Climate Change Frame Acceptance and Resistance: Extreme Weather, Consonant News, and Personal Media Orientations

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ABSTRACT

Across the globe, extreme weather events have brought climate change into people’s daily lives. Extended heatwaves, droughts, and wildfires are now recurring in many regions across the globe. This study asks how the exceptional 2018 summer influenced climate change beliefs among Swedish citizens. More specifically, the study looks deeper into belief formation dynamics under intense, consonant, and extended news reporting – addressing one of the most fundamental media effects in the literature: the over-time maintenance of societal beliefs through cumulative and repetitive exposure to a dominant issue frame. Using a unique three-wave panel survey, the analysis focuses on citizens’ acceptance (and resistance) of the dominant climate change frame provided by traditional media – whether citizens believe in the existence, causes, and consequences of climate change. The findings reveal strong support for belief maintenance effects over time, but also that belief changes are possible. Even in situations of intense and consonant news reporting, acceptance (and resistance) of the dominant climate change frame depends on citizens’ personal media orientations. Both trust in traditional news media and usage of alternative online news emerge as key factors conditioning classic media effects in a fragmented and polarized media environment.

Across the globe, extreme weather events have brought climate change into people’s daily lives. From extreme heatwaves, droughts, and wildfires...
to heavy rainfall, flooding, and snowstorms, people on all continents are experiencing how the climate changes. This was certainly the case for the 2018 summer in Sweden, which was historically extreme. With temperatures significantly higher than normal – in some regions the hottest summer ever registered – people directly experienced some of the potential consequences of global warming. The combination of an unprecedented heatwave, severe drought, and extensive wildfires brought the issues of weather and climate to the center of public discourse for several months.

In this study we ask how such an exceptional summer influenced public beliefs concerning climate change. More specifically, this study looks deeper into belief formation dynamics under asymmetrical and consonant framing by the traditional news media – focusing particularly on the role of citizens’ trust in traditional media and usage of online alternative media. In doing so, we address one of the most fundamental media effects in the literature – the maintenance of societal beliefs through cumulative and repetitive exposure to a dominant issue frame (Morgan & Shanahan, 2010; Perse & Lambe, 2017). While theories of media effects have generated a massive amount of research, the key belief maintenance effect has received very little empirical attention (Potter, 2014; Shehata et al., 2021). As noted in a recent review of media effects, “much research has been limited to short-term manifestations of ‘effects’ that can be easily measured in laboratories or in surveys. [...] for the most part, research has not considered the effects of long-term, cumulative media exposure” (Perse & Lambe, 2017, p. 15).

This study utilizes the context of the extraordinary 2018 summer in Sweden to address these questions. Building primarily upon framing effects theory, we focus particularly on citizens’ acceptance (and resistance) of the established climate change frame that has dominated the news media and public discourse for at least two decades (Brüggemann & Engesser, 2017; Olausson, 2009; Shehata & Hopmann, 2012) and whether citizens believe in the existence, causes, and consequences of climate change. The specific combination of enduring extreme weather conditions on the one hand, and intense consonant news coverage from traditional news media on the other hand, provides a context of resonance with personal experiences that is conducive to frame and message acceptance over time (Chong & Druckman, 2007; Morgan et al., 2015).

By using a unique three-wave panel survey (2018–2019) with repeated measures before and after the exceptional summer, the study provides a longitudinal analysis of citizens’ acceptance (and resistance) of the dominant climate change frame. Apart from studying the impact of extreme weather conditions and consonant news coverage on citizens’ beliefs, our main purpose is to analyze how trust in traditional news media and usage of alternative online news influence acceptance of the dominant climate
change frame. These personal media orientations, we argue, are becoming increasingly important for understanding the conditionality of classic media effects in a rapidly changing media environment (Valkenburg & Peter, 2013).

The findings reveal strong support for belief maintenance effects over time, but also that belief changes are possible. Even in situations of intense and consonant news reporting, acceptance (and resistance) of the dominant climate change frame depends on citizens’ personal media orientations. These findings have important implications for media effects theory in a fragmented and polarized media environment where emerging pockets of frame resistance online challenge the dominant narratives in traditional media.

**Climate change and the formation of sociotropic beliefs**

Public perceptions of the existence, severity, and causes of global climate change are shaped through a complex set of factors. Previous research on climate change opinion has documented a wide range of factors influencing risk perceptions, concerns, and attitudes toward climate policy. These include news media coverage, cues from political elites and interest groups, access to scientific information, weather conditions and events, personal experiences, and a wide set of individual-level variables (Brulle et al., 2012; Capstick et al., 2015). The public opinion literature on sociotropic beliefs suggests that people’s perceptions of societal-level phenomena (collective experiences) depend on a combination of media coverage, interpersonal communication, and personal experiences (Mutz, 1998). Media coverage is particularly important whenever citizens lack alternative sources of information (McCombs, 2014). To understand how broad patterns of media coverage – and dominant news flows in particular – influence citizens’ perceptions of climate change, this study builds upon two media effect literatures.

Most importantly, framing effects theory focuses on citizens’ acceptance (and resistance) of news frames present in media coverage (Chong & Druckman, 2007; Lecheler & de Vreese, 2018). Research suggests that framing effects depend heavily on the dominant news flows provided by traditional media, where the distinction between one-sided and competitive framing environments is crucial (Chong & Druckman, 2007; Zaller, 1992). Studies on the duration of framing effects suggest that repetitive over-time exposure to specific frames increases respondents’ acceptance of the dominant frame (Lecheler & de Vreese, 2018). As such, intense news coverage, that consistently frames certain issues in specific ways, is likely to contribute to opinion stability rather than change – a crucial opinion effect seldom captured in longitudinal studies (Perse & Lambe, 2017; Potter, 2014).
Relatedly, cultivation theory focuses on the impact of cumulative and repeated exposure to a dominant media message on citizens’ perceptions of social reality. Although the relationship between television use and crime perceptions has been the major theme in cultivation research (Morgan & Shanahan, 2010; Potter, 2014), the cultivation mechanisms are widely applicable to a variety of media effects on perceptions of social reality – including genre-specific influences of the news media. With respect to sociotropic beliefs, cultivation refers to “long-term, cumulative consequences of exposure to an essentially repetitive and stable system of messages” (Morgan & Signorielli, 1990, p. 18), by which audiences gradually adjust their perceptions of society to the dominant images provided by the media.

At the same time, media effects are particularly pronounced under conditions of message resonance. The concept of resonance refers primarily to people’s everyday personal experiences with an issue; experiences congruent with media coverage “provide a double dose of messages” that strengthen effects on perceptions of social reality (Morgan et al., 2015, p. 682; see also McCombs, 2014; Mutz, 1998). Resonance can however also refer to citizens’ already held beliefs. News frames that are congruent with established beliefs and cognitive schemas are more likely to be accepted by citizens. As such, a history of long-term cumulative exposure to one-sided framing lowers the cognitive barriers for subsequent acceptance of a dominant news frame – as long as citizens lack the ability and motivation to actively reject the frame (Chong & Druckman, 2007; Zaller, 1992).

The 2018 Swedish summer provides several key ingredients for analyzing media effects under conditions of broad resonance: (1) an intense and one-sided framing environment provided by the traditional news media; (2) universal issue obtrusiveness as people directly experienced the extreme weather conditions; and (3) broad baseline acceptance of anthropogenic climate change among the public. At the same, acceptance of the dominant news frame is likely to be increasingly dependent on citizens’ personal media orientations – their trust in traditional news media and usage of alternative online news.

Climate change frame acceptance and resistance: The role of personal media orientations

Crucial to our argument is the so-called climate change frame, which has been identified as the key frame in mainstream media coverage of climate change cross-nationally (Brüggemann & Engesser, 2017; Shehata & Hopmann, 2012). This frame reflects the IPCC view on climate change and, therefore, typically serves as the starting point for most discussions on the topic. Our conception of the general function of frames in communication and public opinion formation is grounded theoretically in previous
work on issue emphasis framing (Chong & Druckman, 2007; Lecheler & de Vreese, 2018). Following Entman (1993), framing entails the selection of some aspects of reality, making “them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation” (p. 52). As noted by Brüggemann and Engesser (2017), the specific climate change frame can be summarized in four statements: (1) global warming reflects an exceptional increase in average global temperatures since the industrial revolution; (2) climate change is mainly driven by human-induced emissions of so-called greenhouse gases; (3) climate change has severe consequences for ecosystems and humanity; and (4) emissions need to be significantly reduced to avoid profound planetary consequences.

Much research on climate change communication, media coverage, and public opinion focuses on acceptance and resistance to this fundamental climate change frame (Boykoff & Boykoff, 2004; Brüggemann & Engesser, 2017; Feldman et al., 2012; Nisbet, 2009; Shehata & Hopmann, 2012). While frame acceptance refers to the adoption or internalization of the climate change frame as an accurate and valid account of reality, frame resistance (or climate skepticism) can come in different forms. Rahmstorf’s (2004) distinction between trend skepticism (denying that averages global temperatures have increased), attribution skepticism (denying human activity as a cause of climate change), and impact skepticism (denying the negative consequences of climate change) has been adopted widely in the research field and captures the core elements of climate change frame resistance (Brüggemann & Engesser, 2017; Ojala, 2015; Poortinga et al., 2019).

Given the long-term dominance of the climate change frame in traditional news media, framing effects theory predicts broad public frame acceptance manifested as belief maintenance over time. At the same time, these classic media effects are increasingly challenged by the rapidly changing media environment (Cacciatore et al., 2016; Morgan et al., 2015). With growing opportunities for media choice, content diversification and audience fragmentation, media effects become increasingly conditional upon individual-level factors (Bennett & Iyengar, 2008; Valkenburg & Peter, 2013). With respect to sociotropic belief formation in general, and climate change beliefs in particular, we believe that two components of citizens’ personal media orientations are particularly relevant: (1) trust in traditional news media and (2) usage of alternative online news. These two dimensions reflect a fundamental individual orientation toward the news media, which structures how citizens relate to, rely upon, and process news in today’s fragmented high-choice media environments.

On the one hand, media trust influences how people consume and respond to news content. Framing theory puts particular emphasis on source trust and perceived credibility as a moderator of message/frame
acceptance (Chong & Druckman, 2007; Lecheler & de Vreese, 2018). People are more willing to accept frames from traditional news media if they trust those sources. On the other hand, trust in traditional news media is also related to usage of alternative (or non-mainstream) online news sources (Strömbäck et al., 2020). The significant rise of alternative media online provides opportunities for citizens to access content that explicitly challenge news frames from traditional media (Holt et al., 2019). Accordingly, these sites have become forums for climate skeptics to challenge the climate change frame (Feldman et al., 2014) – and research shows that social media function as forums for counter-arguments, climate skepticism, and denial in Sweden, in opposition to the frames in traditional news media (Roloff, 2020).

Taken together, we suggest that trust in traditional news media and usage of alternative online news reflect a fundamental individual-level orientation which structures how citizens relate to news coverage from traditional media. These orientations will likely influence acceptance (and resistance) of the dominant climate change frame promoted by traditional media.

**The case and hypotheses**

To start with, there are strong reasons to expect broad climate change frame acceptance during the exceptional 2018 Swedish summer. Apart from the dominant news flows provided by traditional media, two resonance-related arguments point in this direction.

On the one hand, the baseline for frame acceptance among the public was at a high level already before summer. Numerous cross-national and domestic studies clearly indicate broad acceptance of the climate change frame among Swedish citizens – even though agreement on the importance of climate change as a problem varies over time and across groups (Capstick et al., 2015; Naturvårdsverket, 2018). An overwhelming majority of people had already accepted anthropogenic climate change as a fact. On the other hand, research on extreme weather events indicates that changes in objective conditions can have an impact on climate change beliefs and concern (Deryugina, 2013; Donner & McDaniels, 2013; Hamilton & Stampone, 2013). As summarized in a recent research review, “results, taken together, suggest that long-term temperature anomalies have a robust effect on public perceptions of climate change” (Capstick et al., 2015, p. 50).

In addition, major theories of media effects emphasize particularly strong influences in the presence of one-sided or homogenous information environments (Chong & Druckman, 2007; Peter, 2004). Following Noelle-Neumann (1973), times of media message *consonance, ubiquity,* and *cumulation* are particularly likely to generate powerful effects on public opinion
(Arlt & Wolling, 2016; Shaw, 1979). Although climate change has been on the political, media, and public agenda in Sweden for many years, the exceptional summer pushed media coverage to a new level. Figure 1 illustrates the volume of climate change coverage in six major Swedish newspapers over four years: Aftonbladet, Dagens Industri, Dagens Nyheter, Expressen, Göteborgs-Posten, and Sydsvenskan.

A few things are worth noting from this figure. First, media coverage of climate change increased significantly during summer, following the exceptional heat, drought, and wildfires. Even though the intensity of reporting went down as weather conditioned returned to normal in the second part of August, the volume of media coverage remained high throughout the year and intensified even further during 2019. Second, continued media attention coincided with the rise of climate activist Greta Thunberg and the Fridays for Future movement in the fall of 2018. Protest activities served as a major force of youth expression throughout 2019, contributing to putting the issue of climate change high on the agenda. The 2019 May elections to the European parliament focused extensively on these issues in Sweden. Third, the correlation between the volume of coverage in the different news outlets is strong (average inter-

Figure 1. News coverage of climate change in Swedish media (2016–2019). Number of articles on climate change in six established news media outlets. Lines represent conditional means over time, smoothed by local polynomial regression fitting (LOESS) optimized by minimal sum of squared errors using simulated annealing method (SANN). The combined total visualized as a solid line with confidence intervals (0.05).
item correlation = 0.78), suggesting homogeneity in how the mainstream media covered climate change.

At the frame level, previous research has documented broad acceptance of the climate change frame promoted by the IPCC in Swedish news media, with no space for climate skepticism or fundamental counter-frames (Djerf-Pierre & Olausson, 2019; Shehata & Hopmann, 2012). As summarized by Olausson (2009) “an unquestioned and taken-for-granted frame of certainty is prevalent in relation to the climate issue in the Swedish press” leaving “no room for scientific uncertainties or conflicts about the existence, extent, and current effects of climate change” (p. 430). This almost complete absence of climate skepticism and denial was reflected also in Swedish press coverage of global warming during 2018 and 2019, corresponding to the time frame of the current study (Lindahl & Hansson, 2019).

In sum, Swedish citizens were confronted not only with an extreme weather situation in the summer of 2018, but an intensified and consensual framing environment provided by the traditional news media as well, lasting well beyond the extraordinary heat wave. Thus, people were nested within a saturated information environment characterized by consonance, ubiquity, and cumulation – precisely the conditions typically assumed to generate broad and powerful effects on public opinion in general (Peter, 2004; Shaw, 1979), and media effects on sociotropic beliefs in particular (Morgan et al., 2015; Perse & Lambe, 2017). With broad baseline frame acceptance in Sweden, we should expect these conditions to promote high levels of belief stability over time. Citizens who already believe in anthropogenic climate change will hold on to these beliefs. The extent to which this is the case is however unknown. We therefore address two open research questions:

RQ1: What is the level of climate change frame acceptance and resistance among Swedish citizens?

RQ2: How stable are aggregate and individual level climate change beliefs over time?

These overall opinion dynamics may however hide important individual-level differences related to personal orientations toward news media (Metzger & Flanagan, 2002; Rubin, 1993). Following our conceptualization of Swedish climate change news coverage as a broad and consonant information environmental factor that penetrate every corner of society, individual differences in traditional news exposure are unlikely to adequately capture variations in message reception. Rather, acceptance of the dominant climate change frame provided by the traditional news media is expected to depend on citizens’ trust in traditional news media as well as their orientation toward alternative online news. More specifically, we
expect citizens’ general media orientations to influence climate change frame acceptance as well as resistance in two distinct ways.

First, these media orientations are hypothesized to explain a significant portion of belief stability (i.e., non-change). Both cultivation and framing effects theory hold that the main impact of repeated and cumulative exposure to a dominant frame is to confirm congruent beliefs already held by citizens (Perse & Lambe, 2017; Potter, 2014). Thus, the consonant framing environment provided by the traditional news media is expected to confirm climate change acceptance among people – as long as they do not distrust these media outlets or actively seek alternative news sources (maintenance effects).

H1: Citizens with higher trust in traditional news media are significantly more likely to maintain an acceptance position on climate change beliefs over time.

H2: Citizens with higher use of alternative online news are significantly less likely to maintain an acceptance position on climate change beliefs over time.

Second, whenever there is room for actual belief change, these media orientations will have opposite effects on climate change frame acceptance/resistance (change effects). In this way, individual-level changes in media orientations should strengthen/weaken beliefs over time.

H3: Individual-level increases in trust toward traditional news media will significantly increase acceptance of the climate change frame over time.

H4: Individual-level increases in usage of alternative online news will significantly decrease acceptance of the climate change frame over time.

Data and measures

To address our hypotheses, this study relies on a unique three-wave panel survey conducted in Sweden before and after the extreme Swedish summer. The survey was conducted in collaboration with the Laboratory of Opinion Research at the University of Gothenburg (LORE), using a probability-based sample of web survey participants.1 Importantly, LORE’s sampling procedure is not based on self-selected recruitment, but on probability sampling during the initial recruitment phase.

1This study was subject of an ethical application and was deemed exempt from full review by the Regional Ethics Board, Göteborg. The reviewing body gave an advisory statement declaring no objections to the study (Dnr. 2017/1005-17).
A sample of 3,397 respondents, stratified on gender, age, education, and political interest, was drawn from a pool of probability-recruited participants.²

As illustrated in Figure 1 above, Wave 1 was fielded in late March 2018 (March 22-April 16), wave 2 in December 2018 (December 10-January 8) and wave 3 in early October 2019 (October 7-October 28). In terms of timing, the waves capture Swedish citizens’ climate change beliefs a couple of months prior to the heatwave (wave 1), a few months after the summer (wave 2) as well as approximately one year later. 2,291 respondents participated in wave 1 (AAPOR RR5: 67%), 1,880 in wave 2 (59%) and 1,819 in wave 3 (63%). A total of 1,508 respondents participated in all three waves. The final sample is broadly representative of the Swedish population in terms of gender (51% female), age (17% 30 years old or younger, 15% 30–39, 10% 40–49, 17% 50–59, 23% 60–69, and 18% 70 or older), education (5% elementary school, 36% high school, 17% post-secondary education, 18% university shorter than 3 years, and 25% university at least 3 years). For most of our analyses, we make use of respondents who participated in all three waves of the panel survey.

**Measuring key variables**

The key concepts measured in the study – climate change beliefs as well as two distinct forms of personal media orientations – were operationalized using multiple survey items identical across the three waves.

**Climate change beliefs**

Following previous research on climate beliefs and skepticism, we measured respondents’ perceptions of the nature and causes of climate change using two batteries of factual agree-disagree statements. The specific items were constructed as part of the project, but heavily inspired by previous operationalizations of climate change beliefs and skepticism (Brüggemann & Engesser, 2017; Ojala, 2015; Rahmstorf, 2004). In total, nine items were used, focusing on descriptive (four statements) and casual (five statements) beliefs, following from the overall question: “Different claims are sometimes heard in public discourse on climate change. To what extent do you agree with the following statements?”

²The sample was stratified based on official census data from Statistics Sweden (Statistiska centralbyran) with respect to socio-demographic variables. Data on political interest come from the annual large-scale cross-sectional SOM survey conducted in Sweden, which provide the most representative estimate of political interest in Sweden.
Four items covered descriptive beliefs: (1) Global average temperatures have increased in the past 100 years, (2) Scientists disagree on whether climate change is taking place, (3) Droughts, heavy storms, and floods become worse due to climate change, and (4) Sweden won’t be affected by climate change the next decades. Five items tapped causal beliefs: (5) Emissions of so-called greenhouse gases cause climate change, (6) Changes in earth climate are primarily due to natural variations that humans cannot influence, (7) Increased flight traffic contributes to climate change, (8) Meat production contributes to climate change, and (9) Variations in sun activity is the primary cause of climate change.

Responses to each of the nine statements were registered on a five-point scale ranging from 1 (Not true at all) to 5 (Completely true), along with a separate “Don’t know” option. Although these items were analyzed separately, findings from a principal component analysis (PCA) revealed a clear uni-dimensional structure. Therefore, an index tapping climate change frame acceptance/resistance based on all nine items was also created (Wave 1 $M = 0.74, SD = 0.17$, Cronbach’s $\alpha = 0.84$; $W2 M = 0.75, SD = 0.18$, $\alpha = 0.88$; $W3 M = 0.72, SD = 0.19$, $\alpha = 0.89$).

**News media orientations**

Two forms of individual orientations were measured.

First, trust in traditional news media was captured using a four-item battery based on the survey question: “There are different views in society on news coverage in Swedish media. To what extent do you agree with the following statements? The traditional news media in Sweden …” [Italics in original]. The specific statements included: (1) Don’t tell the truth about important societal issues, (2) Let all important voices be heard in the discussion, (3) Provide a one-sided perspective on important issues, and (4) Provide the best and most reliable information about politics and society. Response scales ranged from 1 (Completely disagree) to 5 (Completely agree). In line with recent conceptualizations and operationalizations, these items were designed to measure generalized trust in news media, focusing on the information coming from these sources (Strömbäck et al., 2020). Based on a PCA, these items were added to an index of trust in traditional news media ($W1 M = 0.53, SD = 0.24$, $\alpha = 0.83$; $W2 M = 0.57, SD = 0.26$, $\alpha = 0.85$; $W3 M = 0.56, SD = 0.26$, $\alpha = 0.86$).

Second, we measured respondents’ usage of alternative news media based on a set of items covering their general inclination to actively seek online news providing alternative perspectives. Two items asking “How often do you use online news websites or social media to follow …” (1) News about societal issues not reported by the traditional media, and (2) News that provide an alternative view on societal issues than traditional media [Italics in original]. These two items were combined with five
additional items on issue-specific alternative media usage: “How often do you use online news websites or social media to follow news that provide an alternative view than the traditional media on the following topics?” [Italics in original]. The items that followed were (3) News about crime, (4) News about the climate and environment, (5) News about medicine and health, (6) News about integration and immigration, and (7) News about the Swedish economy. Response categories on these seven items ranged from 1 (Daily) to 6 (Never). These items were developed as part of the project in order to capture a general orientation toward alternative online media. Following a PCA, these items were added into an overall usage of alternative media index (W1 \( M = 0.34, \ SD = 0.24, \ \alpha = 0.91; \) W2 \( M = 0.34, \ SD = 0.24, \ \alpha = 0.92; \) W3 \( M = 0.34, \ SD = 0.25, \ \alpha = 0.92).\)

Taken together, we conceptualize trust in the traditional news media and usage of alternative media as general orientations that structure and guide citizens’ relationship to traditional news media. As such, it is worth noting that these orientations are strongly negatively correlated (\( r = −0.42, \) \( r = −0.42, \) and \( r = −0.44 \) across the three waves), suggesting that citizens who trust traditional news media are much less likely to seek alternative news, and vice versa.

**Control variables and modeling strategy**

Following the general theories of sociotropic belief formation, several control variables are included in the analyses. Issue-specific interpersonal communication is included to rule out people’s everyday talk about climate change with friends and family as a driver of belief formation. Furthermore, political interest and general trust in politicians are accounted for – as well as a range of socio-demographics such as gender, age and education. Political interest and trust in politicians are included in order to isolate the potentially confounding influence of these factors from the effects of personal media orientations on climate change beliefs (Ojala, 2015; Poortinga et al., 2019; Weber, 2010).

Analytically, the panel structure allows for several powerful modeling strategies. For the descriptive analyses speaking to aggregate and individual belief stability, a combination of aggregate trend analyses, turnover tables, and individual stability coefficients are used. On the item level we used the Wiley-Wiley procedure to estimate measurement error-corrected stability coefficients (Ringlerova, 2019; Wiley & Wiley, 1970). To estimate the effect of media orientations on climate beliefs, we rely both on autoregressive panel models with lagged dependent variables as well as two-way fixed effects panel models focusing on pure within-person variation over time (Allison, 2009). These panel models automatically control for all stable unmeasured between-person differences and thereby provide a strong test of the effects of media orientations on changes in climate change beliefs
over time. As these panel models are estimated using additive indexes of climate change beliefs, we employ specifications for continuous dependent variables.

**Results**

On a descriptive level, our data clearly support findings from previous studies on Swedish climate change opinion. The climate change frame is broadly accepted among Swedish citizens (Figure 2). Across the nine belief items, an overwhelming majority agrees with a position in line with the climate change frame in seven cases. For instance, 86% agree with the statement that *average global temperatures have increased in the past 100 years* (wave 1), while 62% disagrees with the statement that *climate change is mainly due to natural variations* (wave 1). The only two items where such clear majority positions are not evident are *scientists disagree on whether climate change is taking place* (44% disagree, wave 1) and *variation in sun activity is the most important cause of climate change* (45% disagree, wave 1).

**Figure 2.** Nine climate change beliefs across three panel waves (%).

Bars represent the share of respondents taking a *Disagree* (1–2), *Neutral* (3) and *Agree* (4–5) position toward each statement across the three panel waves. The *Don’t know* (6) option is coded as neutral. Estimates are based on all respondents available at each panel wave. Findings are very similar when only respondents participating in all waves are included. Stars (**) indicate statistically significant (95% confidence level) changes compared to the previous panel wave, based on logit models.
Furthermore, Figure 2 points to a substantive degree of aggregate-level belief stability. Most between-wave changes are within one or a few percentage points. The largest aggregate-level change relates to the belief that *Sweden won’t be affected by climate change*. While 73% disagreed with this statement in the first panel wave, 81% did so in the second wave. This “summer effect” regressed to baseline in the third wave however (74%). Although aggregate fluctuations are substantively small overall, several wave-to-wave changes are still statistically significant, as highlighted by the stars in Figure 2. Interestingly, several of these changes represent higher skepticism in the third wave of the panel.

Table 1 provides a deeper look into belief stability by moving from the aggregate to the individual level. Data on three forms of belief stability are presented. First, the columns representing absolute stability show the percentage of respondents who remain on exactly the same scale position between two waves – irrespective of which position they take. The average absolute stability across the nine items amounts to 57% between both time periods. The highest stability is found for *temperatures have increased* (70%), while *scientists disagree on climate change* yields the lowest absolute stability (44%). Second, numbers in the column for acceptance stability, represent the percentage of respondents who remain climate change believers between panel waves. Here the averages are 57% between the first two waves and 58% between the last two waves, with a between-item range of 32–82%.

The final columns display stability coefficients adjusted for measurement error. This Wiley-Wiley procedure is based on structural equation models with each concept specified as a latent variable. Values close to one 1 reflect

### Table 1. Three forms of belief stability (percentages and stability coefficients).

| Survey item                                                                 | Absolute stability | Acceptance stability | Wiley-Wiley stability |
|----------------------------------------------------------------------------|--------------------|----------------------|-----------------------|
| Temperatures have increased in the past 100 years                        | W1-W2: 69%        | W1-W2: 82%           | W1-W2: 0.90***        |
|                                                                           | W2-W3: 70%        | W2-W3: 81%           | W2-W3: 0.89***        |
| Scientists disagree on climate change                                   | W1-W2: 44%        | W1-W2: 32%           | W1-W2: 0.89***        |
|                                                                           | W2-W3: 47%        | W2-W3: 36%           | W2-W3: 0.90***        |
| Droughts, floods and storms become worse                                 | W1-W2: 64%        | W1-W2: 76%           | W1-W2: 0.92***        |
|                                                                           | W2-W3: 66%        | W2-W3: 76%           | W2-W3: 0.95***        |
| Sweden won’t be affected by climate change                              | W1-W2: 57%        | W1-W2: 66%           | W1-W2: 0.83***        |
|                                                                           | W2-W3: 57%        | W2-W3: 66%           | W2-W3: 0.86***        |
| Emissions of greenhouse gases cause climate change                       | W1-W2: 61%        | W1-W2: 73%           | W1-W2: 0.90***        |
|                                                                           | W2-W3: 61%        | W2-W3: 72%           | W2-W3: 0.93***        |
| Climate change mainly due to natural variations                          | W1-W2: 51%        | W1-W2: 51%           | W1-W2: 0.89***        |
|                                                                           | W2-W3: 52%        | W2-W3: 50%           | W2-W3: 0.90***        |
| Increased flight traffic contributes to climate change                   | W1-W2: 57%        | W1-W2: 64%           | W1-W2: 0.87***        |
|                                                                           | W2-W3: 52%        | W2-W3: 57%           | W2-W3: 0.84***        |
| Meat production contributes to climate change                            | W1-W2: 55%        | W1-W2: 48%           | W1-W2: 0.93***        |
|                                                                           | W2-W3: 54%        | W2-W3: 45%           | W2-W3: 0.93***        |
| Variation in sun activity most important cause                           | W1-W2: 56%        | W1-W2: 33%           | W1-W2: 0.92***        |
|                                                                           | W2-W3: 57%        | W2-W3: 34%           | W2-W3: 0.89***        |

Cells entries are percentages and Wiley-Wiley stability coefficients.

*p < .05, **p < .01, ***p < .001.
high between-person – rank-order – stability over time. As such, external events or developments that push all respondents in a similar direction will change the mean value on the belief scale, but not the rank-order stability (each individual’s position in relation to other individuals). As can be seen, when measurement error is accounted for, all items display a high degree of stability: the average stability coefficients being 0.89 between the first two waves, and 0.90 in the last two waves – and all these stability coefficients are highly statistically significant. Importantly, also those items that appeared more volatile based on absolute stability, show much higher rank-order stability once measurement error is accounted for.

Taken together, these descriptive findings clearly suggest that acceptance of the climate change frame is the most common belief position in Sweden, prior to as well as after the summer (RQ1), and that belief dynamics are characterized by substantial aggregate and individual-level belief stability (RQ2).

**Effects of media trust and alternative media usage on belief maintenance**

Turning to the role of media orientations, Figure 3 presents findings from nine logit models predicting climate change belief stability at the individual level. More specifically, the dependent variable reflects whether a respondent maintains a position of climate change acceptance across the three panel waves (=1) or not (=0). For instance, the first graph in the figure illustrates how trust in traditional news media and alternative news media usage influence whether respondents’ agree with the statement that *average global temperatures have increased in the past 100 years*, in all three waves of the panel (i.e. maintaining an “acceptance” position on the scale throughout the entire period). The regressions control for several background variables, including gender, age, education, political trust, interest, and interpersonal climate change discussions.

Figure 3 reveals a pattern of clear and consistent effects of individual media orientations on belief maintenance across the nine belief items. While trust in traditional news media has a strong positive impact on belief maintenance, usage of alternative media has an opposite effect. For instance, moving from the minimum to the maximum value on the media trust scale, increases the probability of maintaining the belief that *emissions of greenhouse gases contribute to climate change* from 0.25 to 0.90, while the corresponding effect is negative but much weaker for alternative media usage. Taken together, however, the pattern in Figure 3 is very consistent. See Figure A1 in the Appendix for an alternative operationalization of belief maintenance across the nine belief items, focusing exclusively
on the subsample of respondents with a baseline (wave 1) climate change frame acceptance position. These results are very similar.

Model 1 in Table 2 presents findings from a global test of belief maintenance, using an additive index of belief stability across the nine items. The dependent variable ranges from 0–9, where 9 represents complete maintenance of frame acceptance across the nine specific items over three panel waves, while 0 represent complete absence of such maintenance.

As expected, the findings closely mirror the estimates obtained for each separate belief item above: trust in traditional news media has a positive effect while alternative media usage has a negative effect. A few things are particularly worth noting here. First, traditional media trust belongs to the strongest predictors of belief maintenance. Thus, the effect of moving from very low to very high trust ($b = 3.30, p < .001$) is even larger than moving from never talking about climate change to talking about climate change daily ($b = 2.62, p < .001$). Second, media trust also trumps other key variables such as political interest ($b = 0.96, p = .001$) and political trust ($b = 0.94, p = .002$). This suggests

![Figure 3](image-url)
that there is something very specific about trust in traditional media here, that is not captured by purely political variables – including general trust in politicians. Third, the two media orientation variables make a significant contribution to explaining belief maintenance. These two variables alone explain ten percent of the variation in belief maintenance – beyond what is already accounted for by all the other variables in the model.3

In sum, these findings clearly suggest that trust in traditional news media has a positive effect on climate change frame acceptance, while usage of alternative news media has a negative effect, manifested as belief maintenance.

### Effects of media trust and alternative media usage on belief change

As a final step we turn to influences on belief changes. Although both aggregate and individual belief stability dominated opinion dynamics during and after the extreme summer, belief changes took place as well. Overall, movements were in line with the dominant framing environment set by traditional news media, signaling further reinforcement of climate change frame acceptance among the public – although there was also evidence of growing frame resistance over time on some of the items, particularly in the third panel wave. These main trends may however hide how media orientations influence changes in frame acceptance and resistance on the individual level.

3Including the two media orientation variables increases explained variance from $R^2_{adj} = 0.22$ to $R^2_{adj} = 0.32$. 

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**Table 2.** Effects of media orientations on climate change beliefs (unstandardized coefficients).

|                      | Model 1     | Model 2     | Model 3     |
|----------------------|-------------|-------------|-------------|
|                      | Belief maintenance | Belief change (LDV) | Belief change (FE) |
| Media orientations   |             |             |             |
| Trust in traditional media | 3.30*** (0.31) | 0.08*** (0.01) | 0.04*** (0.01) |
| Alternative media usage | −1.78*** (0.29) | −0.03*** (0.01) | −0.03* (0.01) |
| Control variables    |             |             |             |
| Interpersonal climate talk | 2.62*** (0.30) | 0.01 (0.01) | 0.03* (0.01) |
| Political interest   | 0.96*** (0.30) | 0.02* (0.01) |             |
| Political trust      | 0.94*** (0.31) | 0.03** (0.01) |             |
| Gender (ref. Female) | 0.22 (0.13) | −0.01* (0.00) |             |
| Age                  | −0.04*** (0.00) | −0.01*** (0.00) |             |
| Education            | 0.33*** (0.05) | 0.00** (0.01) |             |
| Lagged dependent variable |            | 0.79*** (0.01) |             |
| Wave 2               |             |             | 0.01*** (0.00) |
| Wave 3               |             |             | −0.02*** (0.00) |
| $R^2/R^2$ Within     | 0.32        | 0.71        | 0.04        |
| N                    | 1,381       | 1,466       | 2,413       |

Notes: Estimates are unstandardized regression coefficients. Robust standard errors used in the LDV and FE models.  
* p < .05, ** p < .01, *** p < .001
Table 2 presents findings from two different panel regression models speaking to this question: an autoregressive model with lagged dependent variable (LDV) and a two-way fixed effects (FE) panel model. To enable a fine-grained analyses of belief changes, the dependent variable is an additive continuous index based on the original 5-point scales of all nine belief items, with high values reflecting stronger frame acceptance, and low values frame resistance. Model 2 in Table 2 displays effects from the autoregressive model. By including the lagged dependent variable (beliefs), these models estimate how the independent variables are related to (rank-order) changes in beliefs over time. The independent variables are lagged from the previous panel wave. Again, trust in traditional news media has clear effects on belief changes in the expected direction \((b = 0.08, p < .001)\), while usage of alternative news media has opposite effects \((b = -0.03, p < .001)\).

Finally, the two-way fixed effects model provides an alternative specification based on within-person variation only – thereby serving as an additional robustness check. Importantly, the fixed effects model accounts for all stable unobserved heterogeneity between units and, thereby, controls for omitted variables by using “each individual as his or her own control” (Allison, 2009, p. 1). As such, only time-variant variables are included here. The findings lend additional support to the differential effects of trust in traditional news media \((b = 0.04, p = .002)\) and alternative media usage on climate change beliefs \((b = -0.03, p = .013)\), while controlling for the within-person effect of interpersonal communication \((b = 0.03, p = .012)\). Thus, both the LDV and FE models show that respondents move in expected directions based on their personal media orientations.\(^4\) In addition, the two wave dummies of the fixed effects model confirm some of the descriptive patterns above – there is a general statistically significant increase in frame acceptance between wave 1 and wave 2 \((b = 0.01, p < .001)\), but a decrease in acceptance between wave 1 and wave 3 \((b = -0.02, p < .001)\). Thus, frame resistance is actually higher in wave 3 than before the 2018 summer.

**Conclusion and discussion**

The exceptional summer that affected Sweden in 2018 – with an extended heatwave, drought, and wildfires – changed public discourse on climate change in important ways. Not only was the topic brought to the center of public attention the following years, but the unfolding events also brought

\(^4\)Several alternative model specifications were tested to assess the sensitivity of the findings from all three models presented in Table 2. These include adding total traditional news media usage, concern for being personally affected by climate change (as a proxy for personal experience) as well as usage of factors scores obtained from the PCA of media orientations and climate change beliefs. The main findings were consistent across these different specifications.
climate change to Sweden. At least according to the dominant frame provided by the traditional news media. This study analyzed how these developments influenced citizens’ perceptions of climate change, building primarily upon framing effects theory.

More specifically, the study focused on climate change frame acceptance and resistance in a saturated and one-sided framing environment – with broad baseline public acceptance built up cumulatively over the past two decades. From a public opinion and media effects perspective, these conditions of message consonance, ubiquity, and cumulation (Arlt & Wolling, 2016; Noelle-Neumann, 1973; Peter, 2004) coupled with broad message resonance stemming from personal experiences of objective weather conditions, should provide a fertile ground for broad frame acceptance over time (Chong & Druckman, 2007; Morgan et al., 2015). At the same time, such opinion dynamics are most likely to materialize as belief stability and maintenance, rather than change – media effects widely recognized in the field, but seldom addressed empirically (Perse & Lambe, 2017; Potter, 2014; Shehata et al., 2021).

Overall, the findings provide important insights concerning mechanisms behind belief maintenance and change in a saturated but also fragmented media environment. First, results revealed broad acceptance of the climate change frame among Swedish citizens (RQ1), as well as significant levels of both aggregate and individual belief stability over time (RQ2). Second, individual news media orientations matter for belief stability and change. While trust in traditional news media contributed to climate change frame acceptance, both as a belief maintenance (H1) and as a belief change (H3) effect, usage of alternative news media was related to frame resistance (H2 and H4). Put differently, the evidence suggests that these two individual media orientations condition public acceptance and resistance of the dominant frame provided by traditional news media. These findings have several important implications.

First, this study addressed a type of media effect seldom captured longitudinally: the maintenance of beliefs over time in one-sided framing environments provided by the traditional news media (Arlt & Wolling, 2016; Chong & Druckman, 2007; Peter, 2004). More specifically, personal news media orientations contributed significantly to the maintenance of climate change frame acceptance at the individual level, explaining approximately ten percent of the variation in belief maintenance – above and beyond a range of socio-demographic and political factors. This is substantively very important. The maintenance and reinforcement of beliefs among citizens has long been considered as the most important type of media effect (Morgan & Shanahan, 2010; Shehata et al., 2021; Slater, 2007). Few studies have empirically documented such influences longitudinally however (Perse & Lambe, 2017; Potter, 2014). These findings clearly highlight the importance of intense and dominant news flows as a source of opinion
and belief stability among the public – and thereby lend support to an effect process of great significance to media effects theory (Chong & Druckman, 2007; Potter, 2014).

Second, despite the omnipresence of the climate change frame in traditional media, as well as substantive levels of belief stability over time, frame resistance was clearly related to citizens’ personal media orientations. These findings suggest that personal media orientations may be a particularly fruitful concept for understanding frame acceptance and resistance in contemporary fragmented media environments. Conceptualized precisely as general personal orientations toward the news media, rather than exposure to specific outlets, such orientations capture how citizens relate to, rely upon, and process dominant news flows provided by the traditional media. Given the multiplicity of content providers available today, people’s general tendencies toward the mainstream and “established,” on the one hand, and the “alternative,” on the other hand, constitute a key dimension of how citizens cope with the information abundance of high-choice media environments (Hanitzsch et al., 2018; Holt et al., 2019).

Accordingly, the viability of classic theories of media effects in contemporary high-choice environments, including framing but also cultivation (Cacciatore et al., 2016; Morgan et al., 2015), has been extensively discussed (Bennett & Iyengar, 2008; Holbert et al., 2010). Our findings suggest that such influences remain far from irrelevant – at least under specific circumstances. On the one hand, we witness broad public belief patterns in line with the dominant news flows from traditional media. Whenever there is a strong uncontested frame distributed broadly across major news outlets, citizens tend to accept it. Thus, increasing media fragmentation does not necessarily mean that all frames become highly contested. Certain frames (or narratives) maintain a dominant position even in high-choice media environments (Morgan et al., 2015). On the other hand, classic media effects are still likely to become increasingly conditional even when there is a dominant frame (Slater, 2007; Valkenburg & Peter, 2013). This study has emphasized two such conditional factors: trust in traditional news media and usage of alternative online news. Thus, how classic media effects play out at the aggregate and individual level depend on the specific opportunity structures for selective exposure that characterize media environments – and these vary across countries, between issues and over time (Djerf-Pierre & Shehata, 2017; Holbert et al., 2010).

Third, the study also provides insights into the effects of exceptional weather conditions on climate change beliefs (Deryugina, 2013; Donner & McDaniels, 2013; Hamilton & Stampone, 2013). Previous research shows that lasting deviations in temperatures have discernable effects on climate change perceptions (Capstick et al., 2015), and these findings are echoed here. From a media effects perspective, the extreme weather conditions
served as a context of *resonance* (Morgan et al., 2015; Shrum & Bischak, 2001), increasing the likelihood that citizens accept the dominant climate change frame provided by the traditional news media. In addition to offering a context of resonance, however, this extraordinary heatwave also raised the *salience* of climate change as an issue on the media agenda and in public discourse significantly. Paradoxically, while resonance most likely pushed public beliefs toward acceptance of the climate change frame – contributing to belief stability – the extended salience that followed from the summer might eventually have had an opposite effect on public opinion, stimulating counter-framing, resistance, and polarization among specific groups of citizens. Several of the specific belief items displayed small but significant aggregate changes toward frame resistance in the third wave, more than one year after the heatwave, which was captured by the overall climate belief index as well. Thus, after temperatures had returned to normal and the immediate context of resonance disappeared, the continued high level of salience in the media may well have triggered issue fatigue and resistance in some groups.

However, disentangling the precise influence real-world conditions, resonance, and salience is beyond the scope of this study. Despite the use of longitudinal panel data to document belief dynamics over time, questions concerning causality cannot be finally resolved with our analysis. The extent to which the belief dynamics uncovered here reflect influences of news coverage, personal experiences, and/or prior beliefs cannot be conclusively determined. The intense and one-sided news framing environment coincided with an extraordinary heat wave in a country where climate change acceptance among the public has been the norm for a long time. Even though it is not possible to isolate the effect of each factor in this study, media coverage is likely to play a key role here. More precisely, whether citizens perceive extreme weather events as driven by climate change is most likely a long-term media effect as such. By establishing the climate change frame as a psychological *connection mechanism* linking personal experiences to abstract and unobtrusive processes, media coverage serves as a necessary condition for the belief dynamics captured in this study (Mutz, 1998; Weber, 2010).

Relating to caveats regarding causality, a few other limitations of the study are worth highlighting. Given the intensity and ubiquity of climate change news coverage during this period, media coverage was treated as a broad information environmental factor – more or less reaching every segment of society. Thus, in these instances of message consonance, ubiquity, and cumulation (Arlt & Wolling, 2016; Peter, 2004) it is generally difficult to identify media effects based on individual differences in news exposure to specific media outlets (Druckman, 2005). Instead, universal news frame *reception* among citizens was assumed, while differences in frame *acceptence* depends on certain individual-level factors (Chong & Druckman, 2007; Zaller, 1992). Similarly, the study
did not measure individual differences in personal experiences of the extreme summer heat. Rather, we assumed broad universal resonance from the mere fact that temperatures were widely experienced by Swedish citizens under these extraordinary circumstances. Although talking about climate change with friends and family (which was accounted for in the analyses) may capture some of these individual-level differences, a direct measure of personal experience would allow for more distinct tests of resonance effects.

A final issue relates to the lack of content data from alternative news sources. While the climate change frame has dominated traditional news media in Sweden for decades, we know less about various alternative news sources in this regard. Even though a general orientation toward alternative news has clear frame resistance effects, exactly what content users are exposed to remains unclear. As such, in line with our general conceptualization of news media orientations, these resistance effects may either reflect certain content characteristics of these websites or specific selective exposure mechanisms – as well as various combinations of these factors.

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Appendix

Figure A1. The effects of media trust and alternative media usage on belief stability among respondents with baseline (wave 1) acceptance position (predicted probabilities).

Replication of regression models presented in Figure 3, using subsample of respondents with baseline (wave 1) climate change frame acceptance position.