

Work Project, presented as part of the requirements for the Award of a Master's degree in
Business Analytics from the Nova School of Business and Economics.

**A new behavioral change model to accelerate
individual climate action**

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Abstract

The majority of individuals in the European Union is aware of climate-change, but little is done. The greenhouse gas emissions are hitting record highs every year despite high public awareness. This paper starts by examining the drivers of individual climate action throughout literature. The first part is combining behavioral change and communication models with individual interviews to build a new model to accelerate individual climate-action. The second part is assessing the individual drivers in-depth through a survey to build a clustering model. The two parts are combined by building a final model and introducing a digital-solution to accelerate climate-action. The findings and practical solution are building guidance for organizations, governments and entrepreneurship to accelerate individual climate-action.

Keywords: Climate-Action, Behavioral Change, Climate-Change Communication, Clustering, Digital-Solution

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1. Motivation

The global greenhouse gas emissions in the atmosphere hit another record high in 2021 (“Greenhouse Gas Bulletin: Another Year Another Record | World Meteorological Organization” 2021). The IPCC report summarized the devastating consequences of climate change. Despite the scientific evidence and apocalyptic headlines on news outlets, little seems to change for the individual in the western world. The individual seems less convinced that their actions contribute to climate change, which already influences millions of people through draughts, wildfire, food and water shortages, and the simple disappearance of livelihoods. Climate change remains the elephant in the room, and the particular importance of our individual actions seems to meet a standstill when convenience, ignorance, and disagreement are present. Those engaged in climate matters are frustrated by the lack of action and interest from those around them. Millions around the world joined forces for drastic climate protests and movements. The majority of individuals say sustainability matters but do little to reduce individual emissions. This paper explores the different drivers of individual climate-actions to build a practical model that accelerates individual climate actions (CA) through a technology-enabled approach. The literature review builds an umbrella to discover different drivers of individual CA, which builds the baseline to form two distinct motivational questions. The first part combines behavioral and communication models with qualitative data to build a new behavioral change model aiming to accelerate climate change. The second part examines the factors identified in the literature review to build a clustering model that incorporates significant factors. The two parts are then merged in a practical model and solution to accelerate individual climate-action based on the findings of this paper.

2. Literature Review

The literature review sketches out the research landscape and builds the knowledge baseline for this paper. The literature review is divided into internal and external drivers to explore individual CA. The literature review is simplified by introducing the term climate action (CA), comprehensively including all environmental behaviors and actions assessed throughout the literature.

2.1 Internal Drivers

Psychology research must be included to understand internal factors and move towards CA (Converse et al. 2021; Clayton 2015).

Emotions

Research highlights the influence of emotions on CA. *Negative emotions* such as frustration, worry, and concern (English and Claudia 2020) can inhibit action and even promote climate change denial (Nordgaard 2011). Specific negative emotions are associated with CA.

Boredom significantly predicts climate inaction, while *anxiety and helplessness* are weak predictors (Geiger, Swim, and Gasper 2021). *Gamification strategies, meaning-making, and self-discovery* have been suggested as a prioritization to minimize boredom (Geiger, Swim, and Gasper 2021).

Helplessness might not directly predict CA but can lead to a demoralization of climate change (Salomon, Pretson, and Tannenbaum 2017).

High moralization of climate inaction can be directly linked to individual efficacy, which results in stronger CA intention. Although helplessness might not predict CA, it is an

essential driver of moralization and individual efficacy (Lau et al. 2021).

Worry can enhance CA only when personal and collective outcome expectancies, namely efficacy, are high (Gregersen et al. 2021). If people are not worried, factors other than climate change, such as financial savings, might be more effective in altering action (Gregersen et al. 2021). Throughout the studies, emotions are assessed isolated without examining the relationship and causal order, which must be considered in the analysis as individual emotions are interconnected and complex.

Positive emotions, namely hope, interest, and optimism, can motivate us to take action (English and Claudia 2020).

Hope strongly predicts CA (Geiger, Swim, and Gasper 2021). Hope implies recognition of possibility rather than overestimating success and shields from adverse effects of low success likelihood (Bury, Wenzel, and Woodyatt 2020). The cubic function of hope and individual carbon emissions reduction shows that, despite low expectancy, high want can lead to actions until a certain plateau of hope is reached (Bury, Wenzel, and Woodyatt 2020). These findings highlight the importance of focusing on success-possibility rather than probability. Researchers (English 2021; Geiger 2021; Bury 2019) have emphasized the need for hope and positive emotions to motivate CA, broken down on a personal level.

Efficacy has been highlighted as a complementing factor to drive action. Personal efficacy can be divided into *self-efficacy*, how easy it is to take action, and *response efficacy*, how effective one believes actions are (Crosman, Bostrom, and Hayes 2019). Both efficacies are necessary to motivate CA. The individual actions rated low in the effort to execute are more likely to be undertaken without considering the real impact (Crosman, Bostrom, and Hayes 2019). Individuals are frequently unaware of their CA's impact on the climate (Bouman, Steg, and Perlaviciute 2021). Specific CA, namely energy behaviors, were more likely to be

undertaken if perceived as effective to combat climate change on an individual or collective level (Gregersen et al. 2021). Contrary, *collective efficacy* alone failed to be a significant behavior predictor. To move towards CA the ease of taking action should be highlighted among CAs with high impact.

The ease of undertaking actions is often not conflated with the effectiveness of that action, and it is essential to establish understanding and distinction between low- and high-effective CAs first (Crosman, Bostrom, and Hayes 2019). A high level of energy efficiency actions has been predicted by *combining high worry with high collective outcome expectancy*. The significance of collective outcome expectancy might be rooted in climate change as a global challenge that is caused by us on a collective level which needs CAs from everyone (Gregersen et al. 2021). This suggests continuing informing about the climate-change risks while focusing on potential individual and collective actions (Gregersen et al. 2021).

Personal intractability refers to the individual belief that climate change can not be mitigated by individual CAs (Xiang et al. 2019). This intractability might result from the perception of climate change as a psychologically distant risk, impacting the future, distant places, and dissimilar people. Individuals exposed to intractability-inducing information are prone to inaction, which correlates action and intractability (Xiang et al., 2019).

Contrary to a collective orientation, an individualistic orientation may further enhance climate inaction (Xiang et al. 2019).

While emotions can be defined as temporary drivers, values are our stable guidelines for action (Bouman, Steg, and Perlaviciute 2021).

Values

Values influence actions indirectly and are at the start of the chain to action. In unfamiliar

situations, the values are more dynamic, and the distinction between good and evil gets fuzzier (Lau et al. 2021). Urgency and the linkage to harmful consequences can lead to stronger actions by limiting moral choices (Lau et al. 2021). Four individual values, namely biospheric, altruistic, egoistic, and hedonic, have been further explored (Bouman, Steg, and Perlaviciute 2021). *High biospheric values*, meaning how much a person values the natural surroundings, strongly predict CA. When acting on the biospheric values, the other three values can be sacrificed. This highlights the importance of being willing to *sacrifice* as a direct predictor for CA (Thaller, Fleiß, and Burdermann 2020). Moral views are simultaneously status markers and attempts to achieve self-worth (Lau et al. 2021), which should be considered throughout the analysis.

Relationships play a role in sustainable behavior (Lau et al. 2021). Relationships form *ingroup values* affecting CA (Bouman, Steg, and Perlaviciute 2021).

While certain CAs related to personal decisions, for example, food and clothing, are closely related to internal factors, transportation and energy behavior have been shown to depend on external factors (Chuvieco et al. 2021)

Demographics

Socio-demographics, such as age, sex, race, income, and education, can be revealed as weaker predictors of CA than self-sacrifice, reputation, biospheric values, and political affiliation (Thaller 2021; Hornsey 2019). Although these are weak predictors, they are included in the literature review to provide a valuable segmentation tool.

Increased age is associated with climate-friendly behavior (Thaller 2021; Bruderer Enzler 2019). Youth movements such as Fridays for Future show a rise among the younger

generations. The CAs are self-reported within the studies, which might not correctly reflect the real impact of actual actions accordingly (Thaller 2021).

Gender is a significant determinator as females are more likely to engage in conservation behavior while males participate in climate citizenship and visible actions (Thaller, Fleiß, and Burdermann 2020). The underlying gender roles might influence these results, which should be further examined.

The political ideology has been highlighted across studies as one of CA's most significant socio-demographic factors (Thaller 2021; Clayton 2015; Hornsey 2019; Crosman 2019). Right-wing voters are less likely to engage in CA (Thaller, Fleiß, and Burdermann 2020). Conservatives remain more skeptical than liberals that government action will have an appreciable effect (Crosman, Bostrom, and Hayes 2019). A study from Hornsey et al. (2019) portrays climate skepticism as positively correlated with their differences, with political affiliation and free-market ideology being the most noticeable.

Climate skeptics were more likely to portray rejection of climate science if it undermined their political and economic beliefs (Hornsey 2019; Hoffman 2011; Knutti 2019). This notion is backed up by the idea that it is more convenient to believe climate change is a natural phenomenon if one's beliefs conflict with actions necessary to mitigate climate change (Heath 2006). The findings on political affiliation by Hornsey et al. (2016) may be restricted to only the US as the study failed to find this correlation statistically significant in other countries.

2.2 External Drivers

As climate change is not caused by the individual but by us humans collectively (Masson and Fritsche 2021), *social groups* are important to examine (Harth 2021). Others influence our

behavior (Mortensen et al. 2017), implying a shift from personal goals, efficacy or cost-benefit to group goals, efficacy, and benefits (Masson and Fritsche 2021). Even if a personal contribution is considered important, anticipating others' inaction can demotivate people (Masson and Fritsche 2021). The *collective in-group identification* aligns ingroup members' goals and actions through depersonalization and self-stereotyping (Masson and Fritsche 2021).

The social-identity approach proposes that people derive a significant part of their self-concept from social group belonging (Schulte et al. 2020).

Individual identification, with pro-environmental group goals and norms, is crucial for CA (Masson and Fritsche 2021). This identifies members as climate agents with autonomous goals and collective goal-directed actions, whose effects align with the group norms (Masson and Fritsche 2021). For example, salient climate-change threats increased students' support for radical left-wing actions only when these were said to be approved by fellow students (Masson and Fritsche 2021).

Threat will only motivate people if radical climate protection is a normative action of their group. The remodeling of threat into a challenge can motivate actions, while other studies found that severe threat can elevate collective efficacy (Masson and Fritsche 2021).

Like individual emotions, collective emotions are a helpful framework for examining CA (Harth 2021) and can shape environmental group norms and goals (Masson and Fritsche 2021). *Collective hope* is an emotional coping strategy to handle the climate threat (Masson and Fritsche 2021). Hope can be described as a social phenomenon, and people feel hopeful when taking action (Converse et al. 2021).

Collective pride only motivates specific ingroup-enhancing behaviors (Masson and Fritsche

2021). The feeling of being emotionally moved and positively overwhelmed can mediate the effect of collective efficacy on action (Masson and Fritsche 2021).

Helplessness can be mitigated through collective agency to restore the feeling of control (Masson and Fritsche 2021). The groups' perception of reaching its goals, namely collective efficacy, is only enabled when hope is high and is a direct positive predictor when the group is emotionally moved (Masson and Fritsche 2021). *The collective control perception* can increase self-efficacy further (Masson and Fritsche 2021).

Group identities, norms, and emotions can be activated by enhancing the collective "we" (Harth 2021).

2.3 Climate-change knowledge

Climate-related knowledge has long been falsely believed to be the solution to climate inaction. The *information deficit model* was believed to explain why no actions were taken despite an increase in scientific articles (Knutti 2019) and attention throughout recent years (Ceutzig and Kapmeier 2020). The great challenge is turning climate science into action (Naustdalslid 2011).

One study focused on various internal and external factors, including knowledge and the impact on CA. It has shown that knowledge had a small but significant impact on the personal carbon footprint, particularly for food and clothing, while other areas remained insignificant (Chuvieco et al. 2021).

Evidence suggests that knowledge through a university course of climate science, solutions, and personal implementation strategy had a significant impact on the students' reduction in yearly carbon footprint (CF), even five years after the conclusion of the course (Cordero, Centeno, and Todd 2020). However, it is necessary to point out the study's limitations as the

prior students self-selected the course and, therefore, may have been more accepting of such climate-friendly behavior. However, this limitation may also emphasize the importance of *personal investment* in the outcome alongside knowledge as a contributor to lowering personal CF (Bury, Wenzel, and Woodyatt 2020).

A recent study by Wormbs and Söderberg (2021) has similar findings. The decision to fly less among Swedes stems partly from acquiring more knowledge. However, an event or an experience in their lives acted as the catalysator for internalizing the accumulation of knowledge.

Recent studies have tried to understand people's knowledge on self-efficacy and response-efficacy, namely whether and how much CA mitigates climate change (Crosman, Bostrom, and Hayes 2019). The findings suggest an overall failure to estimate the effectiveness of CAs with the most mitigation impact and an underestimate of commonly done but low-impact CAs (Crosman 2019; Pickering 2020; Mäkinen 2014).

Knowledge of climate science is essential; however, the conventional information-deficit model does not withstand today's research. Literature suggests that people generally fail to estimate in the areas of self-efficacy and response efficacy, which may pose a threat to our ability to internalize such climate-friendly behavior.

With a steady increase in the number of climate articles that were cited in the IPCC report without an equally large proportion of CA, it is clear that climate inaction is more than an information deficit (Knutti 2019).

2.4 Literature Review Summary

The drivers of CA in Figure 1 are the baseline for the two motivational questions and analysis to build a model that accelerates individual CA.

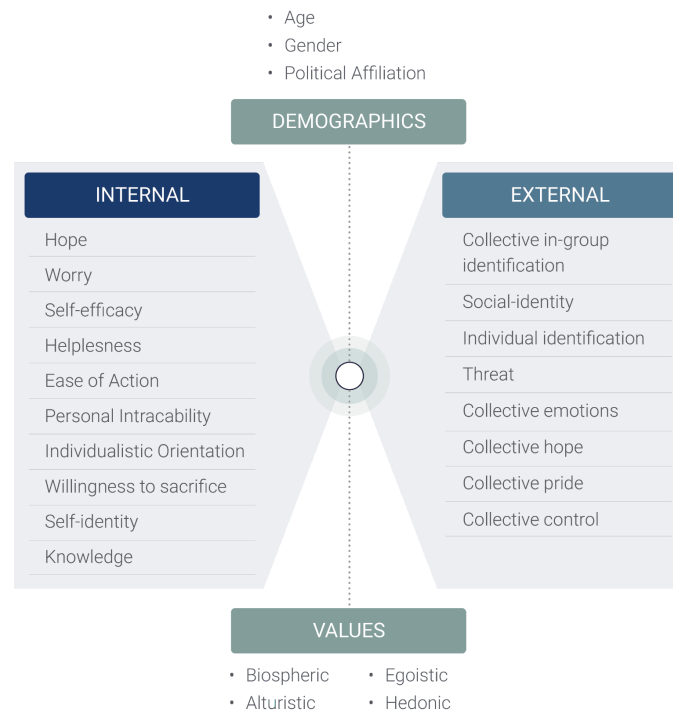


Figure 1: Drivers of individual climate action

3. Motivational Question 1: Accelerating Climate Action by Sophie Andres

The literature review has highlighted the drivers of climate action. This is the first step, but can not directly be used to accelerate CA. A look into behavioral science and communication is necessary to translate these drivers into action. The following motivational question combines behavioral models and communication to accelerate individual CA.

How to combine behavioral and communication models to empower individual climate action?

This is the guiding question and aims to build a preliminary model combining behavior and communication research with primary qualitative data. The combination of the new model with the developed clustering model allows to translate the model into practice. The limitation of this model is clear from the beginning. It will not move everybody to mitigate

the severe consequences of climate change. However, it can be a stepping stone for organizations, companies, governments, and new ventures to innovate old means to move towards individual CA.

3.1 Data Collection

The stages of the data collection influence each other, which moves the collection from a linear to circular process. The multiple qualitative methods generate in-depth knowledge for the analysis (Saunders, Lewis, and Thornhill 2019, p. 188).

Literature Review

The literature review provides the theoretical frameworks and models for the data collection. The literature review is structured like a funnel, linking the published research into the data collection. The review only uses peer-reviewed secondary literature and focuses on climate-change-related research to form a valid analysis. The literature was consolidated and evaluated by relevance, value, and sufficiency to answer the motivational question (Saunders, Lewis, and Thornhill 2019, p. 196). The results were then summarized in the literature review, which identified experts for interviews to explore specific models and theories.

Expert Interviews

The experts interviewed were the researchers of two articles identified as important. An expert is defined as a researcher with a Ph.D. degree working in climate-change communication and behavioral science. As the topics are novel, the pool of experts is limited. The importance is determined by the newness of the research approach in a rather unexplored field to answer the motivational question. The expert interviews provided the opportunity to

explore the research, clarify questions and challenge different aspects. The interviews were conducted as in-depth Zoom interviews with the primary goal to explore the research. Due to time constraints, a preset of open questions (Appendix 1) was prepared to semi-structure the interview. The first expert interviewed was Karine Lacroix, who has co-developed the new theory of behavioral choice and researches within communication as part of the Yale Climate-Change Communication Institute. The second expert interviewed was Brian Cook, who has co-developed the relationship-building model and uses social sciences to analyze how and why particular forms of knowledge establish and persist. Both interviews have been recorded with the agreement, securely stored, transcribed, and thematically analyzed through theory-driven coding (Appendix 2) on the CAQDAS platform dovetail.

Individual Interviews

The individual interviews aimed to explore climate-action in practice and uncover patterns. The zoom interviews were semi-structured and guided through a preset of open-ended questions (Appendix 3). The interviews were conducted in an informal setting, and questions were adjusted to the individual to gain deeper insights. The interviewees were sampled from the targeted population, representing a part of the general population with a particular intention and interest in individual CA (Saunders, Lewis, and Thornhill 2019, p.296). The sampling is guided by non-probabilities and based on volunteers (Saunders, Lewis, and Thornhill 2019, p.297), self-selected through the outreach in networks, for example, university programs. This sampling resulted in ten interviews. The individual interviews followed the same procedure, storing and transcribing as the expert interviews. The transcripts were then thematically analyzed through data-driven coding (Saunders, Lewis, and

Thornhill 2019, p.655). The analysis used the results to build a model that accelerates individual actions in practice.

3.2 Literature Review: Behavior Models

The literature review is the first step towards a new model to assess the current communication and behavior change literature. The two areas are generally in-depth explored but relatively novel regarding climate change. The literature was not made to answer the motivational questions, which is considered throughout the analysis.

Behavioral Changes

Behavioral change research has brought forward different models, and it is important to distinguish between behavioral models and behavior change theories (van der Lidner and Weber 2021). *Behavioral models* are diagnostic tools to identify underlying factors that determine behavior. *Theories of behavior change* examine the generic process to change behaviors. Both are highly complementary as changes require a thorough understanding of the influencing factors (van der Lidner and Weber 2021).

Behavioral Models

There is a mismatch between the actual and intended behavior, which is also referred to as the attitude-behavior gap (van der Lidner and Weber 2021.) It is necessary not only to identify but also to understand the interaction of different behavioral drivers.

The new theory of behavioral choices is one of the models explicitly developed for CA (Gifford, Lacroix, and Chen 2018). The theory combines the dragons of inaction and the theory of planned behavior.

The dragons of inaction are six factors that have been found and validated to be psychological barriers towards CA.

The new behavioral choice theory has improved the original theory of planned behavior to make it suitable for CA. The theory of behavioral choice identifies three drivers of behavior intention. The attitude towards the behavior, including affect, belief and knowledge and perceived control, social norms and the desire for the behavior. The three drivers lead to the intention to engage in the behavior. This intention is influenced by perceived and structural barriers. Due to the attitude-behavior gap, the theory distinguishes between observed and reported behavior (Kormos and Gifford 2014).

Kaiser argues that there is no need for such complex models and introduces the *Chambell paradigm*. This relates motivational forces and the associated costs to goal-directed mitigation behaviors (van der Lidner and Weber 2021). The more likely a behavior is to attain various goals, the more favorable a person's valuation of this behavior (Kaiser 2021). The costs, covering all obstacles, personal resources, and sociocultural contexts, must be counterbalanced with the commitment to act (Kaiser 2021). If the costs of a behavior greatly exceed the environmental attitude, the likelihood of engaging in the behavior is low (Kaiser 2021).

Not all behaviors are goal-directed, and most are *habitual* (Verplanken and Whitmarsh 2021). This requires a proper habit architecture and a stable performance context to allow unobstructed performance.

Behavioral models help understand the target's behaviors to drive behavioral change through behavioral interventions (van der Lidner and Weber 2021).

Behavioral Change Models

Behavioral Change Models focus on how behavior change is happening.

The most used model is the *transtheoretical model*, which suggests six different stages of behavior change: pre-contemplation, contemplation, preparation, action, maintenance, and termination (Prochaska and Velicer 1997). The model was developed in 1997, which might not include the dynamic and innovation of today's challenges.

The *information-motivation-behavioral skill model* proposes that information and motivation will lead to behavioral skills, resulting in behavioral change (Rongkavilit et al. 2010). This model has been rooted in HIV prevention behavior and might not be comparable with the complexity of climate change.

In 2011 the *behavior change wheel* was created (Michie, van Stralen, and West 2011). This is based on capability, opportunity, and motivation, and depending on these factors, different interventions are suggested. This model has been simplified in the *COMB-P model*, which summarizes the wheel into a linear process (Pedersen et al. 2012).

Behavioral Change Interventions

Behavioral change interventions aim to lead to behavioral change.

Implementation intention planning has been found to be effective for habits and goal-directed behavior. This includes a plan that outlines exact cues on where, when, and how to act (Verplanken and Whitmarsh 2021).

Gamification is a rather unusual but effective behavioral intervention for habits. This includes group challenges, which affect normative pressure, information diffusion, and habit formation (Verplanken and Whitmarsh 2021). The interventions require a degree of pro-environmental motivation, values, and ecological identity to solidify the behavior. This overlaps with the

intended focus in the Campbell paradigm (Kaiser 2021)

Interventions further recommended for CA are the provision of valid information from credible sources at points of decision (van der Linden and Goldberg 2020).

3.3 Literature Review: Climate Change Communication

Communication has been found to be a predominant driver of awareness. The role of climate change communication is to educate, inform, warn, persuade and mobilize (“What is Climate Change Communication?” 2020). The different communication models are outlined to highlight the role in accelerating CA.

The Deficit-Model of Science Communication

The guiding principle of the deficit model is the assumption that information transfer can prompt behavior change (Cook and Overpeck 2018). This identifies the public as deficient and in need of being educated and persuaded (Pearce et al. 2015). The model is under criticism as it is grounded in our rationality separated from politics, emotions, and power-relations (Fellows and Proctor 2019). This assumes that knowledge leads to action, more certain knowledge leads to more definite action, and more integrated knowledge leads to more joined-up action (Cook, 2018). This linear model rests on the human ability to take the facts provided and draw obvious conclusions as information is processed in a unified way (Fellows and Proctor 2019).

The Framing Theory

The framing model considers the different circumstances and ways information is perceived (Fellows and Proctor 2020). The “Global Warming’s Six Americas” (Leiserowitz, Maibach,

and Roser-Renouf 2009) is a widespread model (Fellows and Proctor 2020). For information to be fully absorbed by the audiences, it must be actively communicated in an appropriate language, metaphors, and analogy, which should be combined with storytelling, visual imagery, and balanced with scientific information (Pearce et al. 2015). The framing model is widespread and sophisticated but assumes that communication is a one-way flow from science to the public (Fellows and Proctor 2020). Every aspect of communications can be changed, but this does not challenge the underlying deficit model (Cook and Overpeck 2018). A great number proceeds this way while there is a growing attention to new media platforms (Pearce et al. 2015).

The Contemporary Dialogue Model

There is a trend to move from deficit to dialogue (Stilgoe, Lock, and Wilsdon 2014). The relationship-building between climate scientists and the public is rooted in the dialogue model (Cook and Overpeck 2018). Experts have called for innovative responses to break the publics' apathy and prompt changes (Cook and Overpeck 2018). Targeted scientific expert explanation has shown a reduced agreement with the public wait-and-see strategy (Joslyn and Demnitz 2021). The relationship-building incorporates co-production to emphasize innovative forms of knowledge generation resulting from honest collaboration without predetermined hierarchies and boundaries (Cook and Overpeck 2018). The relationship-building approach has been seen to effectively change behavior in socio-economic challenges such as transphobia (Cook and Overpeck 2018). This might not be directly comparable to climate change due to its' systematic nature.

The literature review is the baseline to combine the data collection results with the literature review to build a new practical model.

3.4 Analysis: Accelerating Climate Action

The analysis aims to combine the literature review, individual and expert interviews to build a new model to accelerate individual CA.

Understanding Climate-Action

Before aiming to change behavior, understanding the current behavior is necessary. The new theory of behavioral choice is based on goal-directed behavior. The findings of the expert and the individual interviews have suggested different adjustments to the theory.

Knowledge, despite the criticized deficit model, knowledge is a relevant factor for, especially, highly active interviewees. It had been a significant trigger for CA and helped sustain behavior in the long-term.

On the other hand, as mentioned in the expert interview, *belief* in climate change can be considered non-relevant as current studies show that over 93% in the EU believe in climate change as a severe problem (European Commission 2021). This might differ from the studies back in 2017 when the model was built.

Affect has been emphasized as a driver throughout the literature, particularly emotions. In the interviews, most of the participants were worried about climate change (Appendix 18). The most engaged interviewees have been worried and believed that their action and response matters, reflected in *self-efficacy*. This overlaps with the literature and the strong correlation between *self-efficacy* and *worry*. The interviewees least engaged in CA have highlighted a lack of urgency and self-efficacy. Therefore affect will remain in the adjusted theory.

Norms and values were a high driver for interviewees' actions and were important in the intervention discussed in the expert interviews. Highly engaged interviewees highlighted

substantial *biospheric value* and connection with nature. This is supported by literature, as biospheric values have been a strong predictor for CA. On the contrary, less engaged interviewees were driven by rather social norms or inherent generational values. The expert interviews introduced the social norm messaging as an intervention for somewhat less engaged individuals. Norms and values are verified throughout the interviews as relevant.

The desire to behave was formed by almost all interviewees through a solid intention to fulfill specific goals, no matter if it was a habitual or a one-time goal-directed behavior. The goals were multiple rather than one specific goal, such as climate-change mitigation. This overlaps with the Campbell Paradigm, which suggests that the intention increases if one behavior achieves multiple goals simultaneously.

A degree of *environmental self-identity* is necessary for climate action. This is not only one main assumption of the Campbell Paradigm, but was also validated throughout the interviews as a high environmental self-identity was found among all engaged interviewees.

Knowledge, Affect, Norms and Values, Environmental Self-Identity and Intention lead to the intention to engage in a certain behavior, which overlaps with the individual interview findings as these were the main distinction between highly and less engaged individuals.

Different barriers to behaviors have been further explored in the individual interviews. The expert interviews have highlighted the importance of the context in which climate-actions are taken. The barriers mentioned in the individual interviews are outlined in Appendix 4.

Structural barriers have been mentioned as infrastructure and product offerings. *Perceived barriers* are mainly convenience and time.

The cost barrier overlaps with the Campbell barriers, and it could be a barrier but also an incentive, as certain climate-actions are coming along with financial incentives.

The less engaged interviewees have highlighted that it is still “*too easy to close your eyes*”

and engage in non-environmental behavior. This overlaps with the finding that their actions are rather formed by social norms.

Throughout the interviews, it was highlighted that *high personal drivers, intention, and multiple goals* help allow interviewees to navigate barriers and costs. This then has led to a stronger behavioral intention in retrospect.

Considering the context around the individual behavioral intention, the behavior is formed. It should be kept in mind that the reported and observed behavior is differentiated. Not all behavior remains *goal-directed* but instead transfers into *habitual behavior*, which a solid habitual structure should support.

The adjustments to the theory of CA are outlined in Figure 2 and are the baseline to understand the factors important for CA and develop a model to accelerate CA.

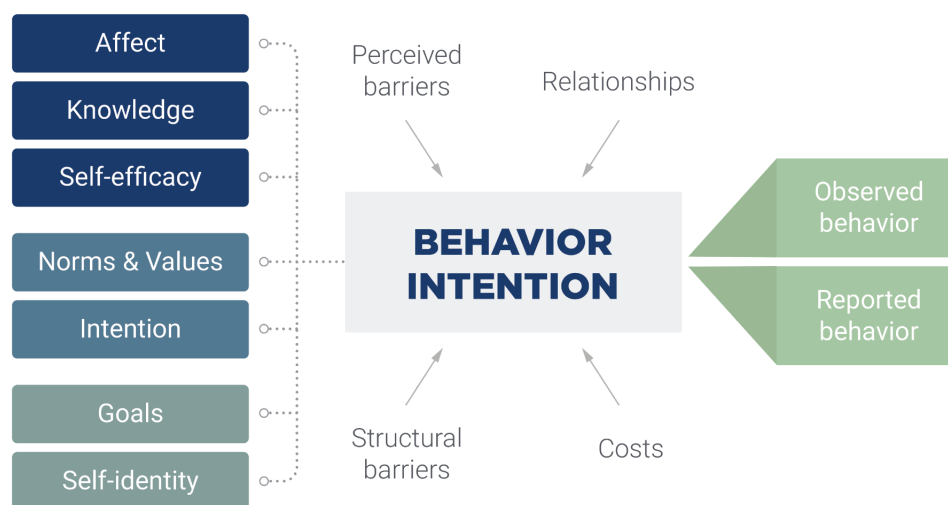


Figure 2: Adjusted theory of behavioral choice

Changing towards Climate Action

The expert interviews and literature review have highlighted different behavioral change models to accelerate CA. However, how did individuals change their behavior? All

interviewees had an underlying awareness, mainly due to the high public awareness and media coverage around the topic of climate change. This is equivalent to the *precontemplation stage*. The awareness was then accelerated through different triggers outlined in Appendix 5.

Social surroundings have been, for the majority of individuals, a trigger. This further interferes with the relationship-building model and the importance of self-perception and social norms. The expert interviews have highlighted the importance of the relationship-building process, including information exchange, disagreements, arguments, and co-creation. Interviewees highlighted this process as an essential factor in building lasting CA.

New media, such as YouTube and Podcasts, have been suggested in the expert interviews as only one point in the relationship-building process. Contrary, interviewees have highlighted that relationships through new media outlets have not only been one point but helped to trigger and maintain CAs. New media, especially in the Millennial and Gen-Z generation interviewed, might play a pivotal role in forming relationships and guiding climate action. Therefore the social frame we are behaving within is critical to be considered throughout the behavioral change.

Information was another trigger, but primarily for engaged interviewees. The focus on information is criticized in the deficit model. However, in the individual interviews, the most engaged interviewees have been the most informed. The source of information highly differs among the engagement of interviewees, which is outlined in Appendix 6.

Almost all engaged interviewees have been continuously using scientific articles to acquire information, especially if such information has not been covered or been contradicted in conventional media outlets. The interviewees perceived the information within conventional

media as repetitive, unreliable, and built to trigger certain emotions. Scientific sources have sought to gain reliable information without being influenced by specific financial incentives.

This has been highlighted by multiple interviewees in the case of food consumption.

Interviewees have highlighted *podcasts, videos, and documentaries* to generate awareness, inspiration, and maintenance but also to build a new form of relationships.

Engaged interviewees have completed *academic courses*. Specific courses have allowed the individuals to understand the systematic and complexity of specific areas, which led to more informed actions. The less-engaged interviewees have done no active research on, for example, specific greenhouse gas emissions or health benefits. This has distinguished the engaged from the non-engaged and highlights the role of knowledge. It has to be highlighted that the interviewees had a particular self-identity and intention, which does not mean that more information will directly translate into more action, as the deficit model assumes.

The *generational inheritance* of values and behaviors was a newly discovered factor. Behaviors and values of parents have been given on to the interviewees, which instead belongs to a particular self-identity that has been formed throughout the generations.

The implementation intention planning (where, when and how to act) has been discussed in the preparation phase throughout the expert interview, especially for individual and habitual climate-actions such as meat consumption.

The action phase is the individual CA and might be the end of the circle for specific goal-directed one-off actions such as making a large buying decision.

The maintenance phase is supported by the habit approach, which is guided through a habitual architecture that allows uninterrupted behavior maintenance and different interventions might help throughout maintenance. In the interview, it has been highlighted

that a high intention, multiple goals, low behavioral costs and barriers can strengthen the maintenance of habits.

The final stage of *termination* of the old behavior and full integration of the new behavior has not been fully reached by some interviewees due to the persistence of specific barriers.

Accelerating Climate-Action

Combining findings and research has shown that behavior change is complex and different factors have been important throughout the journey. The individual interviews have outlined different factors that have been helpful to accelerate climate-action, which are outlined in Appendix 7.

Social surroundings have helped the majority of individuals to engage in CA, which leads back to the *relationship-building model* discussed in the expert interview. Interviewees have highlighted that decisions are made in social surroundings, especially for repetitive behaviors, which are influenced by social norms, self-identity, and social acceptance.

It was highlighted, not only in the expert interview, that the process of relationships, including arguing, disagreeing, finding consensus, and co-creation, have been of high importance for CA.

The relationship-building model has the clear limitation of scale, although relationships should have a spill-over and ripple effect. The interviewees have highlighted new media to build a new form of relationships, specially formed through video and audio channels. One interviewee even felt betrayed when a person following on new media channels stopped CAs. Hence, new media channels could allow scaling the relationship-building model.

Communication is vital in the beginning to accelerate CA and to open up the topic. A certain underlying awareness is already established through conventional media coverage.

Interviewees rather get awareness triggers through new media and social surroundings. The expert interviews have highlighted communication as a tool that can be used in the beginning to open up the topic correctly. Rather than seeing a climate-communication campaign as an end-product, communication should be seen as a vehicle towards actions.

Information was an essential factor, especially throughout the precontemplation phase. The *relevance and reliability* of information were important for engaged individuals. Information in the conventional media coverage is not only misleading and frustrating from the expert perspective but has been described as dull and repetitive by interviewees. Despite the criticism of the deficit model, it was the scientific articles, academics, and in-depth information that have been perceived to lead to CAs, stronger intentions, and commitment. Almost all interviewees have highlighted their proactive research as time-intensive, but engaged interviewees had a predetermined self-identity and interest in the topic, which guided beyond this barrier.

Implementation planning has been discussed as applicable throughout expert interviews in the preparation phase. Interviewees have been preparing where, when, and how to act in the preparation phase. This can not only be helpful to reach the goal but rather maintain the behavior in the long term.

Gamification has been introduced in the maintenance state to maintain a habit and decrease boredom, which might lead to an early exit. This gamification can include i.e. challenges to use normative and social pressure and self-perception.

The specific interventions have to be guided by the specific goal and behavior in place. They should always be adjusted and individualized throughout the process to accelerate CA most effectively.

A practical climate-action model

The climate-action model in Figure 3 combines the findings from literature with the data collection.



Figure 3: The new behavioral change model

The individual is put at the center of the model, including the driving factors outlined in the new theory of climate action. These factors are central and will influence each behavioral change stage.

The second layer is the *transtheoretical behavior change model* as all interviewees have been highlighting the different stages of change. It is built on the precontemplation, contemplation, preparation, action, maintenance, and termination stages. The third layer suggests *adequate behavioral intervention*.

In the precontemplation stage, communication through the framing model allows to open up

the topic and accelerate awareness. The framing of communication allows to include the internal factors and accelerate awareness. Communication is the beginning and is used to accelerate the underlying awareness.

In the contemplation stage, information from scientific, reliable, and relevant sources can form stronger intentions, inform behavior to reach multiple goals, and increase the impact of action through information. The proactive information research has been a deciding factor between highly and less engaged interviewees.

The preparation stage started with a “just try it out” mentality of interviewees, including precise intention planning, including when, how, and where to act.

The action is the execution of the planned behavior, and at this stage, one-time goal-directed behaviors might exit the circle. The non-financial reward of action through gamification allows to incentivize behavior change.

The habitual behaviors continue into *maintenance*, which requires a solid habit architecture and gamification to decrease boredom. The importance of relationships was underlined in the maintenance stage in the interviews.

The termination of the behavior has not been reached by all engaged interviewees but is the ultimate stage to complete the behavior change and can lead to more significant non-financial incentives. This termination can be rewarded adequately to motivate the individual.

The literature review, expert, and individual interviews have highlighted the importance of the context individuals change within. The last layer of this model includes the context formed by relationships, costs, time, and perceived and structural barriers taken from the new theory of behavioral change.

The model is a first attempt to combine literature with the data collection results to accelerate CA in practice.

The individual with the specific and relevant drivers is at the model's core, influencing the outer layers. The focus relies now on how to assess the core to ensure the customization of the outer layers and accelerate climate-action. The clustering of individual CA drivers allows the assessment of the drivers to strengthen the behavioral change.

3.5 Limitations and Future Research

The limitations in the data collection are covering data quality issues, resources, and analysis. The data quality issues are reliability, bias, cultural differences, generalisability and validity (Saunders, Lewis, and Thornhill 2019, p.447). The interviewer, interviewee and participation bias have been considered (Saunders, Lewis, and Thornhill 2019, p.478). The interviewees are sampled throughout the researcher's networks, which leads to bias due to shared networks. Cultural differences must be recognized in the interviews as norms and culture drive CA. This is further influencing generalisability. The ten individual interviews may not represent the general population. This is the result of time and budget limitations. The answers regarding the reported behaviors might highly differ from actual behavior. These limitations are considered throughout the analysis and discussion. Due to these limitations, the new model has limited generalizability towards the general population, cultures, and nations. This allows new perspectives for future research, including the validation through individual interviews, experts, and longitudinal studies, that follow individuals across the whole behavioral change. Future research can examine the influence of the outer context layer to examine the model's validity.

4. Discussion

The discussion serves as an assembly of the models derived from the two individual parts. Its purpose is to suggest a model to improve CA among the sample population by using the proposed clustering model as an assessment component designed to segment the individual prior to applying the behavioral change model and during the behavioral interventions.

The interview and web survey clearly showed shared patterns with, among others, the interviewed being highly worried, just as in the clustering analysis. Furthermore, highly engaged participants had high self-efficacy, turning worry into action. This is further verified in the literature. This emphasizes the validity of a mixed approach of merging the quantitative cluster model with the qualitative behavioral model.

4.1 The Practical Fusion

The models are combined by putting the clustering model in the core of the behavioral change model, represented in Figure 4. This enables the model to consider important drivers predicting climate-action to be assessed and addressed before behavioral intervention.



Figure 4: The new behavioral change model

This combination enables a customized approach to behavioral change and interventions that accelerate CA across organizations, individuals, and corporations.

4.2 The Influence of Barriers and Enablers

Designing a solution with the reported barriers and enablers in mind is crucial to best accommodate for an option that can help nurture CA. Time and convenience score high for many, and it's often considered too easy to buy or engage in unsustainable practices. Many interviewees were also unsatisfied, bored, and not interested in the current selection of news articles and resources available. They longed for content that grew with their knowledge while minimizing time commitment. The individuals active and interested reported an interest-driven approach with “finding your angle” as a strategy for them to get active. The spill-over effects of other related activities not originally intended to reduce CA was also

reported as the primary source of CA, where an environmental-friendly self-identity helped. Although the relationship model relies on the traditional two-way communication relationship, many respondents found themselves connected through new media despite the one-way communication. Many turned to academic papers and literature to satisfy their need for in-depth content that could not be satisfied in controversial media.

4.3 Supporting role of technology

Can technology be leveraged to nurture the individual's CA journey? The suggested model requires steps to build new habits and goal-oriented behavior while customizing the communication and content. Offline media, that is, the use of books, newspapers, and other forms of written material, fall short in the required dynamic and repetitive approach that puts a lot of the work on the individual to be successful without the encouraging guard rails of technology to handle reminders and customization. This is where the potential of the web- and app-based experiences may play an essential role in implementing the suggested model. It breaks the boundaries of what is capable in an offline format and allows the development of guardrails to safeguard individual progress. A case study on behavioral health intervention lays out an overview (Turner-McGrievy et al. 2017), emphasizing the difference in, among other, costs, development time, and alerts. With responsive-web-based applications bringing a similar experience to that of a mobile app, it is less costly and has a lower development time frame (Turner-McGrievy et al. 2017) but is constrained within the browser. This is a draw-back in flexibility and ease of use where the app-based experience also offers notifications and native application features (Turner-McGrievy et al. 2017).

Although it is more costly and time-consuming, the benefits associated with the notification messaging and generally having a mobile app outweigh the utility by comparison to an app that is constrained to the use in a browser.

4.4 The solution

Translating the theoretical model into practical terms comes with limitations and deviations. The theoretical model is only intended for use as a reference line, hence every step of the circle is not always utilized. We recommend a solution that builds on two parts. An initial onboarding aims to bring the users to a baseline of emotions by assessing their current levels in climate predictors (the core of the model). The second part utilizes the behavioral intervention model to nurture climate action, building on the baseline from the onboarding. This section attempts to introduce guard rails for an entrepreneurial solution that could translate the theoretical model into practical terms to be used and scaled by social entrepreneur(s).

4.4.1 The general Approach

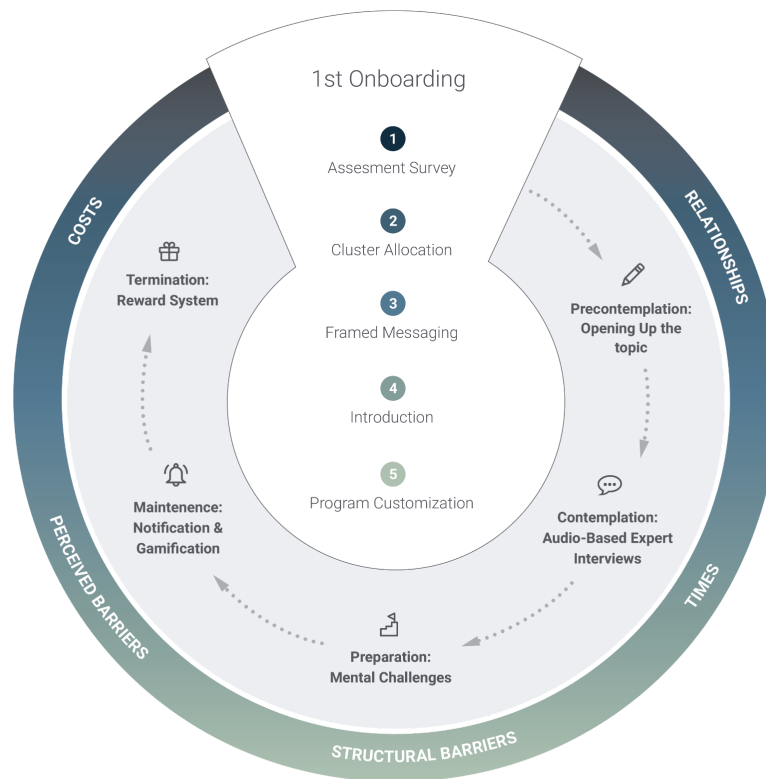


Figure 5: A new approach to individual climate-action

Figure 5 outlines how the new model can be translated into practice by utilizing technology. Onboarding *step 1*) Assessing the drivers using the four assessment questions to allocate the user into one of the four distinct clusters. Their interest will also be determined but not used for clustering. *Step 2*) Discover the cluster the person belongs to *Step 3*) Communicate using framing according to the focus points of the cluster *step 4*) Tailoring information for the entry-phase based on their cluster membership.

Main program *Step 1*) *Communication - opening up the topic*: This resembles the kick-off phase of the model. This represents a piece of framed marketing messaging for new users, either paid or organic, offline or online. For a recurring user, this is email or notifications messaging prompting new content available within their similar interest area. *Step 2*)

Information - audio-based conversations with climate scientists: A large barrier to many interviewees was lack of time and high search costs for reliable and relevant information. Our suggestion is to use a proven and tested dialogue-based format (podcast) with climate scientists to reduce time effort, increase reliability, and introduce relationships. The episodes would be grouped into seasons (programs) that represent a focus area. To internalize the information, the user would be encouraged to practice a mental/reflective challenge relating to their personal life and the content in the conversation. Episodes should be able to be accessed on-demand but to be limited to one a day to encourage the reflection challenge. *Step 3) Preparation phase - fulfilling goal with habit building.* Every season (program) introduces a core habit for the user to pursue. This will be introduced at the end of an information piece when the user has established a fundamental level of knowledge within the area. Although every episode has a reflective challenge, only one episode per season encourages a habit or goal-oriented behavior. *Step 4) Rewarding habitual behavior & goal completion:* Non-financial rewards are given to users to encourage habit building. Utilizing gamification by offering a self-assessed point system, the user collects points and is provided with an overview of the direct or indirect carbon footprint savings this habit has contributed to. *Step 5) Habit maintenance:* With every season presenting a habit, maintaining these are crucial but can quickly grow overwhelming as more habits are added. By prompting the user with notifications and in-app messaging to create weekly checks-in on the habit, the user can collect points if it is still in place, if they struggle, they will be presented a summary season to remind them of the reason they started *6) Rewarding termination of old habits:* With 21 days for a habit to stick, the user will be prompted for a final check-in before the habit is backlogged, rewarded for termination and no longer prompted weekly, unless they decide so.

4.4.2 The practical approach

The following section takes a season, lowering meat consumption, and introduces an example journey for a new user, including the onboarding journey that remains the same independently of the area and only prompts new users.

Onboarding step 1) Presented with assessment and interest questions immediately after initial account creation 2) The user is assessed as cluster 2 - the pessimists with potential. 3) Framing communication with an emphasis on the importance of being hopeful from a scientific perspective. 4) The final step of the onboarding presents the user short season consisting of a short audio-based recording of a conversation with a scientist researching the topic of hope and its importance in climate change.

Main program 1) *Communication*: Users are prompted with a new season on the benefits of a low meat consumption based on their interest in health and animal welfare 2) *Information*: The program contains ten episodes on different aspects of meat consumption with different scientists. Every episode ends with a reflective challenge, such as being conscious of the meat eaten just during one day. When adequate information is reached in Episode 5, the individual has to set their personal goal for meat lowering; this could be Meatless Monday or Meat Monday. As highlighted throughout the paper, it is essential to individualize this goal and make it dependent on the individual core. This goal will form the foundation for the habit they feel realistic about following. *Step 3: The preparation phase*: is at the last episode of the season, allowing the person to do an implementation planning including when, how, and where to act to continue their progress with the goal set and the habit begun. This means when to lower meat consumption; this could be on Mondays, how to do it through new recipes and groceries and where to cook at home, order meal boxes or eat out. However, this

depends on the individual. *Step 4: Rewarding habitual behavior & goal completion:* Although the size of the meat consumption varies, a reward will be given in the app through a point system including an overview of CO2 emissions and personal benefit obtained through the habit change and continuation of such. *Step 5: Habit maintenance.* The habit of lowering meat consumption is added to the backlog and prompted weekly - if a person is no longer enforcing the habit again, they can go through a summary of the podcasts to encourage a relapse of the habit. *Step 6 Reward:* After 21 days, the user will receive a final reminder about their habit, which will be rewarded if completed through the point system and carbon footprint progress.

Although the content of the season is different, the goal is to maintain a reliable and predictable experience for the user to mitigate any confusion associated with the behavioral intervention journey.

5. Limitations and Future Research

The final model is based on the literature review, which many resources have been allocated to. However, there is always a limitation in the domain knowledge that can make question and feature selection challenging. Through the limited data collection, the model is a simplification of reality with a focus on the individual core by considering the outer layer. A different sample throughout the survey and interviews might have led to a different outcome valid in the target population but not throughout the general population. Due to the sampling of data through the personal network, a certain degree of bias from all respondents is anticipated. The final model is a first attempt to bring together evidence-based research with the actual behavior within the target population. Future research can validate the model further through larger samples. Highlighted throughout the interviews, the outer context-layer

is less focused throughout research which needs extensive assessments. The practical solution builds an entrepreneurial opportunity to implement and validate the concept.

6. Conclusion

Ultimately, this paper proposes a first and foremost practical approach through a potential social entrepreneurship project based on the theoretical foundation and models from the climate predictor clustering and behavioral change section. The two sections synergize by being added as an extension to each other. The clustering model is the initial step needed to assess the model's core, the predictors of CA, through an onboarding process. The purpose is to level the playing field for all users and make them aware of their traits before initiating the core program: the behavioral intervention intended to introduce CA into their daily lives through themed programs. This systematic approach to CA relies on mobile technology to prompt the user with notifications, reminders, and usability on the go helping them on their learning journey towards more CA.

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8. Appendix

Appendix 1: Questions Expert Interviews

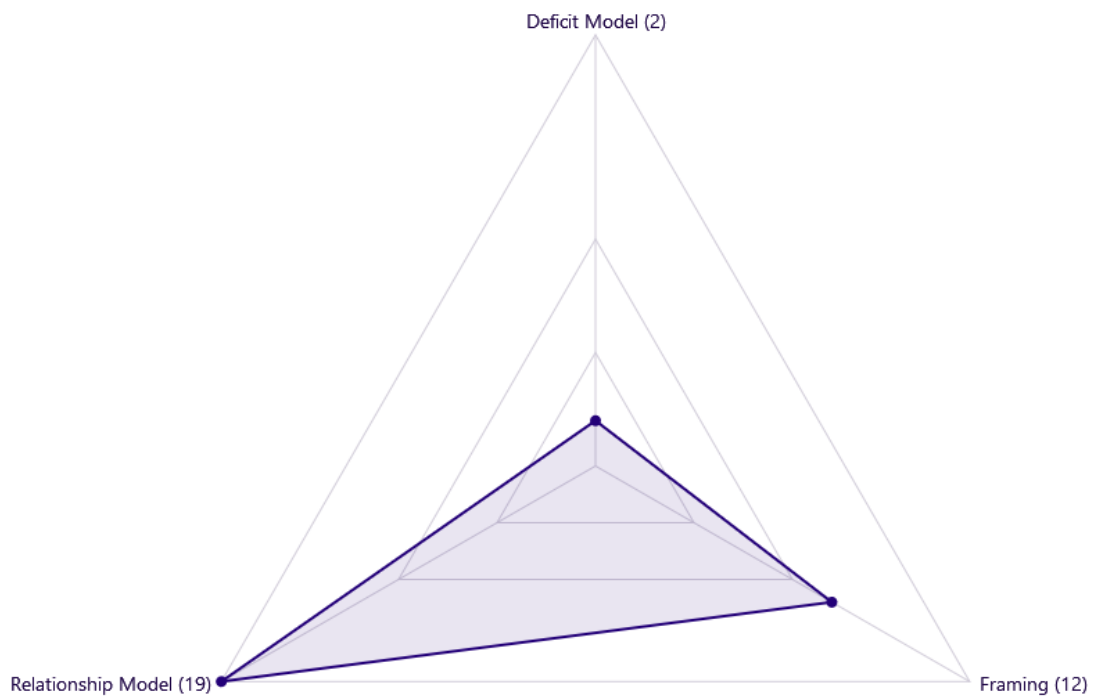
Questions: Katrine Lacroix	Goal
1) Can you summarize the psychological barriers and theory of behavioral choice model?	Align understanding and open-up for questions
2) Within the theory where do you see the role of communication and what role does it take?	Examine the role of communication
3) How familiar are you with the framing model? And how do you see the framing model along the theory?	Examine the role of framing
4) Do you have any thoughts of the relationship building model in communication?	Examining the influence of relationships
5) If you look at habits, how would this affect the theory?	Find parallels to habits
6) What behavioral interventions could be useful along the theory and to change behaviour successfully?	Understand the use of behavioral change and interventions
7) Looking at science communication today, what are the major pitfalls?	Find pitfalls and pains in current communication
8) How would you put the theory best into practice to actually change behavior?	How to move from problem to solution
9) How do you experience climate-action in practice?	Understand key learnings from research and own observations

Questions: Brian Cook	Goal
1) Why did you come up with the relationship-building model?	Understand the motivation behind the model
2) In practical terms what do you mean by building a relationship? Do you mean a 1:1 conversation?	Examine how relationship is defined
3) Scalability is one major hurdle	How could you

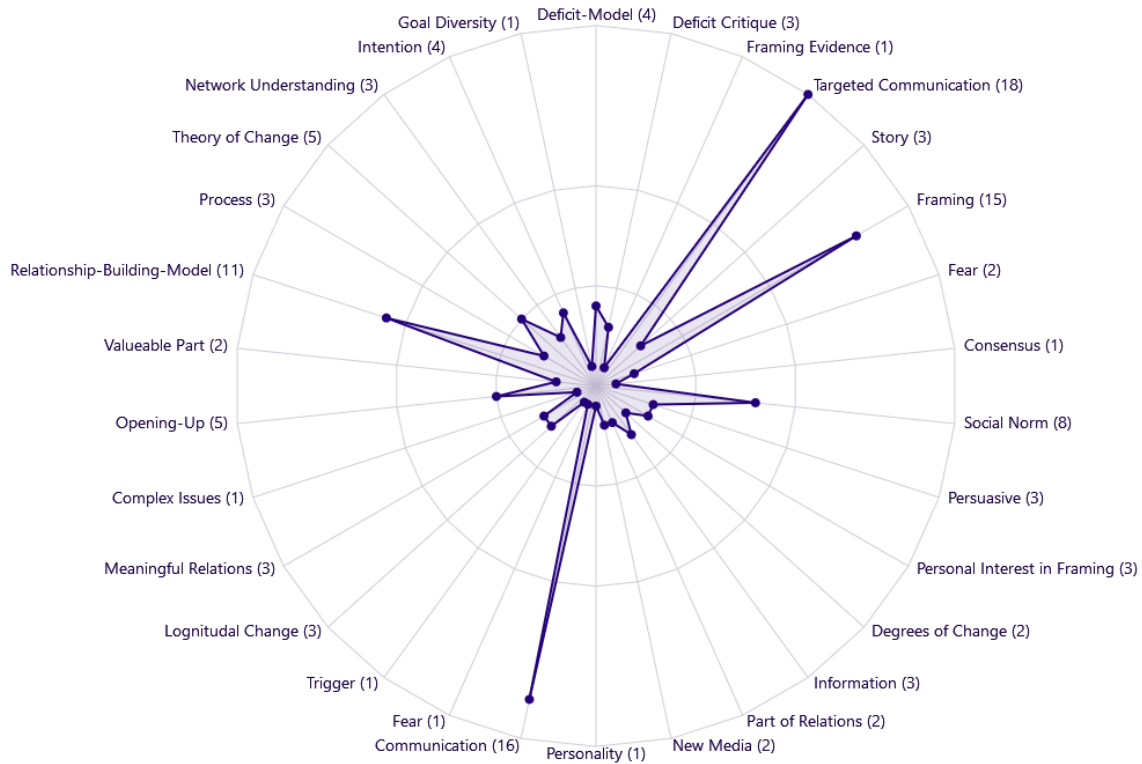
	within your model. How would you allow this model to scale? Does this require every scientist to build a relationship with people?	overcome scalability hurdle
4)	How do you see new media coming in?	Understand in practice how this might turn out
5)	Do you think then that new media can form a relationship?	What is the role of new media in relationship building
6)	How would you do this relationship building in practice?	Practical implications of the model

Appendix 2: Theory-Driven Coding Results of Expert Interviews

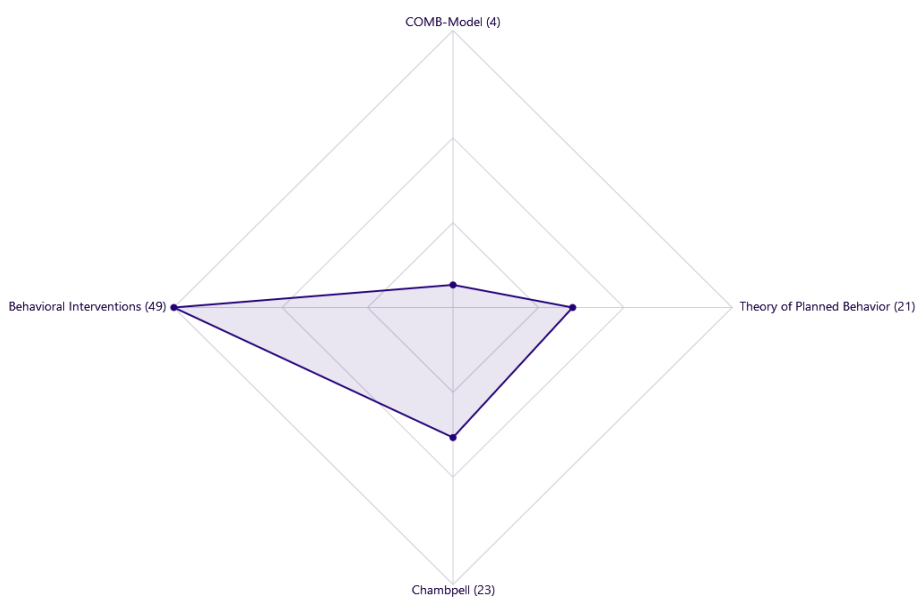
Communication Models: Focus on Relationship and Framing Model (Count Tags)



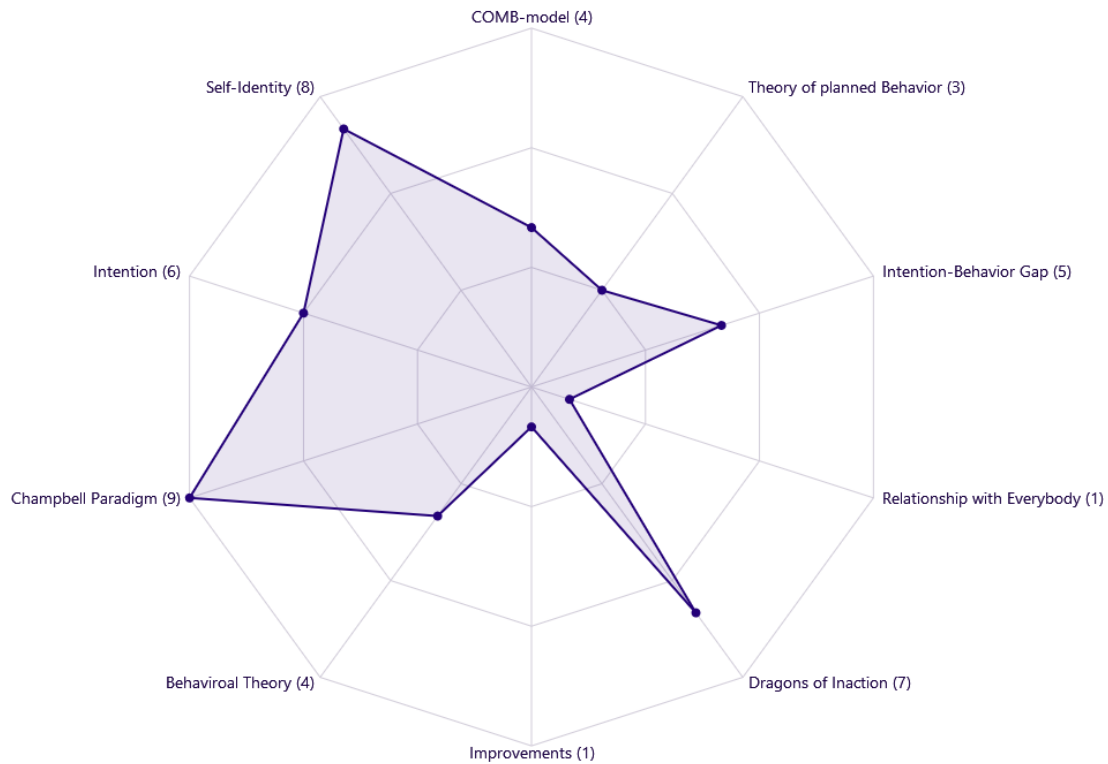
Communication: Focus on Targeted Communication, Framing, Social Norms, Relationships and the role of communication (Counts Tags)



Behavioral Models: Focus on Champbell, COMB-Models and Behavioral Interventions (Count Tags)



Behavioral-Change: Focus on Self-Identity, Intention, Campbell Paradigm, Dragons of Inaction and Intention-Behavior Gap (Count Tags)

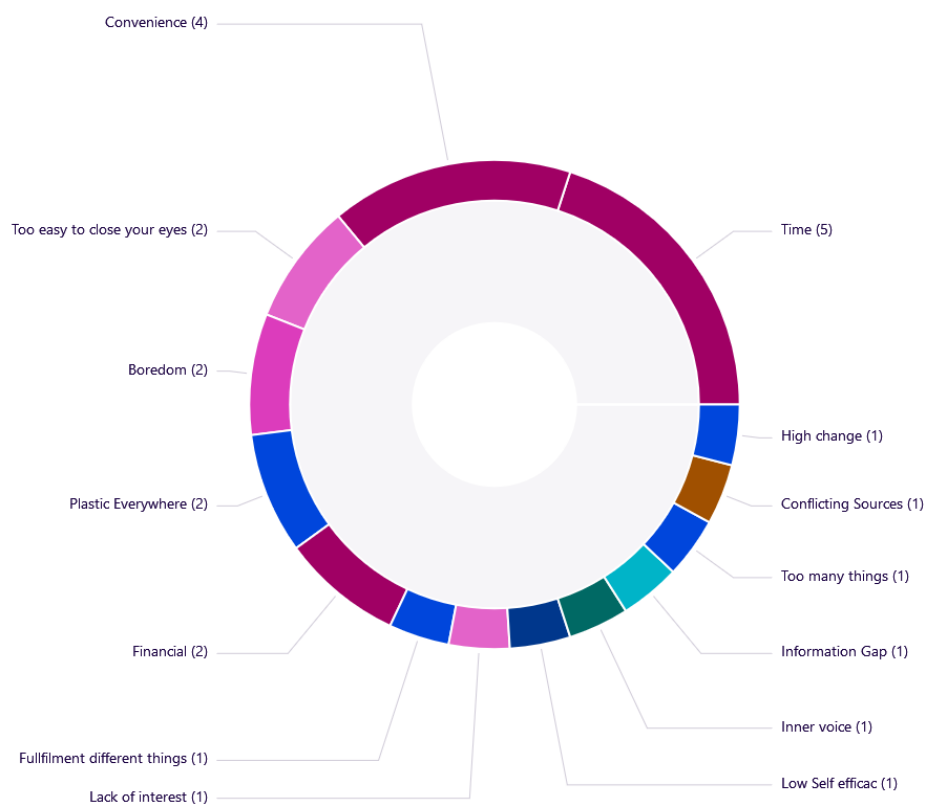


Appendix 3: Individual Interview Questions

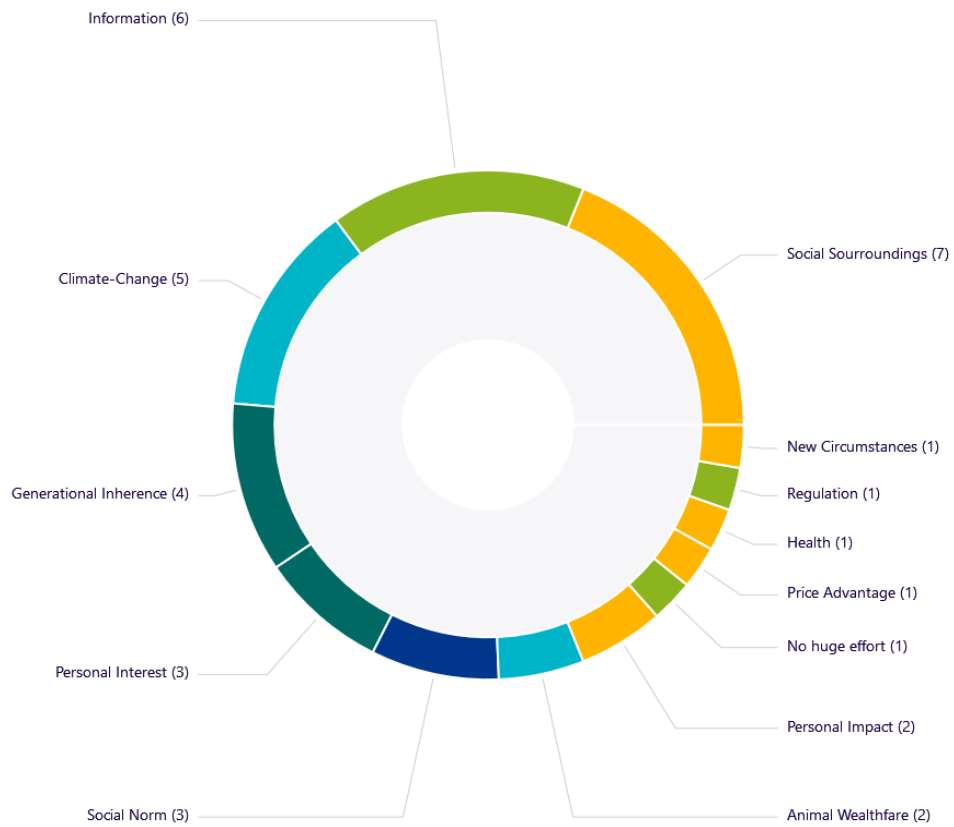
Questions: Individual Interview	Goal
1) How do you feel about climate-change?	Assess feelings in regards to drivers
2) Why is climate-change important to you?	Assess why the topic is relevant
3) Are you doing anything at the moment that you would consider as climate-action?	Understanding the actions taken
4) Why are you taking this action?	Understanding the action motivation
5) Taking one specific action you feel comfortable with. How did you start this action?	Why and how do people get active
6) What triggered this action?	Understanding the triggers of action

7) Where did you find information about the topic? How did you distinguish from a good and bad information source?	Understanding sources of information
8) Where do you generally find information about the topic?	Understanding sources of information general
9) What role did information play?	Understand the role of information
10) How did relationships play into this?	Examine relationships role
11) Have you been able to form a routine around it?	Understand the routine and habit
12) What do you feel like you would like to implement more?	Understanding the desire for more
13) What factors hinder you from this?	Understand barriers
14) What would help you get there?	Examine how to help to accelerate

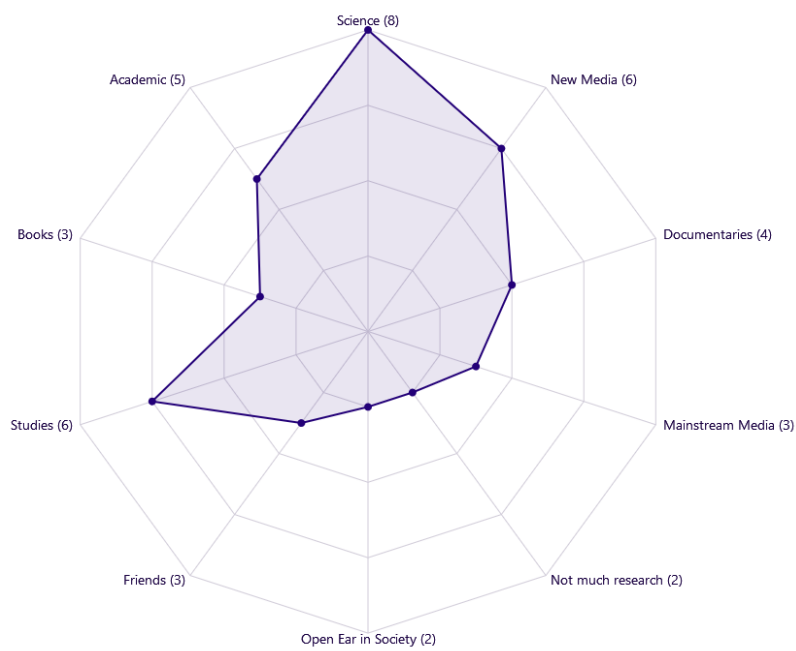
Appendix 4: Individual Interviews - Barriers (Count of Interviewees)



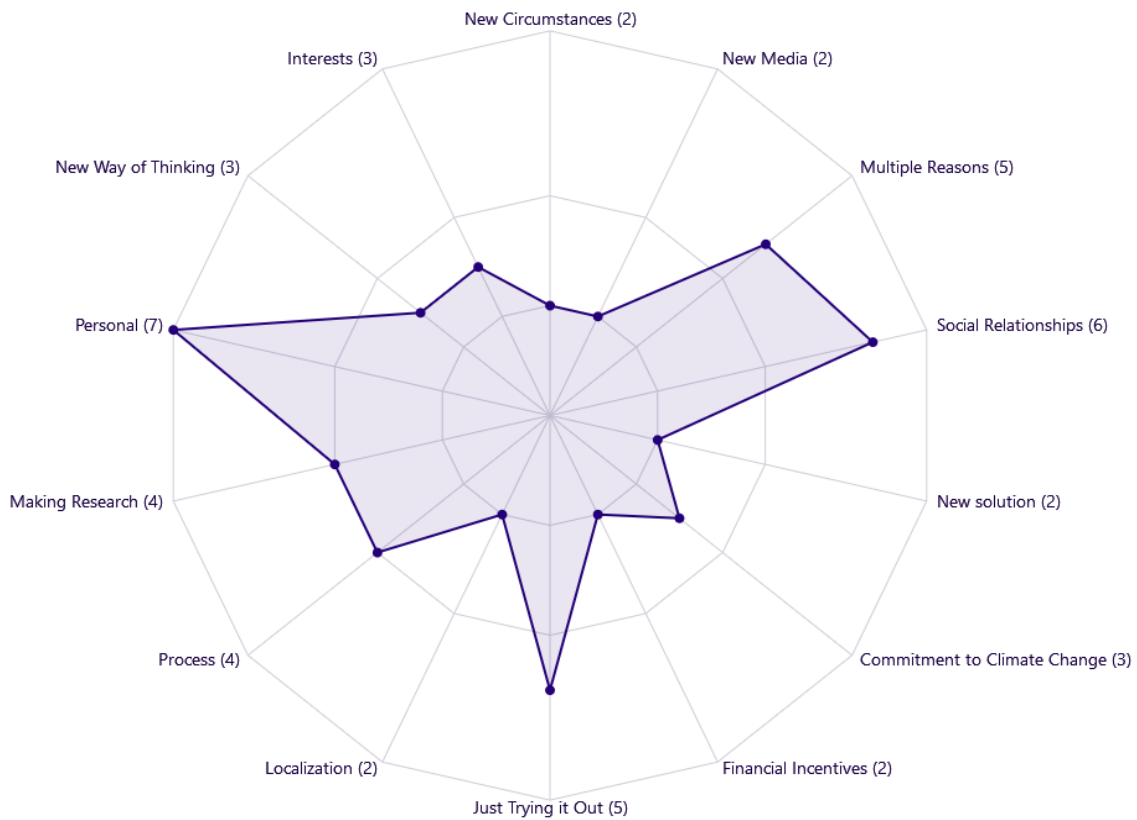
Appendix 5: Individual Interviews - Triggers (Count of Interviewees)



Appendix 6: Individual Interviews - Information Sources (Count of Interviewees)



Appendix 7: Individual Interviews - Helping (Count of Interviewees)

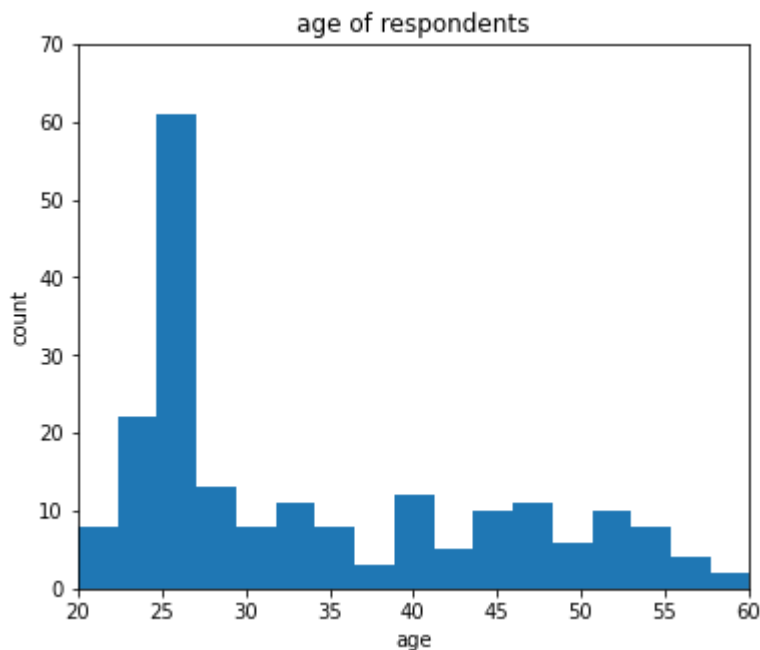


Appendix 8: Questions used to address CA predictors

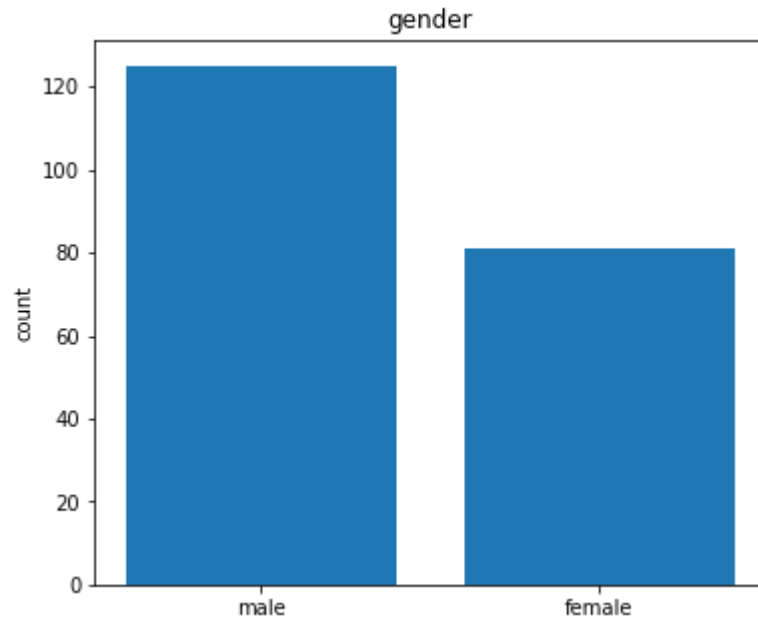
Question	Topics	Application	Source
7) How worried are you about global warming?	Worry	Model & Exploratory Analysis	(Chryst, 2018)
8) How hopeful are you that our society will reach "carbon neutrality" before 2050?	Hope	Model & Exploratory Analysis	Reformulated - (Bury 2019)
9) Overall, how confident are you that your climate action can help mitigate climate change?	Self-Efficacy	Model & Exploratory Analysis	Reformulated - (Gregerse, 2020)
10) To which extent do you think your climate actions mitigate climate change?	Response-Efficacy	Model & Exploratory Analysis	Reformulated - (Brostrom, 2019)
11) I would be willing to give up certain services and products that are convenient for me if this protected the climate	Willingness to sacrifice	Model & Exploratory Analysis	(Thaller, 2021)
12) How knowledgeable do you feel about climate change?	Knowledge	Model & Exploratory Analysis	Self-derived

13) I am the type of person who acts environmental friendly	Environmental identity	Model & Exploratory Analysis	(Van der Werff, 2014)
14) Overall, how confident are you that you could reduce your carbon footprint even more than today?	Self-efficacy	Model & Exploratory Analysis	Self-derived
15) Are you worried about the consequences of climate change?	Worry	Model & Exploratory Analysis	Reformulated - (Chryst, 2018)
16) How old are you?	Socio-demographic	Exploratory Analysis	Self-derived
17) What's your nationality?	Socio-demographic	Exploratory Analysis	Self-derived
18) What is your gender? (Optional)	Socio-demographic	Exploratory Analysis	Self-derived
19) What is the highest level of education you have completed or currently undertaking?	Socio-demographic	Exploratory Analysis	Self-derived

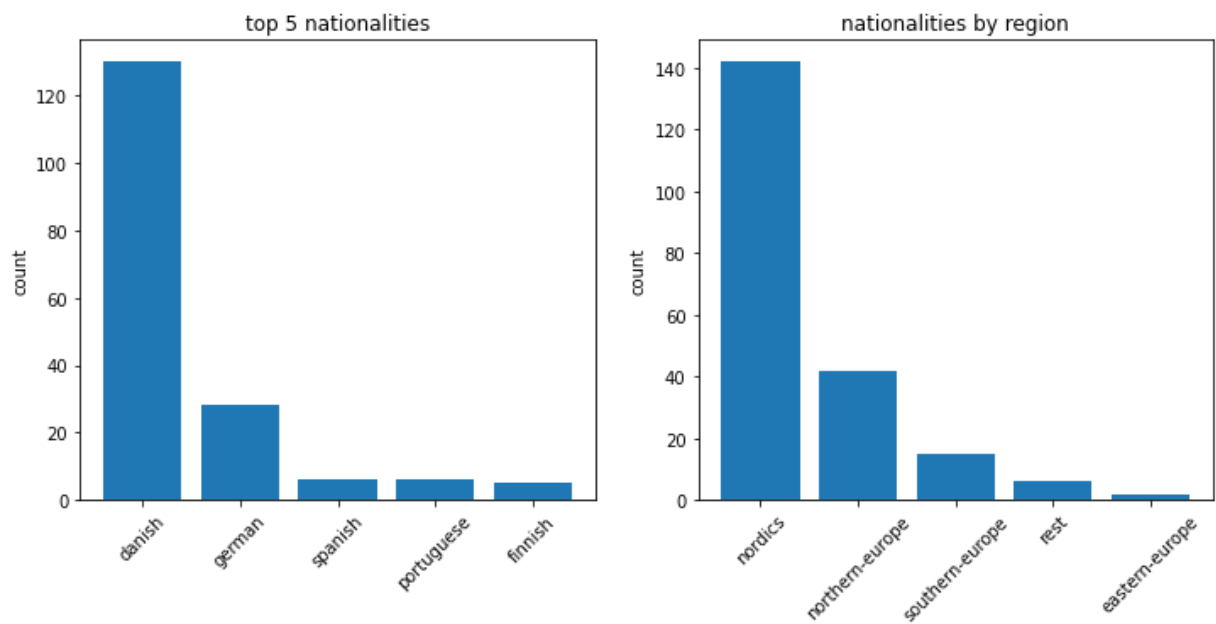
Appendix 9: Age distribution of respondents



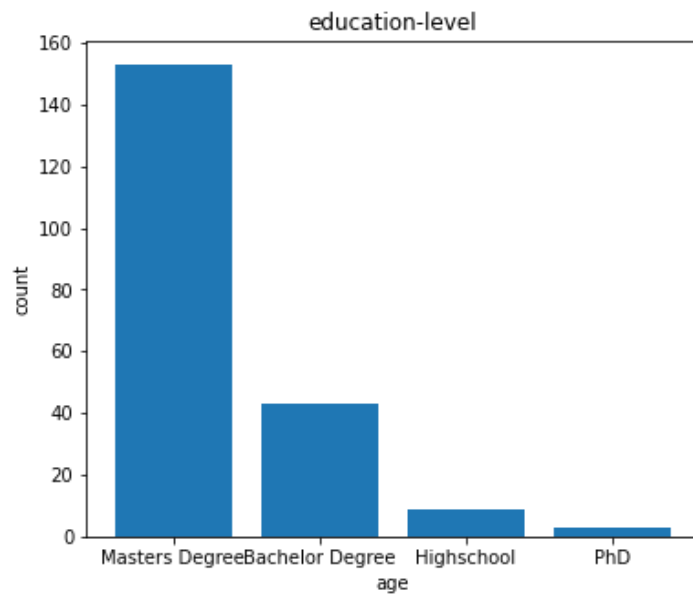
Appendix 10: Gender distribution of respondents



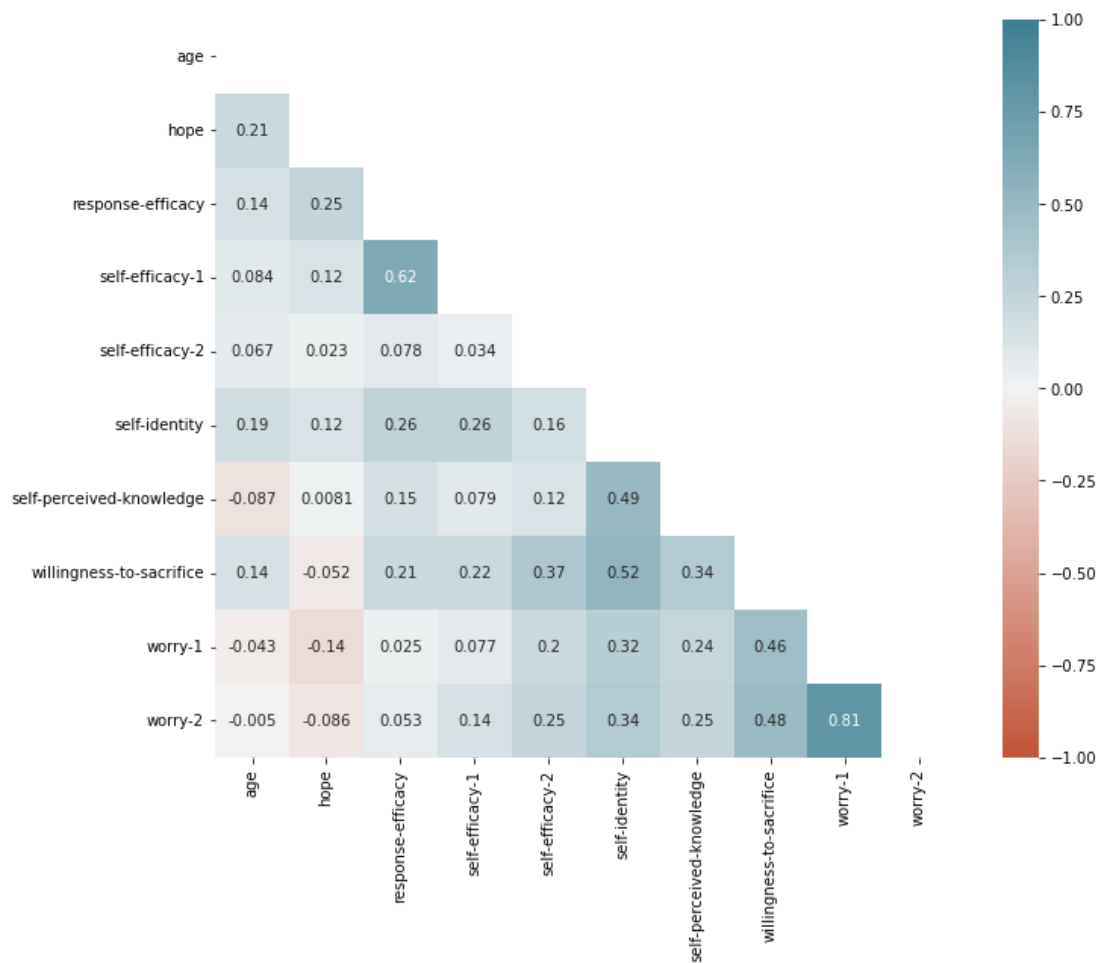
Appendix 11: Nationality and region distribution of respondents



Appendix 12: Educational level among respondents



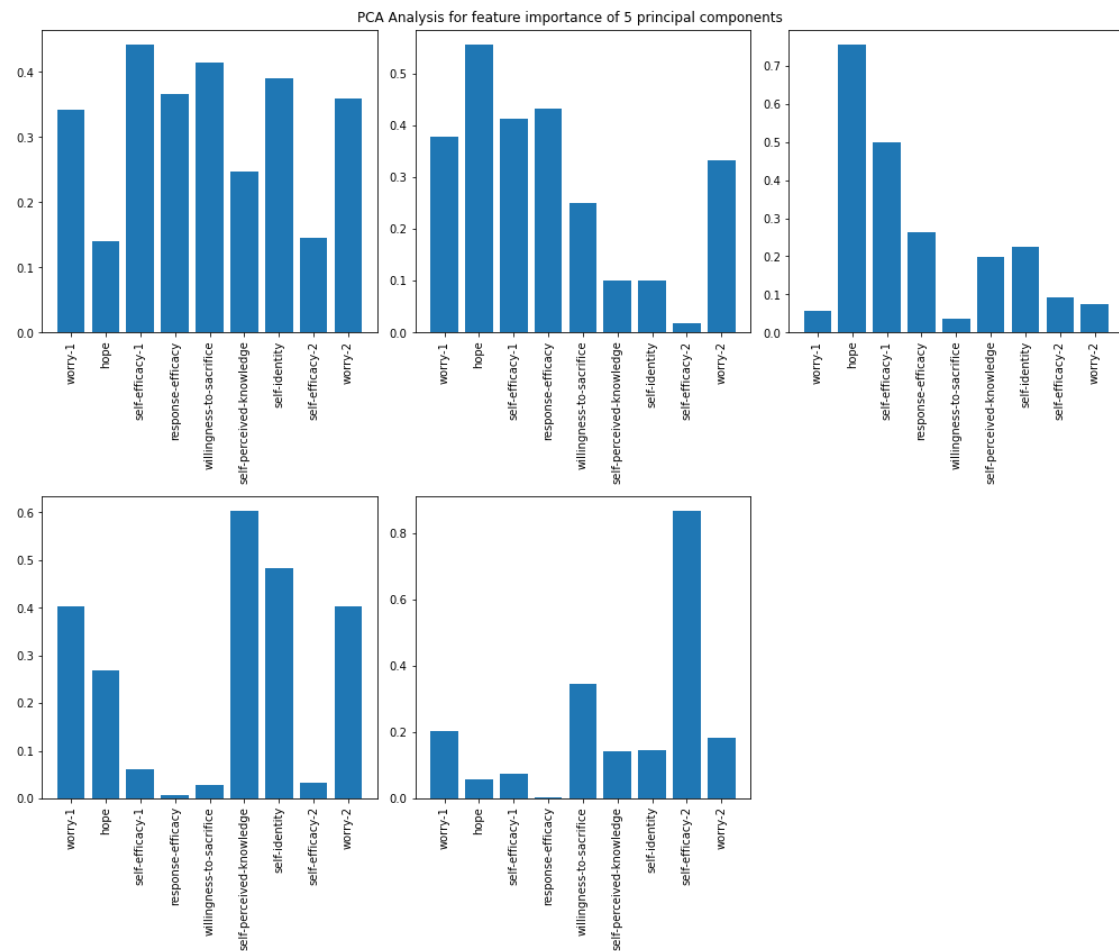
Appendix 13: Correlation between features



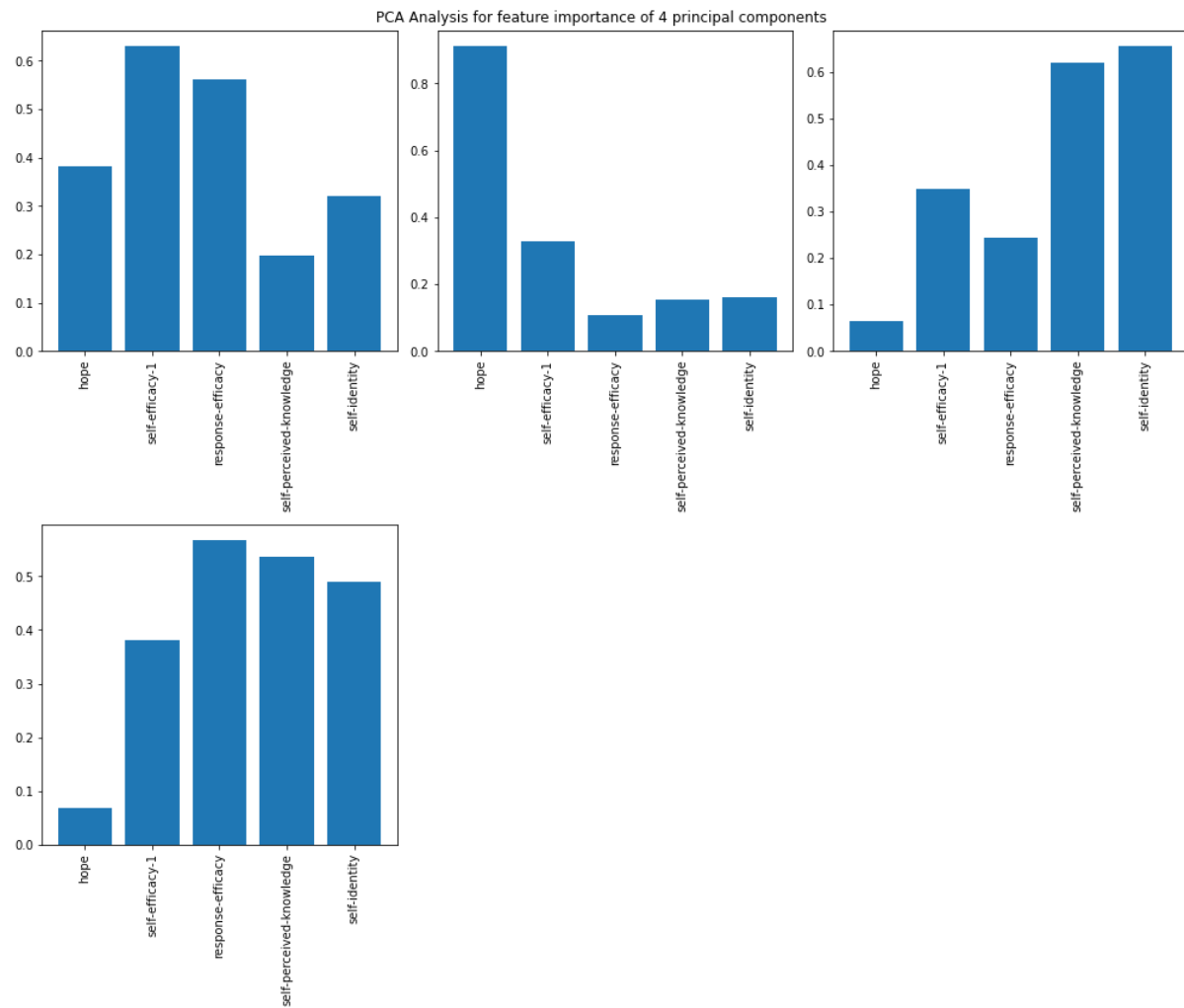
Appendix 14: Mean and Standard deviations for CA predictors

CA Predictor	Mean	Standard deviation
Worry-1	8.08	1.85
hope	4.80	2.36
self-efficacy-1	6.11	2.32
response-efficacy	5.4	2.06
willingness to sacrifice	7.88	1.97
self-perceived knowledge	7.09	1.75
self-identity	6.69	1.93
self-efficacy-2	8.32	1.71
worry-2	8.46	1.82

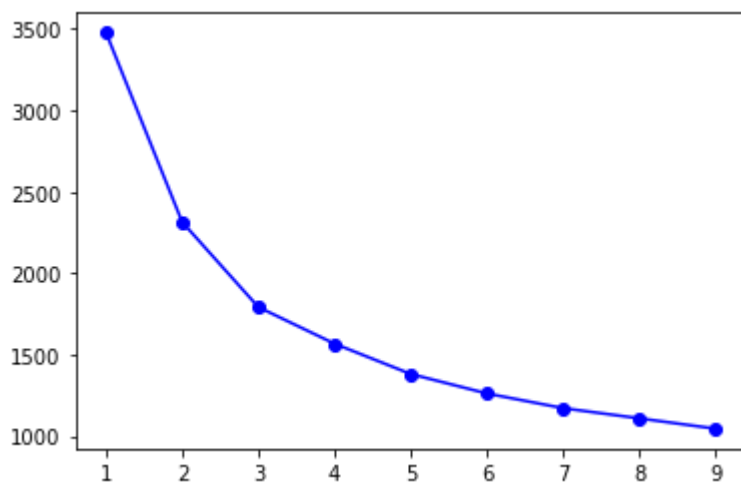
Appendix 15: PCA - explained variance: All features



Appendix 16: PCA - explained variance: Selected features



Appendix 17: Selection of optimal K-Value using elbow method.



Appendix 18: Individual Interviews - Feeling (Count of Interviewees)

