	94,0
	2,00	5	4,3	4,3	98,3
	2,50	1	,9	,9	99,1
	3,50	1	,9	,9	100,0
	Total	116	99,1	100,0	
Missing	System	1	,9		
Total		117	100,0		

Table 7a) ImpactActionWork, aggregated result

Variables and description	If condition	Step/s	Freq.	Perc. (%)
ImpactActionWork	Pre=2 & Post>=1	0,5	1	0,9
		1	1	0,9
(Index between q0007 & q0008) *"I talk about sustainability and climate with my colleagues" & "I'm taking sustainability into account in my work"*		1,5	1	0,9
		2	1	0,9
		Missing	113	96,6
Taking action at work/self-assesed behavior intent regarding taking action at work				
	Pre=2,5 & Post>=1	1,5	2	1,7
		2	1	0,9
		2,5	1	0,9
		3,5	1	0,9
		Missing	112	95,7
	Pre=3 & Post>=1	−1	1	0,9
		−0,5	2	1,7
		1	2	1,7
		2	2	1,7

		Missing	110	94
	Pre=3,5 & Post>=1	−0,5	1	0,9
		0	1	0,9
		0,5	1	0,9
		1	1	0,9
		1,5	1	0,9
		Missing	112	95,7
	Pre=4 & Post>=1	0	4	3,4
		0,5	6	5,1
		1	8	6,8
		1,5	5	4,3
		2	1	0,9
		Missing	93	79,5
	Pre=4,5 & Post>=1	−0,5	2	1,7
		0	6	5,1
		0,5	8	6,8
		1	2	1,7
		1,5	2	1,7
		Missing	97	82,9
	Pre=5 & Post>=1	−1	2	1,7
		−0,5	6	5,1
		0	9	7,7
		0,5	7	6
		1	5	4,3
		Missing	88	75,2
	Pre=5,5 & Post>=1	−1,5	1	0,9
		−1	2	1,7
		−0,5	1	0,9
		0	2	1,7
		0,5	6	5,1

		Missing	105	89,7
	Pre=6 & Post>=1	−1	1	0,9
		−0,5	2	1,7
		0	7	6
		Missing	107	91,5

Table 7b) ImpactActionWork, panel result

Appendix B: Original variables

Original variables			
Name Pre	**Name Post**	**Labels**	**Scale**
Gender	-	What's your gender?	Female, Male, Transgender female, Transgender male, Gender-varian/Non-conforming, Other, Prefer not to say
Age	-	How old are you?	Age groups
q0001_Pre	q0001_Post	My knowledge of environmental sustainability is	Extremely Low, Very Low, Somewhat Low, Somewhat High, Very High, Extremely High 1-6
q0002_Pre	q0002_Post	I worry about the effects of climate change	Strongly Disagree, Disagree, Somewhat Disagree, Somewhat Agree, Agree, Strongly Agree 1-6
q0003_Pre	q0003_Post	I'm aware of how my choices affect the environment/climate	Strongly Disagree/Agree 1-6
q0004_Pre	q0004_Post	I'm willing to change my behaviour for the good of our environment/climate	Strongly Disagree/Agree 1-6
q0005_Pre	q0005_Post	I know what our company's sustainability efforts are	Strongly Disagree/Agree 1-6
q0006_Pre	q0006_Post	I'm proud that my employer engages its employees in climate and sustainability	Strongly Disagree/Agree 1-6
q0007_Pre	q0007_Post	I talk about sustainability and climate with my colleagues	Strongly Disagree/Agree 1-6
q0008_Pre	q0008_Post	I'm taking sustainability into account in my work	Strongly Disagree/Agree 1-6
q0009_Pre	q0009_Post	I think we as a company can have a positive impact on the environment	Strongly Disagree/Agree 1-6
q0010_Pre	q0010_Post	I have knowledge of how my actions impact the environment	Strongly Disagree/Agree 1-6
q0011_Pre	q0011_Post	I'm proud of my personal sustainability efforts	Strongly Disagree/Agree 1-6
q0012_Pre	q0012_Post	I'm actively trying to live a more sustainable life	Strongly Disagree/Agree 1-6

Appendix C: New variables

New variables	
Name	**Labels**
ImpactKnowledge	Aggregated impact knowledge (01_Post-01_Pre)
ImpactKnowledge1	Impact knowledge (Pre=1 & Post>=1)
ImpactKnowledge2	Impact knowledge (Pre=2 & Post>=1)
ImpactKnowledge3	Impact knowledge (Pre=3 & Post>=1)
ImpactKnowledge4	Impact knowledge (Pre=4 & Post>=1)
ImpactKnowledge5	Impact knowledge (Pre=5 & Post>=1)
ImpactKnowledge6	Impact knowledge (Pre=6 & Post>=1)
ImpactWorry	Aggregated impact worry (02_Post - 02_Pre)
ImpactWorry1	Impact worry (Pre=3 & Post>=1)
ImpactWorry2	Impact worry (Pre=4 & Post>=1)
ImpactWorry3	Impact worry (Pre=5 & Post>=1)
ImpactWorry4	Impact worry (Pre=6 & Post>=1)
IndexAwareActions_Pre	Index Awareness Actions 003+010_Pre
IndexAwareActions_Post	Index Awareness Actions 003+010_Post
ImpactAwareActions	Aggregated impact from awareness of actions index (003 & 010))
ImpactAwareActions1	Impact of index awareness actions (Pre=3.5 & Post>=1)
ImpactAwareActions2	Impact of index awareness actions (Pre=4 & Post>=1)
ImpactAwareActions3	Impact of index awareness actions (Pre=4.5 & Post>=1)
ImpactAwareActions4	Impact of index awareness actions (Pre=5 & Post>=1)
ImpactAwareActions5	Impact of index awareness actions (Pre=5.5 & Post>=1)
ImpactAwareActions6	Impact of index awareness actions (Pre=6 & Post>=1)
ImpactWill	Aggregated impact of willingness to change behavior (04_Post - 04_Pre)
ImpactWill1	Impact on willingness to change behavior (Pre=4 & Post>=1)
ImpactWill2	Impact on willingness to change behavior (Pre=5 & Post>=1)
ImpactWill3	Impact on willingness to change behavior (Pre=6 & Post>=1)
ImpactKnowledgeCo	Aggregated impact on knowledge about company efforts (05_Post-05_Pre)
ImpactKnowledgeCo1	Impact on knowledge about company efforts (Pre=1 & Post>=1)
ImpactKnowledgeCo2	Impact on knowledge about company efforts (Pre=2 & Post>=1)
ImpactKnowledgeCo3	Impact on knowledge about company efforts (Pre=3 & Post>=1)
ImpactKnowledgeCo4	Impact on knowledge about company efforts (Pre=4 & Post>=1)
ImpactKnowledgeCo5	Impact on knowledge about company efforts (Pre=5 & Post>=1)
ImpactKnowledgeCo6	Impact on knowledge about company efforts (Pre=6 & Post>=1)

ImpactPrideCompany	Aggregated impact of pride concerning employer engagement (06_Post-06_Pre)
ImpactPrideCompany1	Impact pride concerning employer engagement (Pre=3 & Post>=1)
ImpactPrideCompany2	Impact pride concerning employer engagement (Pre=4 & Post>=1)
ImpactPrideCompany3	Impact pride concerning employer engagement (Pre=5 & Post>=1)
ImpactPrideCompany4	Impact pride concerning employer engagement (Pre=6 & Post>=1)
IndexActionWork_Pre	Index for taking action at work (07+08_Pre/2)
IndexActionWork_Post	Index for taking action at work (07+08_Post/2)
ImpactActionWork	Aggregate impact of index action at work
ImpactActionWork1	Impact action at work (Pre=2 & Post>=1)
ImpactActionWork2	Impact action at work (Pre=2.5 & Post>=1)
ImpactActionWork3	Impact action at work (Pre=3 & Post>=1)
ImpactActionWork4	Impact action at work (Pre=3.5 & Post>=1)
ImpactActionWork5	Impact action at work (Pre=4 & Post>=1)
ImpactActionWork6	Impact action at work (Pre=4.5 & Post>=1)
ImpactActionWork7	Impact action at work (Pre=5 & Post>=1)
ImpactActionWork8	Impact action at work (Pre=5.5 & Post>=1)
ImpactActionWork9	Impact action at work (Pre=6 & Post>=1)
ImpactLOC	Aggregated impact on Locus of Control (09_Post - 09_Pre)
ImpactLOC1	Impact on Locus of Control (Pre=3 & Post>=1)
ImpactLOC2	Impact on Locus of Control (Pre=4 & Post>=1)
ImpactLOC3	Impact on Locus of Control (Pre=5 & Post>=1)
ImpactLOC4	Impact on Locus of Control (Pre=6 & Post>=1)
ImpactPrideSelf	Aggregated impact pride concerning own efforts (011_Post-011_Pre)
ImpactPrideSelf1	Impact pride concerning own efforts (Pre=2 & Post>=1
ImpactPrideSelf2	Impact pride concerning own efforts (Pre=3 & Post>=1
ImpactPrideSelf3	Impact pride concerning own efforts (Pre=4 & Post>=1
ImpactPrideSelf4	Impact pride concerning own efforts (Pre=5 & Post>=1
ImpactPrideSelf5	Impact pride concerning own efforts (Pre=6 & Post>=1
ImpactTrying	Aggregated impact on trying to live/act sustainably (012_Post-012_Pre)
ImpactTrying1	Impact on trying to live/act sustainably (Pre=3 & Post>=1)
ImpactTrying2	Impact on trying to live/act sustainably (Pre=4 & Post>=1)
ImpactTrying3	Impact on trying to live/act sustainably (Pre=5 & Post>=1)
ImpactTrying4	Impact on trying to live/act sustainably (Pre=6 & Post>=1)