Understanding the Impact of Online Media on Climate Change Perception on the Silent Generation, Baby Boomers and Generation X

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ABSTRACT

Social amplifiers such as media play an important role in diffusing complicated information, for example about the climate crisis. With technological advancements online media has become an influential factor in this process. There is limited research on the usage and influence of online media on the climate change perception of the Silent Generation, Baby Boomers and Generation X. Through the European Social Survey (2016) the online and traditional media use are compared by understanding their impact on three dimensions of climate change perception: general perception, worries and causes of climate change. The results show that traditional media remains an significant force, but that among specific generations and dimensions of climate change online media is at times more effective. The results have implications on information campaigns and our knowledge of these under researched generations.

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INTRODUCTION

With recent developments, online media has become an important instrument in the toolkit of businesses, politicians and activists. There is particular attention on how young people have used and continue to use online resources to organize, inform and empower themselves to tackle issues of importance. This is especially the case surrounding the climate crisis. Online media is of paramount importance in the debate on the climate crisis, both on how to tackle it and among those who deny the fact. There is limited attention on how older generations use the online space to inform themselves on climate change and how this relates to traditional news. In this study the association between online media and climate change perspective is analyzed by using the European Social Survey (2016). The Silent Generation (1928-1945), Baby Boomers (1946-1964) and Generation X (1965-1980) will be analyzed in this research with the research question: "how does the Silent Generation, Baby Boomers' and Generation X' online media usage influence their perception of climate change?".

Through Ordinal Least Square Regression with an Interaction Effect, online media use among Silent Generation, Baby Boomers and Generation X and their climate change perception is measured through three different dimensions of climate change perception. This provides insight into what factors are influenced by online media in comparison to traditional media. This research shows that traditional media remains an important factor in information diffusion among these generations. Online media is an influential factor in people's overall climate change perception, however this is isolated to specific generations.

Understanding generational differences is not only relevant from an academic perspective, but also highly relevant from a policy and social perspective. Research shows that older age groups are less concerned about climate change and its impact (Poortinga et al., 2019; Shi et al., 2016; Whitmarsh, 2011). Understanding further what shapes this behaviour allows policymakers and

the environmental movement to adapt their strategies. Understanding this also provides an opportunity to improve multiple societal and health issues, especially among the Silent Generation and the Baby Boomers. Firstly, elderly people are more prone to the consequences of climate change, they are less able to adapt and for example extreme heat has a strong negative effect on their health. Furthermore, isolation among the elderly is a large issue with a large variety of health consequences. Engaging elderly into the climate movement could lead to new contacts and using their skills that would be useful in the climate movement (Pillemer et al., 2021). Furthermore, social media is a powerful tool that reduces social isolation and it increases their quality of life (Haris et al., 2014). Therefore understanding the consequences of social media use among the Silent Generation, Baby Boomers and Generation X can provide important insight into how current and future elderly are exposed to information through online media.

LITERATURE REVIEW

Regardless of the strong scientific consensus on the consequences and mechanisms of climate change, (IPCC, 2022) a strong public debate endures disputing these facts (Hulme, 2009; Maibach et al., 2013; Moser, 2010; O'Neill & Boykoff, 2010; Williams et al., 2015). Climate change is a complicated phenomenon to observe from first-hand experience due to the relatively slow changes over time, which make it difficult psychologically to understand (Van Der Linden et al., 2020). Therefore, the public rely on media for information, since they fulfill the role of social amplifiers (Kosicki, 2006; Moser, 2010; Van Der Linden et al., 2020; Weber, 2010). Through social amplification scientists and experts share complicated findings through channels which are more accessible to a broader population.

Therefore, understanding media coverage of climate change is an important part to understand how people's opinions are shaped, which is the focus of this study. With technological developments the landscape has evolved from TV, Radio and Newspapers to a wide array of online media which has caused debate among scholars what this means for classic media effect theories and public opinion (Bennett & Iyengar, 2008; Holbert et al., 2010). The role of traditional media such as print newspapers, television and radio broadcasts on public opinion have been researched extensively, yet there persists a gap in knowledge on online media, especially among older generations. It is broadly recognized that the framing and attention in media on various issues matter for the opinion of public formation (Chong & Druckman, 2007; Djerf-Pierre & Shehata, 2017; Iyengar & Kinder, 1987; Scheufele & Tewksbury, 2007).

For example, scholars have found that after major cultural events where the climate crisis is highlighted, people take to the internet to read more about it (Mavrodieva et al., 2019). A limitation of this study is that it does not analyse the consequences of this information on

people's behaviour and how people respond to information on the climate. It is not guaranteed that people access information that makes them more supportive of action of climate change.

However, research suggests that people who use social media as a news source are less likely to be climate sceptics (Diehl et al., 2021). These results are moderated by individual-level factors such as political ideology and trust in science and macro level factors such as the economic state of the country (Diehl et al., 2021).

Another factor that influences one's perception of climate change risk is age, with younger people expressing concern for the consequences of climate change which inherently means they understand the scientific consensus on the state of climate (Arbuckle, 2017; Benegal, 2018a, 2018b; Boulianne et al., 2020; Hornsey et al., 2016). Overall, in particular older men with less formal education are skeptical about climate change and the consequences (Milfont et al., 2015; Poortinga et al., 2011; Shi et al., 2016; Whitmarsh, 2011). This is explained by the "white male effect", the trend whereby white men in general are more willing to accept a range of environmental risks, this is specifically different from other demographic groups (Finucane et al., 2000). However, it remains unclear what role information and media plays into this effect.

The gap this research project aims to fill is the nexus between online media and generational differences. Whilst there is a lot of research of how young people engage use the internet and how people have used it, particularly social media, to mobilize for protest such as the Fridays for Future movement (Boulianne et al., 2020; Deng et al., 2017; Freelon et al., 2018; Tufekci & Wilson, 2012), research on other age cohorts apart from Millennials (born from 1980s to late 1990s) and Generation Z (born from late 1990s to 2021) (Dimock, 2019) in the EU is lacking from the academic body of literature (Skeirytė et al., 2022). Beyond the European Union, the

research on generational differences on the perception of climate change is limited. Gray et al. (2019) found that there were no generational differences in emotional responses to climate change in the United States. However, the lack of differences could be because of the design of the study. It was a small sample (*n*=125 per generation) of limited generalizability that is not representative of the general population. Furthermore respondents regardless of age were shown identical figures on the consequences of climate change (Gray et al., 2019). Swim et al. (2022) suggest understanding online media trends as a crucial factor into understanding generational differences and that further research is needed to validate proposed generational differences (Swim et al., 2022). This leads to the following research question: how does the Silent Generation, Baby Boomers' and Generation X' online media usage influence their perception of climate change?

THEORETICAL FRAMEWORK

As outlined in the literature review, the aim of this research is to understand how online media impacts an different generations' perspective on climate change. The theoretical framework of this research is built on findings by van der Linden (2015) who researched what shapes an individuals' opinion and perception of the causes, potential impacts of climate change and appropriate support for various solutions for global climate change (Diehl et al., 2021; van der Linden, 2015). This research found that the personal experience and socio-cultural factors explain significantly more variance in risk perception (van der Linden, 2015). Since it is rare and difficult for people to experience climate change directly (Whitmarsh, 2008) the emotional response are often influenced by popular media (Swim et al., 2011). The level of a reaction often depends on the intensity of how much the negative consequences of climate change can be imagined or experienced (Loewenstein et al., 2001; Weber, 2006).

Online media is one of the channels through which people receive information. Online media is an umbrella term for a large variety of platforms such as social media, blogs, forums, projects and online news media (Aichner et al., 2021; Aichner & Jacob, Frank, 2015). This broad concept was chosen purposefully since there is widespread criticism on single platform research since it lacks generalizability (Mahl et al., 2022; Pearce et al., 2019). The diffusion of conspiracy theories, for example, is not limited to a single platform and are also increasingly moving away from "traditional" social media platforms such as Facebook and Twitter and towards fringe social media platforms, as guidelines and monitoring have become more common (Mahl et al., 2022; Van Dijck et al., 2021; Zeng & Schäfer, 2021).

Understanding the theoretical difference between online and traditional media is a key concept of this study.

Online Media and Traditional Media

An important factor to consider in the media effect research field on democratic states, is that media landscapes are highly contextual. Depending on factors such as whom media is financed by and to the extent to which news networks adapt their content to specific political affiliations, which limits generalizability. For example in the United States, it is largely established that television networks and programs adapt their contents to specific political affiliations (Dellavigna & Kaplan, n.d.; Hart et al., 2020; Jordan & Page, 1992). This is strongly mirrored by the opinions on climate change by the viewership of these stations which closely reflect the political standpoint on environmental issues (Feldman et al., 2012). As the New York Times wrote on this phenomenon: "*What works in cable television news is not an objective analysis of the day's events but hard-nosed, unstinting advocacy of a specific point of view on a sizzling-hot topic*" (Carter & Steinberg, 2006, p. 1).

Interestingly, the critique brought forward on objective analysis in this quote is also applicable to online media. Misinformation is a known problem of online media, because it is both widely available and diffuses fast (Del Vicario et al., 2016; Frish & Greenbaum, 2017; Karlova & Fisher, 2012; Treen et al., 2020; Wu et al., 2016). Particularly, misinformation on climate change is an important topic on which fake news is spread online (Treen et al., 2020). Misinformation on climate change has caused confusion among the public, which has hindered the support and acceptance of mitigation policies (Brulle, 2018; Cook et al., 2018; Ding et al., 2011; Maibach et al., 2013; Treen et al., 2020; van der Linden et al., 2017). It has to be noted that this is an oversimplified perspective and that misinformation is also possible on traditional media platforms, although there is limited research on this issue beyond the American political context (Allen et al., 2020; Kuklinski & Sigelman, 1992).

Additionally, users can curate their personal newsfeed online. People's exposure to information is therefore highly individual since the search results are curated to an individual's search history, preferences and personal interests and avoid news altogether (Chaffee & Metzger, 2001; Djerf-Pierre & Shehata, 2017; McCombs et al., 2014; Prior, 2007). In contrast with traditional media, online media provides individually tailored articles based on the individuals opinions and the continues to recommend content along the same lines due to the algorithms of the platforms. What exactly determines the recommendations is widely considered a black box (Barberá, 2020). Therefore, citizens are essentially not completely in control of the content they consume and whether they want to be in an echo chamber (Barberá, 2020; Sunstein, 2018). Whilst with traditional media there is an element of political background, people have much more control on what media they consume (Fletcher & Nielsen, 2018). Online media plays an important role in how climate change is framed and debated (Aichner et al., 2021; Boulianne et al., 2020; Schäfer, 2012; Williams et al., 2015). Especially the latter, debating, is significant because it exemplifies the two-way communication essence of online media. People have the chance to debate and discuss their opinions in comments, fora and videos (Kahne & Bowyer, 2018; Valenzuela et al., 2012), whereas these debates are limited in traditional media. The accessibility of online media is also a big component of why studying online media separately from traditional media is important, even though mainstream tv stations also produce material for online sources (Allen et al., 2020).

Part of the attitude towards climate change is climate risk perception. This is highly influenced by the information individuals consume (Leiserowitz, 2006; O'Connor et al., 1999; Semenza et al., 2008; Spence et al., 2012; van der Linden, 2015).

Individuals have to rely on social amplifiers such as the media to get access to information in a clear and comprehensive manner. If you consume news that denies the existence of climate

change you will not be worried about the consequences. Furthermore, the measures proposed to tackle climate change are often disruptive and expensive, which if you are in doubt about the existence of climate change you will be in less favor of implementing them. This mechanism works opposite as well. This is an oversimplification. Therefore understanding the consequences of online media on climate change perspective is important.

The focus of this study lies in understanding the relationship between one's age and how online media exposure shapes their risk perception and, therefore, behaviour toward climate change. Understanding the link between perspective and behavior is beyond the scope of this research.

A generation is defined by a group of people who are roughly born around the same time and were exposed to the same zeitgeist as they were coming of age. They often share characteristics and habits. In this analysis the focus will lie on the generations: the Silent Generation, Baby Boomers and Generation X born before 1981. The cut-off date was chosen because people born after 1981 are considered as Millennials which is the focus of a lot of attention in the literature already. Therefore understanding the consequences of social media on these older generations aims to go some way to addressing a gap in the literature. For example, people from the silent generation and baby boomers mainly received information through radio, television and newspapers for the majority of their life. The dawn of the internet coincided with early adulthood for Generation X, however not widespread for personal use until later in life. For all the generations (the Silent Generation, Baby Boomers and Generation X), the rise of social media and the current applicability of the internet was well into adulthood. This means that in contrast to Millennials and Generation Z, they often lack the skills to assess the credibility of online sources and the complexity of echo chambers, misinformation and click-bait. Of course, there are many factors that influence ones digital abilities and bridging this gap is accessible (Helsper & Eynon, 2010).

It is important to note that generations are not absolute groups and an individual's experience is not completely different if they happen to be born past the cut-off point of a certain generation. Generations are merely a broad generalization of individuals grown up in similar circumstances and zeitgeist, as they do not account for personal experiences and background. It remains important to study generational differences on online media usage and their perspective on climate change since it provides us information into the influence of online media and how exposure at what age has an effect. Furthermore, it allows us to track changes in perspectives over time and provide context to continuing changing trends. Another important point to note is that older generations often are aware that the consequences of climate change will not affect them personally and scenarios which happen after 2050 are likely to cause less reaction compared to a younger person, therefore inherently the climate change perspective is influenced by generation.

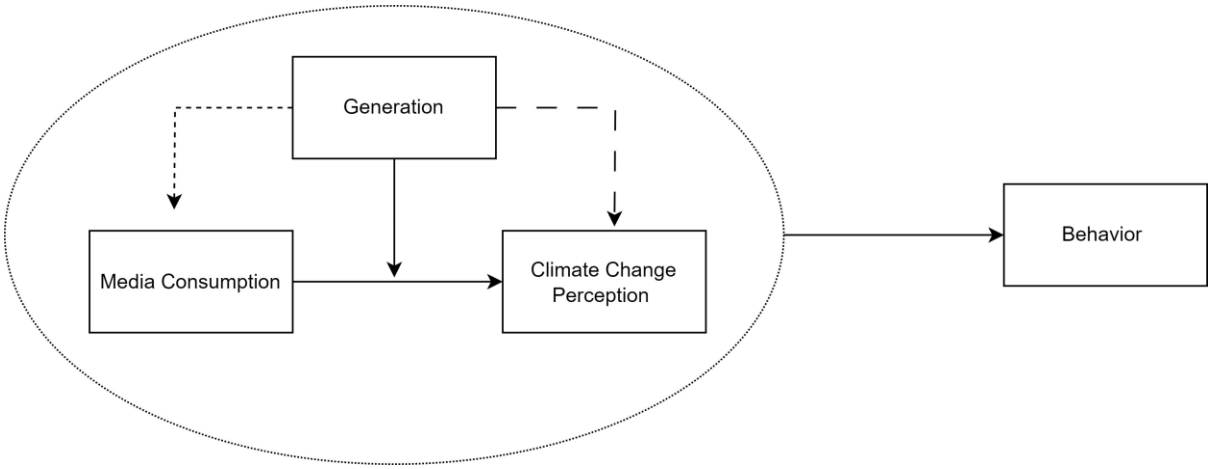

Figure 1 Theoretical Framework

Figure 1 shows the schematic view of the theoretic interplay between the variables. What generation someone belongs to influences how they use media and (subconsciously) their climate change perceptions. The focus of this model lies on understanding the nexus of

Generation, Media Consumption and Climate Change Perspectives, as is highlighted in the schematic view. All of these factors combined influences people's behavior. However, behavior is beyond the scope of this current research.

The hypothesis that leads from this theory is: among the Silent Generation, Baby Boomers and Generation X online media usage influences the climate change perception.

EMPIRICAL DESIGN

For this study, a large representative survey is needed to analyze the consequences of online media use per age. The survey has to ask participants both about online & traditional media use and their perception on climate change. To study the effect of online media accurately, it would be desirable to choose a country or region where people have limited first-hand experience with the consequences of climate change. This increases the probability that people do not have strong personal experience and therefore have to rely on social amplifiers to get the message across. Furthermore, a democratic society would be a good fit of this study since freedom of speech and the press allow for information to diffuse freely. This is important for this study because uncensored access to the internet is vital to understanding how online media influences people's perceptions of climate change. Furthermore, it is potentially in an autocratic regime's interest to downplay the consequences of climate change since it affects factors such as food availability and people's livelihoods, which has the potential to spark protests (Barnett & Adger, 2007).

Furthermore, climate change risk perception is not a definitive and homogenous variable, it adapts over time and between and within countries (Lee et al., 2015; Maibach et al., 2014; Tranter, 2013). Therefore, it is desirable to use a survey that includes multiple countries and multiple years. These elements, alongside the availability of the data, leads to a survey on the

European level such as the European Social Survey (ESS). Due to the limitation in data-availability, the current study will be limited to analyzing multiple countries over a single year. In 2016 there was a special edition of the survey to understand people's attitudes toward climate change and their consequent behavior. This study was performed in multiple countries across Europe[1], but only countries in the European Union will be included in this study since there are European wide climate policies and goals.

Sample

The sample consists of the respondents of the ESS are selected by strict random probability sampling and are representative for all persons above the age of 15. All countries in the survey must achieve at least 1500 respondents, or 800 in countries where the population is less than 2 million after discounting for design effects (Fitzgerald & Jowell, 2010; Poortinga et al., 2019; *Sampling | European Social Survey (ESS)*, 2023). As recommended by the ESS, the appropriate weightings are applied to account for sampling errors, both design and population weight. In the following section the sample is described in more detail per European member state. It is important to note that not all European Member states participated in the ESS of 2016.

In the table below the median and standard deviation of the control variables of the dataset. In the Appendix the descriptive statistics per country

Table 1 Descriptive Statistics Complete Sample

Control Variable	Mean	Standard Deviation
Age[a]	53.18984	11.30158
Education[b]	14.23476	3.703701

[1] The European Social Survey Round 8 of 2016 included Austria, Belgium, Czechia, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Israel, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Russian Federation, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

Religion[c]	1.457954	0.4982464
Minority Group[d]	1.958725	0.1989334
Gender	1.520322	0.4996043

Note:

[a] Age in years, respondents born after 1981 removed from dataset. [b] Years in Formal Education, self-assessed. [c]1= Yes, 2=No, [d]1= Yes, 2=No, [e]1=Male, 2=Female.

Variables: Operationalization

There are multiple independent variables in this research, both respondents internet and media habits as well as age cohort. First, the active online political participation of respondents will be measured by a dichotomous variable (yes/no) on whether respondents have posted about politics online in the last year. Understanding the active participation of respondents is essential to this study because one of the main differences between online and traditional media is the two-way communication possibility of online media. The second variable measures internet use in a more general sense, not distinguishing between the type of activity by asking respondents how often they use the internet (ordinal categories such as never, only occasionally, a few times a week etc.). The variables are recoded into integers. There are a few limitations on these independent variables. They do not ask specifically how people use the internet and what type of content they consume. Furthermore, since the question includes both personal and professional use, a lot of internet usage does not necessarily mean people consume content related to any political issue.

The second independent variable for this study is age cohort. Since the focus of this study is generational differences, the ages of the respondents are compiled by generation. The generations are categorized as the Silent Generation, Baby Boomers and Generation X. Silent Generation is the generation that was born 1928-1945, Baby Boomers from 1946-1964 and Generation X from 1965-1980 (Dimock, 2019). Younger respondents are excluded from this

analysis since there is a lot of research on Millennials and Generation Z and including these groups would lead to inaccuracies in the analysis.

The dependent variable, perception of climate change is measured by three ordinal variables. Each of these variables measure different dimensions of respondents' attitude towards climate change. Whether respondents think the climate is changing, whether they are worried about climate change and what they think causes climate change. These variables were chosen to increase the internal validity of this study and to measure which dimension of climate change perception is most influenced by online media. All three variables are operationalized so that the answers range from climate skepticism to a view that aligns with the scientific consensus on the state of the climate. The answers are recoded into integer values.

As discussed in the literature review, traditional media is an important factor in the information landscape and distinctly different from online media due to various oversight mechanisms and limited two-way communication. Therefore, this study will control for traditional media by including the amount of time (in minutes) respondents spend watching, reading or listening to news. A similar limitation as the internet usage variable applies here. It is difficult to measure what type of content respondents think of with these questions and what medium they associate with it. However, since there are separate questions on internet usage, it can be assumed that this refers to traditional media sources such as TV, newspapers and radio. Finally, to account for specific, difficult to measure objectively, characteristics and variations of each country, a fixed effect for countries is applied as control variables. Furthermore, in this research[2], education and gender will be included as control variables since there is indication that these

[2] The results including the control variables can be found in the Appendix.

factors play a role into shaping climate change perspective (Hamilton, 2011; McCright & Dunlap, 2011)

Model Description

Three models were estimated, one for each dimension of climate change perception, using Ordinal Least Squares Regression (OLS) including Interaction Effect. The dependent variables are normally distributed based on Skewness[3] and Kurtosis[4]. Linearity was assessed through a visual examination of the QQ plot and comparing the reference line (QQ line) to the observed data points. Fixed effects are included in the models to account for country-specific factors as a form of control variables. Cluster-robust Covariance Matrix estimations are included in the regression table in parentheses.

An interaction effect is included in the OLS since a respondent's generation is considered a moderating/interacting variable in this study. The aim of this study is to understand how belonging to a different generation influences your online media usage and whether there is an association with climate change perception. A schematic view of the model design is included (Figure 2) on the next page.

[3] Skewness appropriate levels between -3 and +3. (*Kurtosis - an Overview | ScienceDirect Topics*, n.d.)
Climate Change Perception (-0.9102191); Worries about Climate change (-0.02453462); Causes of Climate Change (-0.1793943)

[4] Skewness appropriate levels between -10 and +10. (*Kurtosis - an Overview | ScienceDirect Topics*, n.d.)
Climate Change Perception (2.820372); Worries about Climate change (3.000465); Causes of Climate Change (3.510187)

Figure 2 shows that generation is a moderating factor in between the online media usage and climate change perspective. It shows that generation does not necessarily influence online media usage or climate change perception but rather the process in between them. Fixed Country Effects functions as a control variable for this approach.

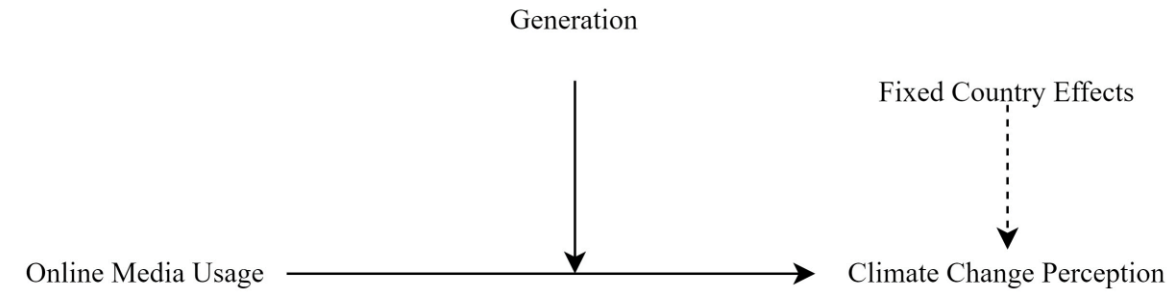

Figure 2 Schematic View of Interaction Effect

RESULTS

Table 2 Climate Change Perception OLS and Interaction Effect

	Do you think climate is changing?	
Coefficient	*Estimates*	*Conf. Int (95%)*
Intercept	-0.00 (0.00)	-0.00 – 0.00
News Consumption Time (Traditional)	-0.90 *** (0.13)	-1.15 – -0.65
How often spend time online	-0.74 *** (0.17)	-1.08 – -0.41
Active User	9.05 *** (0.78)	7.53 – 10.57
Silent	3.37 *** (0.29)	2.80 – 3.94
Baby Boomers	3.64 *** (0.12)	3.40 – 3.89
Generation X	3.51 *** (0.13)	3.26 – 3.76

News Consumption Time * Silent	0.22 *** (0.04)	0.15 – 0.29
News Consumption Time * Baby Boomers	0.00 (0.00)	-0.00 – 0.00
News Consumption Time * Generation X	0.00 (0.00)	-0.00 – 0.00
How much time spend online * Silent	0.00 (0.00)	-0.00 – 0.00
How much time spend online * Baby Boomers	0.90 *** (0.14)	0.63 – 1.17
How much time spend online * Generation X	0.88 *** (0.13)	0.63 – 1.13
Active User * Silent	0.93 *** (0.13)	0.68 – 1.18
Active User * Baby Boomers	0.73 *** (0.18)	0.38 – 1.09
Active User * Generation X	0.71 *** (0.17)	0.37 – 1.05
Observations	14270	
R^2 / R^2 adjusted	0.978 / 0.978	

** p<0.05 ** p<0.01 *** p<0.001*

Note:
CI = confidence interval; *LL* = lower limit; *UL* = upper limit.
[a] 1= Definitely not changing, 4= Definitely Changing. [b] Minutes per day, self-assessed. [c] 1 = never, 5 = every day. [d] 1= Yes, 2= No

The table above shows that news consumption has a negative statistically significant relationship (p <0.001), -0.90 (0.13), with climate change perception. This indicates the more people consume traditional news, the less they are convinced the climate is changing. This is similar to the values for how often respondents spend time online. This indicates that for the question "Do you think climate is changing?" the type of media they consume does not make a significant difference. This is in contrast to whether individuals are active users online. There

is a strong positive statistically significant ($p<0.001$) relationship (9.05) between these variables, indicating that an active online users are more likely to agree with the scientific community that climate is changing.

The interaction effects for table 2 show positive statistically significant relationships for how much time Baby Boomers and Generation X spend online and active internet users for all generations included in this study. This means that, especially for active users, there is a positive relationship with their climate change perspective. This confirms the hypothesis that online media has an influence on the Silent Generation, Baby Boomers and Generation X. In this case, online media exposure leads to views that align with the scientific community. Traditional news consumption only has a statistically significant effect among the silent generation, which is the smallest sample of the generations and the oldest. It is therefore expected that traditional media has a stronger effect among these groups.

It is important to note that the results for news consumption for the Boomer and Generation X and how much time spend online for the silent generation is shown as zero in this table. However, it is found that the results are zero to three significant digits[5]. This shows that how much time Baby Boomers and Generation X spend on engaging with traditional news sources has no strong influence on their climate change perception.

[5]
News Consumption Time * Baby Boomers 0.0007039784
News Consumption Time * Generation X 0.0001829739
How much time spend online * Silent 0.0002049268

Table 3 Worries about Climate Change OLS model and Interaction Effect

	How worried are you about climate change?	
Coefficient	*Estimates*	*Conf. Int (95%)*
Intercept	-0.01 *** (0.00)	-0.01 – -0.00
News Consumption Time (Traditional)	0.83 * (0.42)	0.02 – 1.65
How often spend time online	-0.33 (0.36)	-1.04 – 0.38
Active User	0.35 (2.28)	-4.11 – 4.81
Silent	3.32 *** (0.47)	2.40 – 4.23
Baby Boomers	3.79 *** (0.18)	3.44 – 4.15
Generation X	3.24 *** (0.20)	2.85 – 3.63
News Consumption Time * Silent	0.05 (0.05)	-0.06 – 0.15
News Consumption Time * Baby Boomers	0.01 *** (0.00)	0.00 – 0.01
News Consumption Time * Generation X	0.01 *** (0.00)	0.00 – 0.01
How much time spend online * Silent	0.01 *** (0.00)	0.00 – 0.01
How much time spend online * Baby Boomers	-0.83 (0.42)	-1.66 – 0.00
How much time spend online * Generation X	-0.89 * (0.42)	-1.71 – -0.08
Active User * Silent	-0.79 (0.42)	-1.61 – 0.03
Active User * Baby Boomers	0.13 (0.38)	-0.61 – 0.87

Active User * Generation X	0.14 (0.36)	-0.57 – 0.85
Observations	14270	
R^2 / R^2 adjusted	0.934 / 0.934	

** p<0.05 ** p<0.01 *** p<0.001*

Note:
CI = confidence interval; *LL* = lower limit; *UL* = upper limit.
[a] 1= Not at all worried, 4= Extremely Worried. [b] Minutes per day, self-assessed. [c] 1 = never, 5 = every day. [d] 1= Yes, 2= No

Table 3 shows that there is a statistically significant relationship (p<0.05) with traditional media (0.83), regardless of generation. this indicates that when people more consume more traditional news sources they are more worried about climate change. When looking at the specific generations there is a small positive relationship (p<0.001) with traditional news consumption for Baby Boomers (0.01)and Generation X (0.01). There is a negative statistical significant relationship (p<0.05) between how much time Generation X spends online and how worried they are about climate change (-0.89). this shows that for every unit Generation X spends more time online (categories such as every day, once a week etc.) they are less worried about climate change. This indicates that whilst over the whole sample online media use is not statistically significant with their worries about climate change, for Generation X their online news exposure shows an association with fewer worries about climate change. There are no statistically significant relationship with active news consumption for any generation in particular.

Table 4 Causes of Climate Change OLS model and Interaction Effect

	Do you think that climate change is caused by natural processes, human activity, or both?	
Coefficient	*Estimates*	*Conf. Int (95%)*
Intercept	0.00 (0.00)	-0.01 – 0.01
News Consumption Time	1.37 (0.80)	-0.21 – 2.94
How often spend time online	0.21 (0.46)	-0.68 – 1.11
Active User	-2.78 (4.15)	-10.92 – 5.37
Silent	4.65 *** (0.40)	3.86 – 5.44
Baby Boomers	4.82 *** (0.16)	4.50 – 5.13
Generation X	4.62 *** (0.17)	4.30 – 4.95
News Consumption Time * Silent	-0.30 *** (0.05)	-0.40 – -0.20
News Consumption Time * Baby Boomers	-0.00 (0.00)	-0.01 – 0.01
News Consumption Time * Generation X	-0.00 (0.00)	-0.01 – 0.01
How much time spend online * Silent	-0.00 (0.00)	-0.01 – 0.01
How much time spend online * Baby Boomers	-1.37 (0.81)	-2.95 – 0.21
How much time spend online * Generation X	-1.38 (0.80)	-2.96 – 0.19
Active User * Silent	-1.33 (0.80)	-2.91 – 0.24
Active User * Baby Boomers	-0.33 (0.47)	-1.24 – 0.59

Active User * Generation X	-0.29 (0.46)	-1.18 – 0.61
Observations	14270	
R^2 / R^2 adjusted	0.975 / 0.975	

** p<0.05 ** p<0.01 *** p<0.001*

Note:
CI = confidence interval; *LL* = lower limit; *UL* = upper limit.
[a] 1= I don't think climate change is happening, 6= Entirely by human activity. [b] Minutes per day, self-assessed. [c] 1 = never, 5 = every day. [d] 1= Yes, 2= No

When considering the causes of climate change the only statistical significant relationship is the negative relationship with the traditional news consumption of the silent generation. Indicating that for every unit the Silent Generation spends more time engaging with traditional news sources they are more likely to doubt the existence of climate change and what causes it. The context of this variable is that many climate deniers argue that weather changes over time regardless from human action and that therefore climate change should not be a concern and it will correct itself over time (Dunlap, 2013).

The same issue of table 2 persist for the news consumption of Baby Boomers and Generation X and how time the silent generation spends online that the results are zero to three digits significant[6]. Indicating that the news consumption and how much time they spend online does not have a strong influence on their perception of the causes of climate change.

[6] News Consumption Time * Baby Boomers 0.0005913205
News Consumption Time * Generation X 0.0008669791
How much time spend online * Silent 0.0008694813

DISCUSSION

Overall, the results show that there are significant differences between generations in this study. This shows that factors such as at what age people started using the internet and zeitgeist somewhat influence their behaviors and media diet. There are differences in generational attitudes towards the dimensions of climate change, however, these differences were relatively small. Overall, this study shows that traditional news consumption remains a strong provider of information to these generations. In terms of the perception of climate change (table 2) the results show that there is an statistically significant association with online news consumption for all generations. This indicates that the hypothesis is confirmed.

The other dimensions of climate change perceptions do not share these results. Looking at specific generations the silent generation and Generation X have a statistical association with how often they spend time online and their worries about climate change. It has to be noted that the silent generation is the smallest sample size and this influences the result. Overall, generation X holds a statistically significant association with how often they spend time online and their worries about climate change. Meaning that the hypothesis is confirmed for the silent generation and generation x. For the last model, which looks at the causes of climate change, only traditional news sources and the silent generation are statistically significant. This indicates that the hypothesis is rejected.

CONCLUSION

The aim of this research is to understand how online media influences people's perceptions of climate change, with particular focus on the Silent Generation, Baby Boomers and Generation X. this resulted in the research question: "how does the Silent Generation, Baby Boomers' and Generation X' online media usage influence their perception of climate change?". Results show that when looking at their general perception of climate change, active internet users have a strong association with agreeing with the scientific consensus of climate change. Furthermore, how much time Baby Boomers and Generation X spend online has a positive statistical significant relationship with their perception of climate change. When asked about the samples worries on climate change, traditional news media has a positive

statistical significant association. How much time the Generation X has spend online has a negative statistical significant relationship with their worries on climate change, indicating that the more time they spend online the less worried they tend to be about climate change. Finally, when asked about the causes of climate change the only statistical significant relationship was between traditional news sources and the silent generation. This shows that online media does not have a strong relationship with what people perceive to be the causes of climate change. This is an interesting finding since deniers of climate change portray the shifts in the climate as natural shifts over time and no action is required to change this. These theories are often diffused online, showing that people belonging to the Silent Generation, Baby Boomers and Generation X in Europe in 2016 are not influenced by this rhetoric.

There are a few limitations to this study that influence the results. First of all, the question posed in the ESS are quite broad and there is space for interpretation by the respondents. Secondly, the study design relies on limited personal experience of climate change. While individuals might not consciously have been exposed to climate change, in 2016 the effects of climate change are known and affecting communities worldwide. Therefore it is difficult to say with certainty that the perception of climate change individuals hold are strongly influenced by media. Respondents can have family members in other continents which feel the consequences stronger, influencing their perceptions. Respondents can travel or feel the consequences of climate change in their daily lives while others do not. This influences the generalizability of the results.

Furthermore, it is important to reiterate that this survey was conducted in 2016, nearly 8 years ago. In the meantime, results might be very different since the climate movement has continued to grow and attention from governments all across Europe have taken new steps to limited the consequences of climate change. It would be an interesting study to compare the results in the current climate and understand the evolution on this topic.

The results of this study show that there are strong differences among generations and that the results change per dimension of climate change. Therefore more research is needed to further understand the underlying mechanisms of climate change perception.

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APPENDIX

Table Descriptive Statistics Country

	Age[a]		Education[b]		Religion[c]		Minority[d]	
Country	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Austria	57.51812	12.50956	12.507246	3.028380	1.293151	0.4555190	1.954794	0.2078970
Belgium	56.88507	13.40731	13.495805	3.921135	1.566085	0.4959228	1.966334	0.180801
Czechia	55.25429	11.74449	12.350485	3.211369	1.817284	0.3866723	1.987654	0.1104913
Germany	57.67167	12.72333	14.328328	3.384004	1.438775	0.4964323	1.956044	0.2050778
Estonia	58.38771	13.61961	13.087052	3.446372	1.716303	0.4510812	1.825417	0.3798537
Finland	56.21168	12.81859	12.278994	5.438113	1.341033	0.4743787	1.976902	0.1503164
France	58.88523	13.24053	13.699561	4.219604	1.434483	0.4959333	1.980296	0.1390511
Hungary	59.82095	13.85515	12.051724	3.911086	1.482068	0.4999421	1.964135	0.1860516
Ireland	59.27770	13.98798	13.779856	4.061854	1.506237	0.5002212	1.936590	0.2438249
Italy	59.03515	13.58842	11.914894	3.222917	1.542601	0.4987413	1.986547	0.1153332
Lithuania	57.61650	13.60433	14.427424	3.721906	1.259136	0.4383426	1.970930	0.1680719
Netherlands	57.92648	13.31012	11.116461	4.476949	1.256348	0.4368805	1.978235	0.1460050
Poland	58.15924	12.60178	12.808917	2.901317	1.094862	0.2933137	1.916996	0.2761612
Portugal	59.05906	13.56456	13.755663	4.096430	1.659615	0.4740665	1.961539	0.1924002
Spain	56.83740	12.59939	12.283537	3.302007	1.100515	0.3010743	1.979381	0.1422871
Slovenia	58.93370	13.37231	9.548066	5.418969	1.306264	0.4614766	1.954794	0.2078970
Sweden	59.59547	13.84892	13.277245	3.886909	1.617492	0.4555190	1.966334	0.180801
United Kingdom	57.59031	13.01918	12.188326	3.540410	1.460993	0.4959228	1.987654	0.1104913

Note:

[a] Age in years, respondents born after 1981 removed from dataset. [b] Years in Formal Education, self-assessed. [c]1=Yes, 2=No. [d]1=Yes, 2=No

Table: Models with Control Variables

	Do you think climate is changing?		**How worried are you about climate change?**		**Do you think that climate change is caused by natural processes, human activity, or both?**	
Coeffcient	*Estimates*	*Conf. Int (95%)*	*Estimates*	*Conf. Int (95%)*	*Estimates*	*Conf. Int (95%)*
Intercept	6.48	-7.90 – 20.85	0.17	-22.70 – 23.04	-3.84	-22.93 – 15.25
News Consumption Time	-0.00	-0.01 – 0.01	-0.01 *	-0.03 – -0.00	-0.00	-0.01 – 0.01
How often internet use	-0.72	-2.16 – 0.73	0.57	-1.72 – 2.87	1.26	-0.66 – 3.17
Active User	-0.09	-3.31 – 3.13	1.18	-3.94 – 6.30	1.01	-3.26 – 5.29
Education	0.06	-0.18 – 0.31	0.07	-0.31 – 0.46	0.04	-0.28 – 0.36
Gender	-0.03	-1.10 – 1.04	-1.30	-3.00 – 0.41	-0.28	-1.71 – 1.14
Silent Generation	-3.09	-17.47 – 11.29	3.07	-19.80 – 25.95	8.17	-10.93 – 27.27
Boomers	-2.88	-17.25 – 11.49	3.31	-19.56 – 26.18	8.39	-10.71 – 27.48
Gen X	-3.08	-17.46 – 11.29	2.78	-20.09 – 25.65	8.16	-10.93 – 27.26
News Consumption Time * Silent	0.00	-0.01 – 0.01	0.01 *	0.00 – 0.03	0.00	-0.01 – 0.01
News Consumption Time * Boomers	0.00	-0.01 – 0.01	0.01 *	0.00 – 0.03	0.00	-0.01 – 0.01
News Consumption Time * GenX	0.00	-0.01 – 0.01	0.01 *	0.00 – 0.03	0.00	-0.01 – 0.01

How often internet use * Silent	0.71	-0.74 – 2.15	-0.58	-2.88 – 1.71	-1.25	-3.17 – 0.67
How often internet use * Boomers	0.70	-0.74 – 2.14	-0.64	-2.93 – 1.66	-1.28	-3.19 – 0.64
How often internet use * Gen X	0.74	-0.70 – 2.18	-0.55	-2.84 – 1.74	-1.24	-3.16 – 0.67
Active User * Silent	0.06	-3.16 – 3.28	-1.43	-6.55 – 3.69	-1.16	-5.44 – 3.12
Active User * Boomers	0.04	-3.17 – 3.26	-1.36	-6.48 – 3.76	-1.06	-5.34 – 3.21
Active User * GenX	0.02	-3.20 – 3.24	-1.35	-6.47 – 3.77	-1.06	-5.33 – 3.22
Education* Silent	-0.06	-0.30 – 0.18	-0.07	-0.45 – 0.32	-0.05	-0.37 – 0.27
Education* Boomers	-0.06	-0.30 – 0.19	-0.06	-0.44 – 0.33	-0.03	-0.35 – 0.29
Education* Gen X	-0.05	-0.29 – 0.19	-0.05	-0.44 – 0.33	-0.02	-0.35 – 0.30
Gender* Silent	0.10	-0.98 – 1.17	1.38	-0.33 – 3.09	0.43	-1.00 – 1.86
Gender* Boomers	0.06	-1.02 – 1.13	1.36	-0.35 – 3.07	0.22	-1.21 – 1.64
Gender* GenX	0.07	-1.00 – 1.15	1.37	-0.34 – 3.08	0.26	-1.17 – 1.68
Observations	14270		14270		14270	
R^2 / R^2 adjusted	0.015 / 0.013		0.020 / 0.019		0.020 / 0.018	

** p<0.05 ** p<0.01 *** p<0.001*