Climate Autobiography Timeline: Adapting Timeline Research Methods to the Study of Climate Perceptions

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(Manuscript received 6 October 2021, in final form 30 March 2022)

ABSTRACT: Climate perception is a growing area of study in the social sciences and one that has implications on the tools and strategies we use to communicate climate change risk information. However, the range of climate perception studies remains limited, focused primarily on perceptions of day-to-day weather, sudden-onset severe events, or long-term permanent change. Phenomena situated between these extremes (e.g., annual- to decadal-scale variability) are largely missing from social science of climate research. Whether this is due to limited perception by research participants, is due to limited research attention, or is a reflection of the methods commonly applied to human dimensions of climate research, this gap precludes analysis of the full range of complex climate experiences and their influence on climate perception and understanding. In this paper, we offer a proof of concept for the climate autobiography timeline (CAT), a visual timeline tool developed to assess climate perception while prompting an ordered consideration of time, with the goal of eliciting insights into complex and long-term climate experiences such as low-frequency climate variability. Results are based off a preliminary application of the CAT across focus groups conducted in Newfoundland and Labrador, a province of Canada that is subject to low-frequency climate variability and frequent high-impact weather. Results reveal three key findings: 1) weather and climate narratives are commonly anchored to two time periods, potentially obscuring perceptions of variability; 2) narratives focus on socially important weather and climate phenomena; and 3) the social and visual coconstruction of weather and climate narratives may yield more holistic representations of local climate knowledge.

SIGNIFICANCE STATEMENT: The purpose of this work is to highlight the utility of timeline research methods to the study of climate perception research. Specifically, the climate autobiography timeline (CAT) serves as a tool that can address limitations of research tools commonly applied to the study of climate perceptions, notably the inability for current methods to elicit and organize complex climate experiences. Failure to capture these experiences may prevent a holistic and socially grounded understanding of climate perceptions. Drawing from a preliminary application of CATs in the province of Newfoundland and Labrador in Canada, we highlight how the tool can provide information complementary to, but distinct from, data collected through more commonly used methods such as interviews or surveys. This approach holds promise for analyses of long-term climate history, impacts of historical severe events, and cultural impact of weather and climate.

KEYWORDS: Social Science; North America; Climate change; Climate variability; Communications/decision-making; History; Societal impacts

1. Introduction

Climate change research is currently benefiting from increased attention in the social sciences. Analyses of climate change perception (Hamilton et al. 2016; Asplund 2016; Leiserowitz 2006; Henry 2000; Dunlap 1998) and attitudes (Konisky et al. 2016; Roser-Renouf et al. 2014; Donner and McDaniels 2013; McCright and Dunlap 2011; Zahran et al. 2013) give insight into ways people synthesize climate science and their own observations into broader understandings of their environment and climate risks (Cunsolo and Ellis 2018; Wright 2014; Krauss and von Storch 2012; Wolf et al. 2009). However, climate-related social science research often adopts a reductive view of atmospheric phenomena, focusing on a limited range of the larger continuum of events acting on small spatial and short temporal scales (“weather”) through to global and (effectively) permanent change (Finnis et al. 2015). Specifically, analyses of the human dimensions of climate typically focus on permanent change (e.g., Hamilton et al. 2018) and, occasionally, the influence of the immediate past, such as the previous few days (Li et al. 2011; Egan and Mullin 2012; Hamilton and Stampone 2013) or recent seasons (Donner and McDaniels 2013). Treatment of slow-changing and transient, but regionally important, phenomena operating over years or decades (hereinafter low-frequency variability, or simply variability) receive considerably less attention in the
social sciences, despite a long history of detailed research in the natural sciences (e.g., Barnston et al. 2005; Hasselmann 1997).

This implicitly limits the scope of climate perception analyses in the social sciences, precluding full engagement with the broader complexities of climate science while restricting transdisciplinary efforts to integrate climate science with social science analyses of climate attitudes, action, and support for policy solutions. Addressing this knowledge gap requires detailed analysis of climate recall, narratives, and sense making that allows for reflection and organization of memories spanning decades of personal experience. However, research tools commonly applied in social dimensions of climate research are not fully suited to this task. Here, we expand the tool kit for understanding climate perceptions by proposing a novel research tool specifically designed for this purpose [the climate autobiography timeline (CAT)] and demonstrate its application in a study region that experiences significant low-frequency climate variability.

a. Holistic climate experiences

Low-frequency variability includes a range of atmospheric phenomena, usually understood to derive from persistent anomalies in aspects of the climate system that take months to decades to form or dissipate (e.g., ice cover, deep soil moisture, large sea surface temperature anomalies), or variability in external factors connected with climate (e.g., cooling due to aerosols emitted during volcanic eruptions). The term encompasses, but is not limited to, large-scale teleconnections such as the Pacific decadal oscillation (Mantua and Hare 2002), Atlantic multidecadal oscillation (AMO; Knight et al. 2006), and North Atlantic Oscillation (NAO; Hurrell and Deser 2010), all of which promote regionally significant anomalies in temperature or precipitation that can persist for years and may obscure global trends for decades in isolated locations (e.g., Finnis and Bell 2015). While the influence of low-frequency variability is often clear in climate records, the degree to which it is perceived by residents in affected locations remains unclear, as there are almost no studies to date that explicitly explore these perceptions. One notable exception is a study by Makuvaro et al. (2018), who found significant discrepancies between the perceptions of local farmers living and working in central Zimbabwe and local climate records. Specifically, in comparing survey data with climate records, they found that while farmers’ perceptions of increased temperature were aligned with meteorological data, farmer’s perceptions of increased seasons without rainfall, increased floods, overall reduced seasonal rainfall, and long dry spells were unreliable (Makuvaro et al. 2018). This baseline evidence does not suggest that we should abandon studies of low-frequency variability perception, but rather prompt a need for more critical assessments of the tools used to generate climate perception data and the conclusions we draw from those data and potential discrepancies.

This need is underscored by qualitative research suggesting that low-frequency variability may exert a significant influence on climate understanding in resource-based communities and professions (Riedlinger and Berkes 2001; Crate 2008, 2011; West and Vásquez-León 2008), although this possibility has not been extensively or systematically studied (Finnis et al. 2015). By contrast, recent research into the collective memory of significant disasters suggests severe limits in our ability to recall and contextualize environmental events after a short period has passed (from a few years to a few decades; e.g., Fanta et al. 2019). Still, these remain imperfect assessments of low-frequency variability perception, inferred from studies focused on fundamentally different research questions. Specifically, it remains unclear how conclusions drawn from research into catastrophic events (e.g., large-scale floods and hurricanes) scale with either the magnitude of events (from inconvenient weather through to single costly catastrophes) or their persistence (from days through to decades). For example: how do perception and recall of a persistent drought compare to those of a week-long acute flood? Addressing these questions requires new methods developed to explicitly explore the perception of the full range of experienced climate phenomena, including weather through low-frequency variability through change.

b. Timeline methods to generate climate narratives

Researchers across diverse disciplines use timeline-based research methods to organize information around complex topics that are difficult to discuss in traditional narrative formats. Much of the work that uses timeline-based tools is related to qualitative health research, often motivated by the ability of the method to facilitate tough and often complex discussions with participants who are experiencing a range of stigmatized health disorders or conditions (recent examples include Pell et al. 2020; Monica et al. 2020; Rees et al. 2019; Williams 2018). However, timeline tools have increasingly extended into other disciplinary spaces, exploring diverse topics (Marshall 2019) such as the experiences of immigrant women (Kolar et al. 2017), student veterans’ decision-making (Mobley et al. 2019), life skills transfer among athletes (Kendellen and Camire 2020), and ways humans make meaning (Martsin 2018). Timeline perspectives (if not necessarily timeline tools) are beginning to see application in environmental and conservation science (e.g., Rehage et al. 2019), however, to our knowledge visual timeline methods have not previously been applied to human dimensions of weather and climate. This is perhaps surprising, considering climate is innately bound with temporality, both in terms of physical and ecological time scales and sociocultural time scales (Ruwet 2021; Lockie and Wong 2018). As such, timeline methods offer considerable untapped potential to collect and visualize climate narratives in a manner that emphasizes temporal aspects of climate and climate change.

Despite the limited use of timelines in weather and climate research, particularly research exploring human perceptions and experiences, they present an opportunity to generate more complete narratives and documentations of people’s lived experiences of weather and climate. For example, the visual nature of timeline-based methods allowed participants to “jump around” in time when discussing their life experiences while efficiently situating events (and orienting listeners) in a
longer history (Adriansen 2012). Visual timelines have also been used to complement semistructured interviewing approaches to help focus participant’s attention, serve as a memory aid, and situate participant responses in broader personal and structural contexts (Kolar et al. 2017). Similar methods have also helped researchers identify turning points, epiphanies, and critical moments in participants’ lives, leading to greater understandings of complex topics such as social resilience and risk avoidance (Gray and Dagg 2019; Harris and Rhodes 2018). In group settings timeline-based methods helped generate detailed and accurate data associated with long-term disaster recovery, addressing shortfalls associated with longitudinal postdisaster research, such as lapses in memory and the simplification of events (Sword-Daniels et al. 2015). Ultimately, these timeline methods are supposed to ease recall, facilitate data validation, reduce tension when discussing sensitive topics, and enhance interview transparency, rapport, and data cogenesis (Marshall 2019). Timelines in weather and climate research may also serve as a useful tool for meeting ongoing calls for a greater consideration and integration of diverse ways of knowing in climate science (Roesch-McNally et al. 2020). As it relates to studies that explore low-frequency variability perceptions specifically, it may help to aid recall, expand the discussion, and untangle complexities of weather and climate events experienced across decades. Additionally, it may help contextualize discrepancies between climate perceptions and climate records, such as those documented by Makuvaro et al. (2018).

In this study, we present the CAT, developed to enhance the recollection and discussion of climate memories and experiences. The CAT was inspired by the life history calendar (LHC), a method developed to conduct interdisciplinary life course research, addressing concerns associated with the failure of human memory in recalling memories across the life-span (Giele and Elder 1998). By prompting the use of retrieval cues, enhancing cognitive abilities, and encouraging conversational engagement with a topic (Belli 1998; Nelson 2010), LHCs are intended to ease recall and make inconsistencies in recollections easily recognizable (and hence amendable) (Freedman et al. 1988). Traditional LHCs are a highly structured tool printed on a matrix with temporal cues running horizontally and domain cues running vertically (see Freedman et al. 1988, p. 43). They were designed for precision in event sequence and timing (Freedman et al. 1988), however a variety of modifications of the traditional LHC have been made to address limitations of the tool or to make the tool more applicable to the study of interest. In particular, the CAT draws on a qualitative adaptation of the LHC, which forwent the structured design for a more open design that prioritized breadth and depth of narratives over precision in event sequence and timing (Nelson 2010). Instead, the researcher and research participant can codevelop temporal and thematic cues, which are added to a blank piece of paper. This process is followed with probing questions to generate rich narrative data. This article is centered on two complementary objectives: 1) to demonstrate what we can learn about weather and climate narratives from the implementation of CATs, and 2) to describe strategies for enhancing the capacity of the CAT to generate rich weather and climate narratives.

2. Methods

The current work examines the recall, interpretation, and communication of climate experiences, as reported by participants in a region strongly influenced by low-frequency climate variability, the province of Newfoundland and Labrador in Canada (Finnis and Bell 2015). Data were collected via a two-stage qualitative approach; a first stage consisting of 33 one-on-one semistructured interviews, and a second consisting of three focus group discussions. Focus groups introduced the CAT, designed to facilitate recall and organization of significant climate recollections. Here, we center our discussion on data generated during these focus groups, both through implementation of the CAT tool and subsequent discussion.

a. Study sites

Research was conducted in Newfoundland and Labrador, Canada’s easternmost province and the northernmost Atlantic province (Fig. 1). Consisting of a large island (Newfoundland) and a larger continental region (Labrador), the province features a pronounced climate gradient that ranges from humid microthermal to the southeast through to Polar climates toward the north and west. Past research has emphasized the province’s susceptibility to low-frequency decadal-scale climate variability, linked to phenomena such the North Atlantic Oscillation and Atlantic multidecadal oscillation (Finnis et al. 2015; Finnis and Bell 2015; Way and Viau 2015; Banfield and Jacobs 1998). The region, and the island of Newfoundland in particular, is known for severe weather ranging from frequent strong winter storms (cyclogones), frequent fog events, and extreme snowfall to occasional remnants of tropical cyclones (e.g., Roberts 2014).

Participants were recruited from four communities in the province: provincial capital St. John’s (population ~212,000 metro area) and Cape Broyle (population ~500) in southeastern Newfoundland; Corner Brook (~30,000), located on the island’s west coast; and Happy Valley–Goose Bay (~7,000), the largest community in Labrador (Statistics Canada 2021). All locations experience relatively cool summers but considerably different winters. Sites in the southeast (St. John’s and Cape Broyle) are characterized by relatively mild winter temperatures (~3.6°C, on average) but frequent winter storms, producing high winds and precipitation. Winter temperatures generally decrease toward western sites, along with exposure to storms; Happy Valley–Goose Bay is considerably colder (~15.3°C mean temperature), but with fewer high wind events (Environment and Climate Change Canada 2022).

b. Recruitment

Interview participants (stage 1) were initially recruited through physical advertisements posted at businesses and municipal buildings in study communities, along with advertisements on community social media pages. Additional households were recruited directly through a random sampling of local telephone numbers. Recruitment was limited to participants over the age
of 30, who had lived near a study community continuously for at least 15 years. This ensured sufficient experience with local climate to identify common patterns and unusual events. Basic demographic information for stage-1 participants is given in Table S1 of the online supplemental material. Participants were offered a CAD 10 gift card for their participation in the study. Interviews were conducted by telephone and lasted between 13 and 90 min, with an average length of 46 min.

Stage-1 participants were subsequently invited to one of three focus groups (stage 2), conducted in St. John’s, Corner Brook, and Happy Valley–Goose Bay. Additional participants were recruited through a convenience sample, again using physical advertisements and social media. In total, 12 individuals participated in the focus groups: one with two participants who had both participated in stage 1, a second with three participants who were all new to the study, and a third with seven participants, three of whom participated in stage 1. Lunch was provided at each focus group discussion as an incentive for participation.

c. Instrument design and application

Stage 1 consisted of semistructured interviews, guided by prompts addressing participants’ relationship with their environment; impressions of local weather, climate, seasonality, reliability, and variability; personal recollection of weather events; and, toward the end of the interview, questions about climate change (familiarity with the topic, observed climate changes). The exact content and progression of topics was largely determined by individual participants to better understand the content and character of their individual weather and climate memories and impressions.

The CAT tool was designed to complement the preceding interviews, further exploring lifelong weather and climate memories while explicitly including temporal organization. Adopting a qualitative open structure (Nelson 2010), the CAT tool includes an oversized piece of paper (approximately 1 m) with a “timeline” down the center; one end was labeled First Day in Community, with the opposite labeled Yesterday. As such, the timeline provides participants with a visual representation of their full tenure in a community. The tool was pilot tested in two sessions with colleagues (12 total), with each volunteer completing a timeline, sharing results, and providing feedback on the structure of the CAT and its implementation in group settings.

To complete the CAT, participants were asked to reflect on weather and climate in their community, and write or draw
memories alongside an approximate timeframe, such as a specific date, year, or decade, depending on their memory. Participants were also instructed to include any associations they had with that weather or climate memory, for example, financial impacts, a vacation, or a life-milestone. Memories could be specific events (e.g., 2016 windstorm) or a general description of a particular timeframe (e.g., an exceptionally warm summer). The CATs could be completed in whatever way was most meaningful to the participant.

CATs served as the central activity of stage-2 focus group discussions, which were concomerated by three researchers who each served a different role (facilitator, notetaker, and manager of logistics). These focus group discussion sessions started with a summary of key findings from stage 1, including commonly recalled weather phenomena, reports of observed change, and research questions arising from interview analysis. Notably, the topic of climate variability perception was presented, defined, and visually illustrated using simple plots and color-varying animations. Following discussion and feedback on this opening material, the CAT activity was introduced, and instructions were delivered. After 30 min dedicated to filling out the timelines, a moderated discussion was held in which participants were encouraged to share their entries and reflect on their timelines and the activity. Following the conclusion of each focus group discussion, the moderators engaged in a collective debrief about process and emerging themes as a form of data exploration to inform the formal coding process (Shenton 2004).

d. Data generation and analysis

Audio recordings were the data generated from the one-on-one interviews, which were primarily conducted by telephone. Two sources of data were generated as part of the focus group discussions 1) the physical CATs and 2) audio recordings of the moderated discussions following the completion of the CATs. Interview audio recordings, CATs, and focus group discussion audio recordings were digitally transcribed and imported into the NVivo qualitative data analysis software. Results were analyzed using an iterative, multistep coding process involving open and axial coding steps (Bernard 2017; Williams and Moser 2019). Coding and preliminary interpretation of interviews was completed in advance of the focus groups, then subsequently recoded along with focus group transcriptions and CAT results. This approach allowed refinement of emergent themes in light of additional data extracted in a different setting (group, rather than individual) using different tools (e.g., CAT). Effectively, stage 2 provided further context for interpreting stage-1 results.

3. Results

The results presented below focus on answering the following research questions 1) What weather and climate phenomena emerge as meaningful in the lives of participants? and 2) What are the strengths and weaknesses of the CAT in relation to its ability to generate holistic weather and climate narratives? In addressing these questions, we demonstrate the type of data that can be generated and information that can be learned from the implementation of the CAT tool. Further, the results point to ways that the tool can be further refined to improve its capacity for generating rich, nuanced, and holistic climate narratives.

Stage-1 semistructured interviews explored climate and weather memories, encouraging reflection on the types of events recalled, the significance of these events in their lives (e.g., concrete impacts, reasons particular events were memorable), and how these events fit within broader understandings of local climate. Research goals in this stage included assessing the weather and climate phenomena prevalent in the lives (and recollections) of participants and exploring relationships between these recollections and perceptions and understandings of both long-term (global) change and transient (regional) variability. High-impact winter weather (heavy snowfall and high winds) and unseasonal anomalies (cold summers, warm winters, and reduced lake and sea ice formation) dominated recollections. Events were often connected with necessary changes in behavior (e.g., placement of garbage in response to winds; adjustments to winter travel and recreation schedules), or impact on a significant life event (e.g., event cancellations; school closures). Interviews proved useful for collecting weather and climate narratives and subsequently assessing communication styles and content. However, interviews did not provide sufficient organization to properly examine the influence of event timing on constructed climate knowledge. A notable challenge was that participants’ responses were rarely temporally situated relative to each other; unprompted references to time were typically vague (e.g., “now” vs “then,” “earlier,” “recently,” “used to”), although there was a tendency for respondents to describe climate as “changing” or “different.” There was also a recurring focus on events occurring either in their earliest years in a community or the very recent past, although properly situating most recollections between these extremes was difficult.

Following preliminary interview analysis, the CAT was developed as a simple means of introducing temporal structure to participants’ narratives, while encouraging reflection on events between introductory and recent weather and climate experiences. That is, it was purposefully developed to address questions about change and variability perception in a manner that interviews did not. A transcribed sample of a completed CAT is shown in Fig. 2.

The remainder of the results section focuses on the key findings emerging from analysis of completed CATs and related focus group discussions. Participant quotes from focus group discussions are included to illustrate main points. Pseudonyms are used to protect the confidentiality of participants.

a. Blackout dates

The content of CAT entries is qualitatively similar to narratives collected during interviews (e.g., similar weather phenomena, personal impacts), reinforcing findings from the first phase of the study on the weather experiences that remain most accessible and relevant to participants. However, the addition of the CAT’s timeline structure provided additional insight into how recall is distributed throughout a participant’s
life. When prompted to complete the CAT in relation to the weather and climate in their current community (either St. John’s, Corner Brook, or Happy Valley–Goose Bay), results tended to fall into one of three broadly defined periods: period A, associated with their introduction to a community (e.g., childhood; first 5–10 years following a move); period C, covering the very recent past (last 5–10 years); and period B, covering the typically longer (15–60 year) span between these shorter endpoints. Depending on the participant age, periods A and C collectively account for 30%–60% of a participant’s time in a community (avg. 36%), while period B accounts for 40%–70% (avg. 64%). Despite their shorter duration, the majority of participant recollections occurred during A and C and were roughly equally distributed between the end points. By contrast, relatively few recollections for the longer period B were provided. It is also notable that CAT entries associated with peri-trast, relatively few recollections for the longer period B were provided. It is also notable that CAT entries associated with per-...
the CAT entries, the results presented here highlight discussions that were prompted by the CATs and ultimately facilitated by the visual nature of the CATs.

Although both stages of the study were centered on exploring the experiences of low-frequency variability rather than change, the data collected centered predominantly on perceived climate change. In both the interviews and focus group discussions that followed the CAT activity, participants focused on changes they noted in their communities without being prompted to discuss climate changes (to prevent diverting the focus away from low-frequency variability). Oftentimes during the focus group discussions, participants would reference their completed CATs and compare their childhood memories (or initial years) with their recent past and discuss how the weather and climate have changed.

Lewis: I’ve noticed that since I came to Goose Bay… in 2000 there was very little wind in winter and now almost every day there is wind.—Focus group discussion quote (Happy Valley–Goose Bay)

As part of the focus group discussions, participants revealed a variety of other ways, beyond their memories, that they came to perceive climate changes in their communities, including photographs, family stories, weather logs, activity logs, social media, and newspaper articles. In the St. John’s focus group, a man communicated a story he had heard from a family member to illustrate change.

Patrick: My wife’s cousin… he said that when they were about 13 or 14 going to school, they would go down to the marina center… they would walk to school right across the ice. Haven’t seen that all this time—Focus group discussion (St. John’s)

What was noticeably absent from the focus group discussions was any form of discussion around climate variability. This was even the case when participants discussed their use of alternative sources to document and understand their local climate experiences (e.g., weather journals). There were no suggestions that comparable “change” had occurred in the past, which would have indicated climate variability. Rather, recent conditions were interpreted as novel, or unprecedented. This absence of climate variability is even more striking because during the focus group, a direct effort to elicit conversations about climate variability was made by defining the term, providing locally relevant information about climate variability, and prompting questions specifically about low-frequency variability. Despite these efforts, participant conversation remained limited to permanent change. For example, when asked if any of the experiences noted on their CATs indicated a presence of low-frequency variability, participants across all three focus groups immediately referred to their experiences of change, not variability.

Moderator: Can you think of anything from your experiences that might indicate the presence of long-term variability in your community?

Jason: Harbors freezing over. You don’t see that.

Helen: It wasn’t just the harbor, it was the ocean. It would take an hour maybe two hours to walk across. It’s insane.

Moderator: So, you all remember the harbor freezing over or the ocean freezing over. If it’s long-term variability that would imply that maybe you’d expect it to freeze over again?

Jason: Yes, if it’s a cycle. That’s correct.

Moderator: Have you seen it go in any sort of cycle? Where it didn’t freeze over and then it does, and then it doesn’t? Or has it been something that you just noticed that it changed?

Jason: It just changed. It used to freeze over, and that was in the 50s and 60s, and I haven’t seen it since.—Focus group discussion quote (St. John’s)

As part of these explicit discussions, participants were at no point able to express ways in which climate variability would be personally useful to the ways they lived their lives. A man from the St. John’s focus group expressed the following:

Shawn: I find that thinking about information about long-term cycles, it seems like in a way it’s less relevant to my life. And I think maybe to people in general. Because I think people tend to think a little more short-term, just in terms of what they’re going to do day-to-day. I guess I would wonder if I was being told that there was a longer-term sort of cycle taking place and that I may expect some changes down the road, I’m not sure what I would do with that information.—Focus group discussion quote (St. Johns)

This quote also illustrates the psychological distance of low-frequency cycles. A man from the Corner Brook focus group shares a similar sentiment:

William: When you’re stuck in the cold, that’s what you’re dealing with… you’re not really thinking much about, thinking “this will pass.”—Focus group discussion quote (Corner Brook)

As part of these conversations, some participants did think of stakeholders who may find information about climate variability useful. For example, participants mentioned farmers, investors, and those working in recreational and tourism industries.

d. Time and prompt limitations

As part of the open discussion following the CAT activity, we asked participants directly about potential improvements to the CAT tool and activity. Overall, the time and location restrictions associated with the focus group CAT activity and follow-up discussion influenced their ability to reflect on memories and experiences. Participants indicated two primary recommendations 1) wanting more time to complete the CAT activity and 2) to be able to work on the CAT in different locations (e.g., at home or at work). According to participants, the context cues and social references that they could tap into would help to trigger different memories about their past experiences. Examples of these types of engagements included speaking to loved ones, referring to social media, and looking through photograph albums.

4. Discussion

In this study we present a tool designed to elicit, order, and interpret weather and climate recollections and perceptions. Inspired by methods in life course research (e.g., Giele and...


In this context, reports of warming are not surprising. However, it remains notable that recollections of warmer conditions prior to 1980s–90s were not identified in either interviews or CAT entries, despite having a significant number of participants who would have experienced these periods. It is possible that relatively warm periods prior to the 1980s had limited impact on residents or shifted gradually enough to escape notice. Alternately, the blackout phenomena captured in CAT responses supports the interpretation that prior experience of variability is less remembered or is linked to less accessible recall.

Consideration of winds provides further support for the hypothesis that variability perception is strongly limited by recall. Winds appear to have increased in recent years (Wilhelm 2022; Bird 2019); however, this is a very recent reversal of an extended downward trend that reached a minimum in the mid- to late 2000s (Wilhelm 2022; Lucio-Eceiza et al. 2020, 2019). While many participants reported an increase in winds, none identified the preceding calm decade. This may reflect the limited impact (and, consequently, memorability) of calm periods; alternately, it may again reflect limited recall during the blackout period. If so, wind records suggest that climate memory fades relatively quickly (~10–20 years).

Concerns about the blackout phenomena are not purely academic. It is highly likely that variability will again prompt transient, regional cooling or reduced winds within the study region, and results suggest that this could be falsely interpreted as a cessation of anthropogenic climate change, instilling unwarranted confidence with regard to climate impacts and the necessity for climate action. This concern is greatest in areas strongly affected by the NAO and AMO and relatively sheltered from anthropogenic climate trends. This includes southeast Newfoundland (Finnis and Daraio 2018), home to the majority of the provincial population.

The degree to which other factors influence the blackout phenomena remains unclear. Application of the CAT with a strict time limit may have limited responses to the most immediate or formative climate memories, exaggerating the significance of the blackout effect. However, it remains notable that time-limited reflections on climate experience frequently prompt a then-versus-now comparison, providing important context for researchers to consider when deciding on the most appropriate tools to answer particular social science questions, especially those related to climate perceptions. Differing support for climate action under differing weather conditions (e.g., Hamilton and Stamponi 2013) or transient increases in concern following major events (e.g., Fanta et al. 2019) may partially reflect the blackout effect. Similarly, our assessment that participants are focused on “change” despite having experienced pronounced “variability” may reflect either the range of other factors that shape climate perception or an inadequate fit between the climate metrics examined and participant experiences of weather. Assessments of regional climate variability typically rely on annual or seasonal averages (Lucio-Eceiza et al. 2020, 2019; Finnis et al. 2015; Finnis and Bell 2015; Way and Viau 2015; Banfield and Jacobs 1998) (Finnis et al. 2015; Finnis and Bell 2015; Way and Viau 2015; Banfield and Jacobs 1998) or annual maximum values (Bird 2019). This may obscure subtle or nuanced climate
impacts, such as the shifts in the frequency of extreme or high-impact events, which are likely more noticeable than shifts in averages and more memorable than changes in the single most extreme event in a given year. We may be hearing reports of changes that have not been adequately assessed in available climate data.

Careful interpretation of qualitative climate narratives can be useful in overcoming the apparent mismatch between climate data and reported perceptions, and the CAT provides a structured means of eliciting, ordering, and categorizing these narratives. Resulting detailed descriptions of weather and climate events, patterns, and trends permits exploration of climate metrics that reflect the content of narratives (e.g., event frequency, rather than simply magnitude), allowing climate data analysis to focus on phenomena that prove memorable. Results also highlight the personal and social impact of various weather events, allowing examination of participants’ primary climate concerns, cultural connections to climate, and self-identified vulnerabilities. In these regards, the CAT serves as a potential tool for bridging divides between the observation of atmospheric phenomena (e.g., station data) and analyses of weather impacts on people and their climate perceptions. In the current study, the CAT was critical in highlighting regional concerns about winter conditions while providing insight into key aspects of memorable winter weather (lake or harbor ice formation; unusual thaws; heavy snowfall). Similarly, results have proven useful in characterizing wind experiences, as illustrated by a detailed assessment of wind climate that was both motivated and informed by CAT results (M. Koitnurm et al. 2022, unpublished manuscript).

The CAT exercise also proved popular with focus group participants, providing a highly interactive opportunity to reflect on climate and generate material for subsequent peer discussion. Local climate knowledge and perceptions are not formed in isolation, but rather through a combination of personal experience and peer interactions that add context, points of comparison, and differing perspectives on those experiences. As applied in the current study, the CAT served to replicate this coconstruction of weather and climate narratives in miniature, providing an opportunity to observe the exchange of personal experiences and, to a limited degree, assess their integration into a larger understanding of local climate character. Participants were able to identify consistencies and discrepancies in their recollections together, forming a more holistic documentation of local climate experiences than one-on-one interviews could have generated alone. The cocreation of “semantic knowledge” (or learned knowledge) that CATs can facilitate (e.g., through the comparison and deliberation of different CAT entries) has been found to be influential in how individuals interpret, experience, and respond to climate hazards (Drost 2013). For researchers, there may be potential to use a similar timeline approach to assess climate vulnerabilities and adaptation needs in collaboration with communities; for example, a CAT exercise could be used to ground and inform application of collaborative vulnerability assessment tools (e.g., Irvine et al. 2016). For climate adaptation practitioners, the use of CATs may prove useful in identifying community values and adaptation priorities, which can facilitate the development of culturally and socially relevant climate communication tools and strategies, such as seasonal calendars (Chambers et al. 2021), landscape photograph visualizations (Schattman et al. 2020), or decadal climate information (Mehta et al. 2013).

5. Research limitations and future research

The primary limitations of this study are that the CAT tool was used in an exploratory research context with a relatively limited sample of participants, significant time constraints, and limited opportunity for participants to leverage context clues and social prompts to complete their CATs. As such, there is opportunity to expand our knowledge of the utility and limits of timeline tools in climate perception research. For example, future research may consider how CATs function to elicit climate narratives across diverse stakeholder groups. Exploring the applicability of the CAT to perceptions and understandings of climate change, particularly in areas that experience less significant climate variability, may also be insightful. Last, we believe there is promise in using the CAT tool in a more collaborative, long-term context—specifically, understanding whether individuals working together to complete a CAT over time can yield further insights about climate experiences, perception, and memory.

6. Conclusions

The data generated in this study offer a proof-of-concept of the CAT tool, demonstrating its practical potential for the study of social experiences of weather, climate, and climate change. The approach is distinct from qualitative data collection instruments commonly applied to climate perceptions research, offering information complementary to typical interview and survey methods, and providing a means of data triangulation, particularly for those studies that aim to link and compare physical climate data with social science perception data. To our knowledge, the CAT represents the first application of timeline-based methods to the study of climate perceptions; the approach is well suited to interactively exploring climate in a structured manner that emphasizes temporal organization, while allowing free consideration of diverse and complex climate experiences. Using such tools, we create opportunities to showcase local knowledge and provide infrastructure for eliciting organized and succinct climate narratives. This can empower local stakeholders as it provides tangible documentation of complex climate experiences, nested within relevant social experiences, that can inform decision-makers in diverse sectors (such as agriculture and tourism stakeholders, which were mentioned by participants). In addition, the data generated with the CAT tool highlights that timeline-based methods can serve as useful “bridging tools” to integrate the physical and social science of climate change.

Applied to the study of weather and climate narratives in the province of Newfoundland and Labrador, the CAT provided qualitative data on climate and weather perception and local knowledge that was complementary to, but distinct from, data collected through semistructured interviews. In
combination with long-form interviews and focus group discussions, the CAT tool proved helpful in identifying and visually representing the range and character of weather and climate phenomena that most inform participants’ understandings of climate. Here, this meant an emphasis on wind and winter-related weather in the data, a result that may be different if the CAT were adopted in other contexts. Results were also useful in confirming and exploring the tendency for participants to focus on formative and recent weather and climate experiences (points A and B) as temporal anchoring points in their interpretations of climate, at the expense a longer intervening blackout period. This tendency informed participants’ lived sense of climate and helped contextualize perceived climate changes.

Acknowledgments. Funding for this project was provided by the Social Sciences and Humanities Research Council of Canada, as well as the Marine Environmental Observation, Prediction and Response (MEOPAR) Network. This study was approved by the Interdisciplinary Committee on Ethics in Human Research (ICEHR) at Memorial University of Newfoundland in St. John’s, Newfoundland, Canada, approval 20170557.

Data availability statement. Because of confidentiality agreements with the research participants, supporting data can only be made available to bona fide researchers subject to a nondisclosure agreement. Details of the data and how to request access are available from Dr. Joel Finnis at Memorial University of Newfoundland.

REFERENCES


