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Making memories that matter: how do different recollections of an Antarctic tourism experience impact future conservation behavior?

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ABSTRACT

Antarctic tourism is increasing and diversifying leading to different types of experiences and memories. While the journey is considered a once-in-a-lifetime experience, little empirical research exists to understand memories' formation and their influence on pro-environmental behavior intentions (PEBI). To explore these relationships, we used a mixed-method approach to analyze surveys collected from Antarctic tourists during 2019-2020. We identified two dimensions of memories that resulted in three distinct groups of tourists: the *snapshot* group likely to recall specific trip components, the *reflective* group likely to think and share about their experience, and the *reflective & transformative* group likely to indicate that their experience impacted them personally. We examined the relationships of these groups with experiential outcomes and PEBI. We found significant positive relationships, with the strongest outcomes in the *reflective & transformative* memory group. Our results suggest that tour operators have been effective at enhancing public awareness and conservation concerns by triggering reflective memories; however, there is still a need to effectively cultivate transformative memories. Through this exploratory research, we offer insights into specific actions that operators, guides, and travelers might consider for maximizing the memory-making experience and inspiring tangible outcomes regarding Antarctic conservation which might also translate into other tourism contexts.

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Introduction

Natural areas, landscapes, and seascapes have long been tourist attractions (Albrecht, 2021; Mandic & Walia, 2023). Tourism that is based on natural resources, or nature-based tourism (NBT), had grown before the COVID-19 pandemic and is rebounding in the post-pandemic era, generating concerns about its negative impacts and contributing to debates regarding over-tourism (Honey & Frenkiel, 2021). While the negative impacts of NBT continue to receive attention, the pandemic has also strengthened the realization that NBT is a valued cultural ecosystem service and an important conservation tool for protected and natural areas, where public presence and support for their sustainable management is crucial (Mandic & Walia, 2023).

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NBT is recognized for its contributions to biodiversity conservation as well as sustainable livelihoods in local communities (The World Bank, 2020). Each year around eight billion NBT tourists visit protected areas and other natural destinations in the world, generating a multitude of environmental, economic, and social benefits (Spenceley, 2021). NBT also offers opportunities to enhance environmental awareness among tourists (Ardoin et al., 2015; Ballantyne et al., 2009; Chiu et al., 2014). Furthermore, past research has demonstrated the positive effects of NBT on place attachment (Ballantyne et al., 2011b), strengthening emotional relationships with places (Manzo, 2003), creating transformative (Morgan, 2010) and memorable experiences (Soulard et al., 2019), and fostering pro-environmental behaviors and intentions (PEBI) (Larson et al., 2015, 2018a). These effects can foster positive changes in tourists not only at the NBT destination itself, but also in their home, work, or leisure environments following the experience (Ballantyne & Packer, 2005, 2011).

Antarctic travel, a form of NBT, raises numerous concerns concerning its environmental impacts, especially with the substantial carbon footprints involved (Eijgelaar et al., 2010; Tejedo et al., 2022). Yet a persistent justification for these long-haul trips, primarily from the industry, is the claims of significant beneficial outcomes associated with an Antarctic travel experience. The argument goes that Antarctic travel is designed with deliberate educational and learning opportunities that seek to cultivate pro-environmental outcomes (Cajiao et al., 2022) while producing memorable and transformative experiences that could foster advocacy for the conservation and protection of the continent. The unique characteristics of Antarctica and its potential to spark intense feelings among tourists make it an ideal NBT setting to examine memorable experiences.

Past research on Antarctic tourists has examined the associations of Antarctic travel and learning experience with PEB intentions (Powell et al., 2008, 2012; Cajiao et al., 2022). Tin et al. (2012) analyzed the public perception of different management strategies, while Vila et al. (2016), and Alexander et al. (2019) studied the "ambassadorship effect" of the Antarctic journey that compels travelers to advocate for the Last Frontier following their return home. However, with a few exceptions, the relationships among experiences, memories, and transformation in the polar regions are based mostly on presumptions and assumptions rather than empirical evidence, and no published study has examined how memories could influence long-term beliefs or behavior changes among the Antarctic tourists.

With a global movement for tourism to "come back better" after the COVID-19 pandemic (Spenceley, 2021), our study fills an important and timely knowledge gap by examining the formation of memorable and transformative experiences to inform tourism programming and management while stimulating further research as tourism expands in Antarctica. Our specific study objectives were to: 1) characterize links between different dimensions of memories and tourists' experiential outcomes and PEBI 2) determine the existence of different memory profiles associated with the Antarctic tourist experience, and 3) identify associations of different tourist memory groups with experiential outcomes and PEBI.

Literature review

Memories of NBT experiences

The tourist experience and its constituent stages have been extensively studied, with a heavy emphasis on experiences occurring during or immediately after travel (Uriely, 2005; Kim, 2009; Albrecht, 2021; Kim et al., 2021b). While on-site tourism experiences are important by generating an array of momentary reflections and transitory feelings, lasting tourism memories and their recall with personal relevance can be critical to understanding the long-term impacts of an NBT experience (Kim, 2009; Kim et al., 2022b) and potentially tourists' subsequent thinking and

actions. Indeed, some scholars consider memories the most significant outcome remaining for tourists after a trip (Braun-LaTour et al., 2006; Hosany et al., 2022).

Kim et al. (2012) first defined a memorable experience as a "tourism experience positively remembered and recalled after the event has occurred". Memorable experiences can be linked to transformative learning experiences that generate important and long-lasting effects in an individual's life, giving personal meaning to those events through memory creation and retention (Coelho et al., 2018). Mezirow (1997) argues that transformative learning implies a self-reflective and integrative experience—the type of experience that is often linked to tourism- (Knollenberg et al., 2014). Morgan (2010) and Coghlan and Gooch (2011) also argue that tourism could be a form of transformative learning experience eliciting profound changes in people's behaviors, attitudes, and beliefs. Thus, transformative experiences, fueled by memories, can influence travelers' beliefs and behaviors in such a way that they see themselves as agents of change beyond the experience (Soulard et al., 2019).

Studies on memorable experiences in tourism have steadily increased in the last decade, including the application of a variety of methods and underlying theories in different settings (Hosany et al., 2022). While the field of psychology is advancing the understanding of neurological drivers of episodic and working memory in humans *via* methods such as electrophysiological testing (Herweg et al., 2020), investigations of memory in the tourism context have historically focused on self-reported measures of memory expression following a trip. Building on the foundations of the Memorable Tourism Experiences (MTE) scale (Kim et al., 2012), researchers have applied variations that include negative memories (Kim, 2018), experiential factors (Chandralal & Valenzuela, 2015) destination attributes (Kim, 2014), and behavioral intentions (Coudounaris & Sthapit, 2017; Coelho et al., 2018). Studies have also explored whether the use of technology (e.g. mobile apps) enhances the memory-making experience due to a reduction in travel uncertainties (Kim et al., 2021a; Torabi et al., 2022).

Relevant to NBT settings, Jorgenson et al. (2019) developed a Tourism Autobiographical Memory Scale to understand the effect of travel experiences on the lives of tourists, especially when exposed to exceptional settings. They found two distinct dimensions of memories: those related to how often the person recalls and shares the experience with others (i.e. rehearsal), and those related to the impact that memory has on a traveler's life (i.e. impact). Memorable and transformative experiences may be especially powerful in polar tourism. The fact that Antarctic travel has evoked profound memories and transformative experiences among legendary explorers demonstrates the intensity of the Antarctic experience (Stonehouse & Snyder, 2010). Considered by many tourists as a one-in-a-lifetime, life-changing opportunity, Antarctic travel could lead to the adoption of PEBI and ambassadorship (i.e. long-term advocacy for a destination after a trip) through the formation, and subsequent sharing, of memorable and transformative experiences (Miller et al., 2020; Alexander et al., 2019).

Factors associated with memories of NBT experiences

A variety of factors influence how NBT experiences develop and become memorable over time, including emotions evoked during the experience and the specific details of the trip itself (Kim et al., 2022a). Quynh et al. (2021) argue that emotions are an essential element of a memorable destination and that emotions are shaped by the different services provided and interactions generated through the tourist experience. Hughes (2013) asserted that positive and negative emotions prompt visitors to pledge their support for environmental conservation and behavior intentions. Massingham et al. (2019) reported that negative emotions could act as mediators when prompting conservation engagement at ecotourism destinations. Later, Kim et al. (2021b) incorporated negative experiences into the memorable tourism experiences concept, emphasizing their importance in memories and experience formation.

The role of emotions in memory formation has recently attracted substantial attention among tourism scholars. Hosany et al. (2021) described a variety of approaches that could be used to operationalize emotional experiences in tourism, including context-specific, self-reported scales for measuring the intensity and valence of tourists' emotional experiences. Ballantyne et al. (2011b) and Buckley (2022) examined how emotional and sensory factors could contribute most strongly to memorable wildlife tourism experiences, specifically. Their findings show that powerful emotions, even if they were brief or were experienced years ago, can generate memorable experiences for individuals that have the potential to influence their future thinking and behavior. Although emotions might be particularly powerful at dramatic polar tourism destinations, only a few studies focused on awe have explored this possibility (e.g. Powell et al., 2012).

In addition to emotions, other trip characteristics may influence how tourists emotionally react to and remember their travel experience. For example, Kim (2014) found that destination attributes such as activities, quality of service, and local amenities influenced how tourists remembered a trip. Other research has examined how tourist preferences for specific travel elements such as accommodations, transportation, perceived value, and cultural and heritage elements of a destination can affect perceptions, both during and after travel (Lacher et al., 2013; Liao & Chuang, 2020). By accounting for the influence of trip attributes, tourism managers can improve the emotional appeal of destinations and enhance tourists' experiences, as well as memories of these experiences.

Pro-environmental outcomes of NBT

NBT offers the opportunity for tourists to experience first-hand both wildlife and the conservation efforts to protect habitats and species (Hehir et al., 2023). Pro-environmental outcomes can be defined as the positive change in attitudes, concerns, management preferences, and behavior intentions obtained through the tourism experience (Cajiao et al., 2022). Literature on pro-environmental outcomes is extensive and covers different NBT settings, suggesting that these experiences could facilitate changes in tourists' pro-environmental behaviors, attitudes, and beliefs (Larson et al., 2015; Ramkissoon & Mavondo, 2017; Larson et al., 2018a; Hughes, 2013). Research also shows that behaviors might focus on site-specific outcomes and impacts, or they might be broader and more global in nature (Larson et al., 2018b; Steg & Vlek, 2009). Such outcomes could be influenced by specific antecedents such as Last Chance Tourism motivations and the power of first-time tourism experiences (Eijgelaar et al., 2010; Hehir et al., 2023). In many cases, research on pro-environmental behaviors in tourism tends to focus on behavioral intent rather than sustained, long-term actions (Ballantyne & Packer, 2011; Hughes, 2013; Hehir et al., 2023), highlighting the need for more work to examine factors that influence long-term behavior change. Moreover, a meta-analysis of NBT studies by Ardoin et al. (2015) identified gaps in the empirical research that documented changes in tourists' environmentally related knowledge, attitudes, intentions, and actual behaviors. Their review found that few studies measured environmental behavior directly, and even fewer included longitudinal assessments of persistent changes in attitudes or behaviors.

Limited research on pro-environmental behavior has been conducted in polar settings. In the Arctic, Miller et al. (2019) found that the polar bear viewing experience has the potential to increase tourists' ambassadorship and PEBI. For a more longitudinal perspective, Reis et al. (2015) depicted the transformative effect of the *Students on Ice* program on students who visited the Arctic and, after several years of participation, altered their involvement as environmental stewards for different causes. In Antarctica, Powell et al. (2008) found that even though tourists' knowledge and PEBI increased significantly immediately after the journey, three months after their actual engagement in pro-environmental behaviors was only minimal This aligns with Cajiao et al. (2022), who argued that tourists traveling to Antarctica already possess high levels

of pro-environmental attitudes and behavioral intentions, leading to few significant changes after the journey. Hehir et al. (2023) found that travel to Last Chance destinations, especially when visited for the first time, prompted higher PEBI concerning philanthropic support. Overall, research suggests the different ways that tourists remember an experience, and choose to express those memories, might impact future pro-environmental actions, helping to ensure that PEBI is actualized. Our study sought to explore this possibility.

Methods

Sampling approach

We collected data from December 2019 to March 2020 corresponding to a larger dataset of Antarctic tourists (Cajiao et al., 2022). Four months before the start of the season, tour operators were contacted by the International Association of Antarctica Tour Operators (IAATO) Secretariat and invited to participate in the study. Three tour operators (2019 IAATO members) volunteered to participate, resulting in seven trips surveyed. These trips included two different modalities common in Antarctic travel: traditional sea-borne Peninsula (cruise) and air-cruise Peninsula (air-cruise). The survey instrument consisted of pre-and post-trip questionnaires. However, only the post-trip survey data are presented in this paper, as they directly address the three study objectives of this research. Surveys were originally developed in English. They were translated into French and Chinese and sent to academic native speakers to assess translation consistency.

Operators of the cruise modality collected the post-survey on the last day of the tour before arriving at the port of disembarkation. Operators belonging to the air-cruise modality were asked to distribute surveys according to their mode of transport. Due to ethical considerations in data collection protocols, only passengers older than age 21 were invited to participate in the survey even if they were traveling in the same group. To maximize consistency in survey administration, survey packages containing printed questionnaires, protocols, scripts, and consent forms were provided to all participating tour operators.

Survey instrument

For our survey instrument, we adapted quantitative and qualitative items from past research (i.e. Powell et al., 2008, 2009; Jorgenson et al., 2019; Ballantyne et al., 2011b; Manley et al., 2017) with wording adjusted for the Antarctic context. Our hybrid approach attempted to harness the power of mixed-methods research to understand complex phenomena (e.g. autobiographical memories) from multiple angles (Creswell & Clark, 2018).

Because actual memories are exceptionally difficult to measure outside of laboratory settings (Herweg et al., 2020), we assessed self-reported memory within the context of attribution theory, which focuses on how personality, values and beliefs, social identity, and other factors affect how people report things (Harvey & Weary, 1984). We adapted six items from the Tourism Autobiographic Memory Scale (TAMS) to measure visitor experiences through the expression of personal memories following a trip (Jorgenson et al., 2019; Table 1). Unlike episodic memories, which are simply recollections of experiences, autobiographical memories align with attribution theory by placing the recollection in a much larger frame of reference (e.g. one's life history) that informs causal explanations and reactions (Fivush et al., 2011). We included items designed to measure both rehearsals (e.g. "When I return home from Antarctica, I will continue to think about my trip") and impact dimensions of TAMs (e.g. "My Antarctic trip influenced the way I see the world") (Jorgenson et al., 2019), also integrating themes from related scales (Kaltenborn, 1998; Ballantyne et al., 2011a). Although we adapted wording from the original TAMS scale to

Table 1. Factor structure[a] of items adapted from the tourism Autobiographic memory scale (TAMS) reported by travelers to Antarctica in 2019-2020 (n = 432).

			Pattern Matrix		Structure Matrix	
Index/Items[b]	Mean	SD	Fac. 1	Fac. 2	Fac. 1	Fac. 2
1. Reflective Memories (3 items; Cronbach's α = .821)	**9.25**	**1.09**				
As I remember my trip, I will vividly recall the stories and images of Antarctica	9.24	1.17	**0.884**	−0.010	**0.879**	0.496
When I return home from Antarctica, I will continue to think about my trip	9.39	1.06	**0.770**	0.038	**0.792**	0.478
When I return home, I will write and/or talk to others about my trip (e.g. email, Facebook, blog, letter, text)	9.10	1.54	**0.666**	−0.001	**0.666**	0.380
2. Transformative Memories (3 items; Cronbach's α = .883)	**7.90**	**2.05**				
My Antarctic trip influenced the way I see the world	7.86	2.24	−0.039	**0.897**	0.474	**0.875**
My Antarctic trip is significant in my life because it reminds me of my place on Earth	8.28	2.15	0.002	**0.815**	0.468	**0.817**
The emotions I experienced during my Antarctic journey were unique and life-changing	7.61	2.41	0.071	**0.812**	0.535	**0.852**

[a]Exploratory factor analysis conducted with Principal Axis Factoring and oblique (Promax) rotation; KMO = 0.813. Highest factor loadings for the pattern matrix and structure matrix are in bold. Two factors with eigenvalues > 1.0 (Factor 1 = 3.5, 58.3% of cumulative variance explained, Factor 2 = 1.2, 19.2%, r = 0.571).
[b]Items rated on scale from 0 = Not agree at all to 10 = Strongly agree.

enhance the simplicity of interpretation and better fit the Antarctic context, we retained the overall intent of the items to capture two main categories of memories: the concept of rehearsal, which refers to "the frequency in which individuals recall the event in various mediums", and the concept of impact, which refers to "the level of importance a memory has in a person's life" (Jorgenson et al., 2019, p. 574). Thus, although we did not measure specific memories, our use of this practical instrument enabled us to evaluate how tourists access, process, and assess their memories of the trip. All autobiographical memory items were rated on a scale from 0 = Not agree at all to 10 = Strongly agree. We applied the same open-ended question made by Powell et al. (2008) "How did this Antarctic tourism experience affect you?" to capture memories qualitatively.

We examined several factors that might be associated with the formation of memories. We assessed tourists' satisfaction using five items describing trip attributes linked to trip satisfaction that are often applied in tourism destinations, including NBT settings (Park et al., 2018; Jarvis et al., 2016). The items assessed included "enjoyment of the itinerary", "educational and learning opportunities offered", and "overall quality of the trip", all relevant to the Antarctic experience (Table 2). These items were rated on a scale from 0 = Not at all satisfied to 10 = Extremely satisfied. We assessed emotional reactions to the Antarctic experience by asking to what extent tourists experienced seven different emotions on their trip (awe, excitement, surprise, respect, happiness, sadness, fear). The list of potential emotions was adapted from Powell et al. (2012) research in Antarctica and designed to capture a range of positive and negative emotions that may be experienced following NBT tourism experiences (Buckley, 2022; Hosany et al., 2021; Ballantyne et al., 2011a; Table 3). All items were rated on a scale from 0 = Not at all to 10 = All of the time.

To assess the potential impacts of the Antarctic experience, we measured tourists' intent to engage in several dimensions of pro-environmental behavior after their trip (PEBI), including

Table 2. Factor structure[a] of items measuring trip satisfaction reported by travelers to Antarctica in 2019-2020 (n = 437).

Index/Items[b]	Mean	SD	Factor Loading
1. Trip Satisfaction	**9.39**	**0.74**	
(5 items; Cronbach's α = .834)			
Enjoyment of the itinerary	9.48	0.81	0.819
Educational and learning opportunities offered	9.37	0.93	0.763
Excursions and activities	9.47	0.88	0.763
Level and amount of interpretation	9.14	1.20	0.632
Overall quality of the trip (service, food, lodging, etc.)	9.50	0.90	0.622

[a]Exploratory factor analysis conducted with Principal Axis Factoring and oblique (Promax) rotation; KMO = 0.798. One factor with eigenvalues > 1.0 (Factor 1 = 3.1, 61.6% of cumulative variance explained). One item ("length of your journey") was omitted from the scale due to relatively low factor loading (0.499) and higher SD (1.34).
[b]Items rated on scale from 0 = Not at all satisfied to 10 = Extremely satisfied.

Table 3. Multi-factor structure[a] of items measuring emotions experienced during a trip to Antarctica reported by travelers in 2019-2020 (n = 437).

			Pattern Matrix		Structure Matrix	
Index/Items[b]	Mean	SD	Fac. 1	Fac. 2	Fac. 1	Fac. 2
1. Positive Emotions	8.96	1.18				
(5 items; Cronbach's α = 0.869)						
Happiness	9.05	1.50	**0.815**	−0.028	**0.812**	0.079
Excitement	8.88	1.47	**0.795**	−0.008	**0.794**	0.096
Surprise	8.48	1.67	**0.774**	−0.021	**0.771**	0.081
Respect	9.26	1.22	**0.762**	0.050	**0.769**	0.149
Awe	9.10	1.33	**0.737**	0.012	**0.739**	0.109
2. Negative Emotions	**2.28**	**2.57**				
(2 items; Cronbach's α = 0.732)						
Sadness	2.81	3.10	−0.018	**0.812**	0.089	**0.810**
Fear	1.73	2.61	0.022	**0.724**	0.116	**0.727**

[a]Exploratory factor analysis conducted with Principal Axis Factoring and oblique (Promax) rotation; KMO = 0.811. Highest factor loadings for the pattern matrix and structure matrix are in bold. Two factors with eigenvalues > 1.0 (Factor 1 = 3.5 = 4, 49.3% of cumulative variance explained, Factor 2 = 1.6, 22.3%, r = 0.131).
[b]Items rated on scale from 0 = Not at all to 10 = All of the time.

specific actions potentially impacted by tourism experiences (Hughes, 2013; Ballantyne et al., 2011b). Following behavioral dimensions described by Larson et al. (2015), the list of items included conservation lifestyle behaviors (e.g. recycling and resource conservation, minimizing recreation impacts), environmental citizenship (e.g. supporting policies and regulations to address climate change, to protect marine fisheries), social environmentalism (e.g. sharing information about environmental issues in Antarctic) and financial contributions (e.g. donating money to support Antarctic conservation; Table 4). All PEBI items were rated on a scale from 0 = No more likely (to engage in behavior after the trip) to 10 = Way more likely. As previous research has shown, experiencing, and potentially developing an affinity for a destination could influence beliefs and preferences regarding destination management (Kaltenborn, 1998; Huang et al., 2008; Tin et al., 2012). To examine the potential relationship between tourists' connection to Antarctica and their management preferences, we asked them to indicate the extent to which they would oppose or support four different strategies for managing human impacts in Antarctica (Table 5). All management preference items were rated on a scale from −5 = Strongly opposed to +5 = Strongly support. Finally, we asked respondents to report their nationality and age.

Data analysis

Before investigating research objectives, we examined the dimensionality of scales using exploratory factor analysis. Following recommendations from Howard (2016), we tested factorability

Table 4. Multi-factor structure[a] of items measuring intent to engage in future conservation behaviors among travelers to Antarctica in 2019-2020 (n = 418).

			Pattern Matrix		Structure Matrix	
Index/Items[b]	Mean	SD	Fac. 1	Fac. 2	Fac. 1	Fac. 2
1. General Conservation Behaviors (6 items; Cronbach's α = .905)	**7.61**	**2.25**				
Minimize impacts when visiting natural areas	8.11	2.58	**0.917**	−0.090	**0.859**	0.503
Conserve resources and recycle materials	7.76	2.80	**0.867**	−0.065	**0.824**	0.495
Support policies and regulations designed to address climate change	7.76	2.66	**0.820**	0.039	**0.846**	0.570
Support policies and regulations designed to protect marine fisheries	8.03	2.52	**0.788**	−0.002	**0.787**	0.508
Support policies and regulations that limit tourist activity in sensitive natural areas	8.17	2.25	**0.710**	0.140	**0.801**	0.599
Use public/alternative transportation or carpooling to reduce CO2 emissions	5.82	3.40	**0.530**	0.204	**0.662**	0.547
2. Antarctic-specific Financial Contributions (2 items; Cronbach's α = .850)	**6.32**	**2.88**				
Pay an additional fee for this trip to support conservation initiatives in Antarctica	6.24	3.25	−0.089	**0.897**	0.491	**0.839**
Donate money to organizations concerned with Antarctic conservation	6.38	2.93	0.076	**0.833**	0.615	**0.882**
3. Antarctic-specific Social Environmentalism	**8.50**	**2.10**				
Share information about environmental issues in Antarctica with others	8.50	2.10	0.405	0.336	0.622	**0.598**

[a]Exploratory factor analysis conducted with Principal Axis Factoring and oblique (Promax) rotation; KMO = 0.878. Highest factor loadings for the pattern matrix and structure matrix are in bold. Two factors with eigenvalues > 1.0 (Factor 1 = 5.4, 60.3% of cumulative variance explained, Factor 2 = 1.0, 11.3%, r = 0.647). Despite cross-loading, we retained the single "social environmentalism" item as a separate factor due to its unique content.
[b]Items rated on a scale from 0 = No more likely (to engage in behavior after trip) to 10 = Way more likely.

Table 5. Factor structure[a] of items measuring support for Antarctic tourism management reported by travelers to Antarctica in 2019-2020 (n = 437).

Index/Items[b]	Mean	SD	FactorLoading
1. Support for Tourism Management (4 items; Cronbach's α = .804)	**4.02**	**1.23**	
Establish seasonal restrictions on human access to sensitive sites	4.08	1.51	0.883
Set aside land in Antarctica as protected areas where human use is prohibited	3.97	1.76	0.799
Limit the number of visitors to Antarctica	3.45	1.87	0.649
Responsible management of travel to Antarctica	4.57	0.88	0.608

[a]Exploratory factor analysis conducted with Principal Axis Factoring and oblique (Promax) rotation; KMO = 0.773. One factor with eigenvalues > 1.0 (Factor 1 = 2.6, 65.5% of cumulative variance explained).
[b]Items rated on scale from -5 = Strongly oppose to + 5 = Strongly support, with midpoint of 0 = Not sure.

using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and then employed Principal Axis Factoring (PAF) with an oblique (Promax) rotation to allow for potential correlations among factors. Thus, our results include the pattern matrix (which shows the factor loadings/coefficients) and the structure matrix (which shows the correlations between the variables and factors). We

retained factors with eigenvalues greater than one and retained items with factor loadings of 0.5 or higher. For items that cross-loaded on two factors, we either deleted the item (e.g.1 item under trip satisfaction) or, in cases where item content was critical to analysis (e.g. Antarctic-specific social environmentalism), retained the single item as a separate factor. When PAF analysis revealed a distinct dimension, we created an aggregate index score for each dimension by calculating the mean of the items within the index on the original response scale. We also calculated Cronbach's alpha to assess the internal consistency (i.e. reliability) of each sub-scale. These index scores were then used in subsequent analysis.

We first examined frequencies, means, and descriptive statistics to determine the prevalence of each response, including different dimensions of memories, within the larger sample. We examined bivariate correlations to initially compare relationships among different dimensions of memories, inputs into memory formation (i.e. trip satisfaction, emotions), and potential outcomes (e.g. conservation behaviors, support for tourism management). Next, to characterize Antarctic tourists based on their autobiographical memories, we integrated data from the two different memory dimensions that emerged from the factor analysis (i.e. reflective and transformative, see below) to evaluate respondents' memory profiles. These profiles were defined by the relative strengths of scores on the two memory dimensions, and to identify specific groups of tourists based on three memory profiles: travelers with relatively episodic, or "snapshot", memories of the trip (scores of less than 9.0 out of 10 on both scales), travelers with strong reflective memories but weak transformative memories (scores of 9.0 or higher on the reflective scale, but less than 9.0 on the transformative scale), and travelers with both reflective & transformative memories (scores of 9.0 or higher on both scales). It should be noted that no respondents scored 9.0 on the transformative memory scale without scoring at least 8.0 on the reflective memory scale (8 people were between 8.0 and 9.0 on that scale), hence we did not include a "transformative memory only". We chose a strong memory threshold of 9.0 on both 10-point scales to provide a more conservative estimate of memory strength (i.e. only the strongest memories counted), with the assumption that self-reporting bias might lead to over-reporting of anticipated recollections immediately following a trip (Hosany et al., 2022).

After identifying different groups of travelers based on the autobiographical memory profiles they reported, we performed a series of ANOVA tests to compare associations between memory groups and (a) specific experiential outcomes (e.g. trip satisfaction, emotions) and (b) future behavior intentions (e.g. PEBI, support for tourism management). To minimize the likelihood of Type 1 errors (i.e. false positives) when conducting multiple hypothesis tests, we adjusted the familywise error rate using Tukey's HSD method to facilitate more conservative interpretations of results (Abdi & Williams, 2010). All analyses were conducted in IBM SPSS Statistics Version 28.0 (IBM Corp., 2020).

We analyzed qualitative data by coding responses to the open-ended motivation question and attributed one label to every word or phrase. We repeated the process until the point of saturation was reached (Saldaña, 2013). To ensure reliability, a second researcher also participated in the coding. Researchers deliberated until reaching a consensus about consistency in the use of the different labels. Figure 1 was constructed to summarize the most frequently mentioned labels among different groups of travelers previously identified based on the memory profiles they reported (*snapshot*, *reflective*, or *reflective & transformative*).

Results

Sample size and demographics

Our sample size across seven trips surveyed consisted of $n = 453$ respondents. Not all surveys were fully completed, therefore sample size varies in the different analyses presented. For quantitative analysis, we treated incomplete responses to specific questions as missing data. A

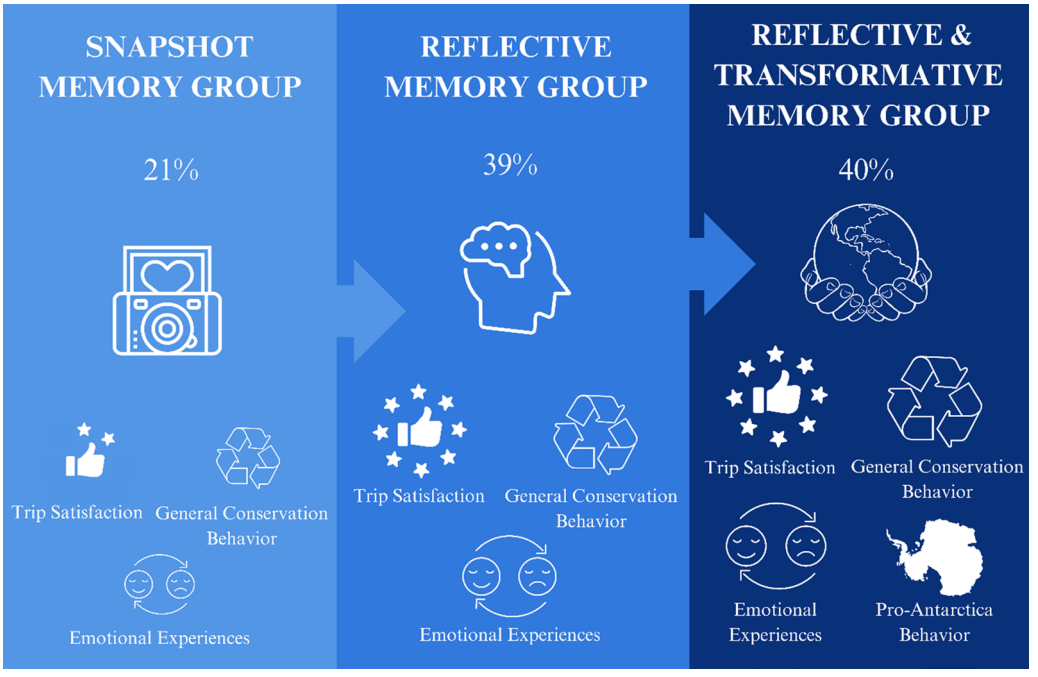

Figure 1. Antarctic tourists' autobiographical memory groups based on the memory profiles they reported.

total of 355 respondents corresponded to the sea-borne Peninsula modality while 98 respondents corresponded to the air-cruise Peninsula modality. Almost half of the respondents (46%) identified as Australian. The remaining half reported different nationalities including the USA (26%), France (6%), Canada (5%), the UK (5%), and New Zealand (5%), and 1% from other countries such as Germany, Italy, India, and Belgium. The mean age of participants was 61 years old, with 64% of tourists within the age range of 60–80 years old. About 26% of respondents were 40–60 years old, while just 9% were younger than 40 years old and 1% were 81 years or older.

The dimensionality of Antarctic tourism memories

Our PAF analysis (Table 1) revealed two distinct dimensions of autobiographical memories that closely aligned with the two dimensions (rehearsal and impact) identified by Jorgenson et al. (2019). We called these dimensions *reflective memories*, which focused on elements of rehearsal (e.g. thinking/writing about my trip), and *transformative memories*, which were likely to produce more significant impacts on one's life (e.g. changing the way I see the world). Tourists were more likely to report *reflective memories* ($M = 9.25$, SD = 1.09) than *transformative memories* ($M = 7.90$, SD = 2.05). On the reflective memories scale, 77.2% of respondents scored an average of 9.0 or higher; on the transformative memories scale, 39.9% scored an average of 9.0 or higher.

Defining experiential and pro-environmental behavior intention (PEBI) variables

We observed a single dimension for trip satisfaction (Table 2). Overall trip satisfaction ratings were very high ($M = 9.39$, SD = 0.74), 95.8% of respondents scored an average of 8.0 or higher, and 77.6% of respondents scored 9.0 or higher. The seven emotion items effectively measured

two categories: positive emotions ($M = 8.96$, SD = 1.18) and negative emotions ($M = 2.28$, SD = 2.57; Table 3). Respondents were much more likely to report positive emotions (63.6% scored an average of 9.0 or higher) than negative emotions (4.3% scored an average of 9.0 or higher) on the trip.

Based on PAF analysis, we grouped PEBI into three dimensions: (1) general conservation behaviors that can occur outside of the Antarctic context, and Antarctic-specific behaviors linked to either (2) financial contributions or (3) social environmentalism (Table 4). Respondents were more likely to report future engagement in general conservation behaviors ($M = 7.61$, SD = 2.25; 36.2% scored an average of 9.0 or higher) than Antarctic-specific financial contributions ($M = 6.31$, SD = 2.88; 23.5% scored 9.0 or higher). However, respondents were most likely to report future engagement in social environmentalism related to Antarctica ($M = 8.50$, SD = 2.10, 63.7% scored 9.0 or higher). We observed a single dimension underlying support for tourism management in Antarctica (Table 5). Overall support for tourism management ratings was relatively high (M= +4.02, SD = 1.23), and 67.8% of respondents scored an average of +4.0 or higher.

Memory dimensions and correlates

Correlation analyses showed significant positive relationships between mean scores on both autobiographical memory dimensions and every aspect of trip satisfaction (Table S1). However, correlations between trip satisfaction and reflective memories were generally stronger than those for transformative memories. On the other hand, transformative memory scores displayed stronger correlations with emotions experienced on the trip, including both negative and positive emotions (Table S1). Correlations between memory dimensions and positive emotions ($r = 0.573$ for reflective, $r = 0.591$ for transformative) were higher than correlations between either dimension and trip satisfaction ($r = 0.552$ for reflective, $r = 0.388$ for transformative).

Although scores on both the reflective and transformative memory scales were significantly and positively associated with PEBI and support for tourism management, intent to engage in future behaviors was more strongly associated with higher transformative memory scale scores ($r = 0.527$) than reflective memory scale scores ($r = 0.357$; Table S2). Support for tourism management in the Antarctic was also significant and positive, though differences between these correlations in the different memory scales were minimal (Table S2).

Characterizing tourists' memorable experiences

We identified three groups of tourists based on relative strengths across the different dimensions of autobiographical memories (Figure 1). Overall, 21% of respondents reported relatively weak or potential episodic memories only (hereafter, *snapshot memories*), 39% of respondents reported strong scores for reflective memories only (*reflective*), and 40% of respondents reported strong scores for both reflective and transformative memories (*reflective & transformative*). All autobiographical memory groups were comparable in terms of demographic attributes, including tourists' nationality and age. However, the *reflective & transformative* memory group showed the highest percentage (14%) of respondents in the age range of 21 to 40 years old.

Differences among the groups concerning experiential and PEBI variables were pronounced (Figure 2, Table S3). For example, respondents in both the *reflective* and *reflective & transformative* autobiographical memory groups reported higher levels of trip satisfaction than respondents in the *snapshot* memory group, $F(2,447) = 70.4$, $p < 0.001$. Differences between groups were even more pronounced for positive emotions, with the *reflective* and *reflective & transformative* memory groups reporting the strongest positive emotional experiences, $F(2,447) = 102.3$, $p < 0.001$. Surprisingly, the strongest negative emotional experiences were also observed for the *reflective & transformative* group, though overall expression of negative emotions was rare,

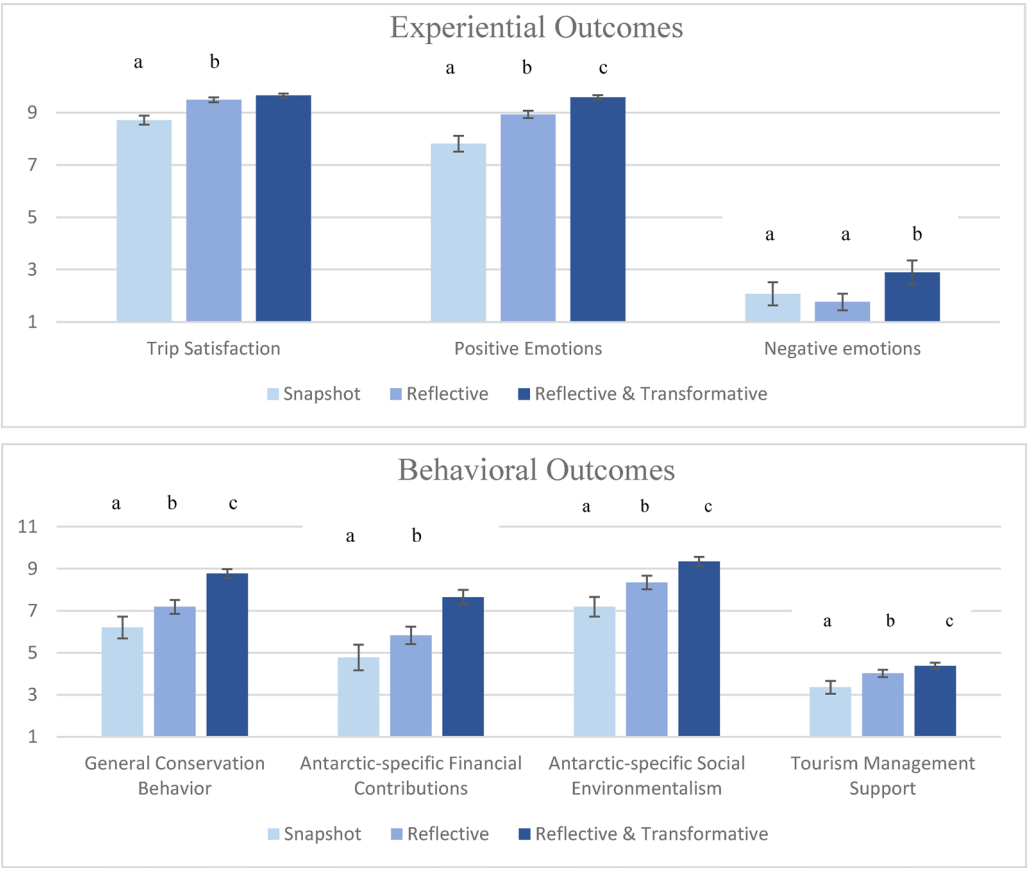

Figure 2. Results of ANOVA tests comparing mean scores of key experiential (trip satisfaction, emotions) and PEBI variables (conservation behavior, support for tourism management) associated with different groups of Antarctic tourists based on the autobiographic memories they reported following their trip (n = 429).
Superscripts denote significant differences among means based on post hoc Tukey's test at p = 0.05. Scores for all scales ranged from 0 to 10, except for tourism management support (-5 to +5). Memory categories were defined as follows: snapshot memories = individuals who scored <9.0 on both memory scales; reflective only = individuals who scored ≥9.0 on reflective memory scale but not on the transformative memory scale; reflective and transformative = individuals who scored ≥9.0 on reflective and transformative memory scale and reflective memory scale.

$F(2,434) = 9.0$, $p < 0.001$ (Figure 2, Table S3). Similar patterns were observed for all of the behavioral intention variables. In each case, respondents in the *reflective & transformative* memory group were significantly more likely than respondents in any other group to express intent to engage in general conservation behavior, $F(2,445) = 56.6$, $p < 0.001$, as well as pro-Antarctic behaviors such as financial contributions, $F(2,436) = 39.9$, $p < 0.001$, social environmentalism, $F(2,443) = 38.8$, $p < 0.001$, and support for tourism management, $F(2,448) = 23.3$, $p < 0.001$. Respondents in the *reflective* memory group also reported higher scores for all behavioral variables than individuals in the *snapshot* memory group. In summary, strong autobiographical memories—particularly transformative memories—were associated with more emotional experiences and stronger PEBI, including Antarctic-specific conservation behaviors, following the trip.

We analyzed the open-ended question "How did this Antarctic tourism experience affect you?" to gain additional insight into the influence of emotions on the formation of different tourist memory groups. We received a total of 210 quotes. Of these, 37 contained words or statements related to the *snapshot group*, 71 for the *reflective group*, and 102 for the *reflective &transformative* group. Our analysis resulted in 35 emotion labels and a total of 337 mentions

or statements related to those labels. Figure 3 shows the overlap of emotions reported by individuals across the three memory groups. Findings suggest that, in the majority of cases, the *reflective & transformative* memory group also reported emotions expressed by the other two tourist memory groups, but to a much higher degree.

The *snapshot* memory groups' responses resulted in 50 emotional labels (15% of all emotionally-laden statements came from this group) and an average of 1.3 emotions reported per person. The most frequently reported emotions for this group were learning, amazement, awareness, appreciation, concern, and enjoyment. Examples of quotes from respondents in this category include:

> *"I really enjoyed seeing all of the wildlife in its natural habitat. "and "I was impressed by this outstandingly beautiful wilderness".*

The *reflective* memory groups' responses resulted in 108 emotional labels (32% of all statements) and an average of 1.5 emotions reported per person. The most frequently reported emotions for this group were awe, awareness, amazement, appreciation, learning, need to protect, and respect. Examples of quotes in this category include:

> *"It makes you realize how small a place humans have on this planet" and "It was the most amazing experience of my life".*

The *reflective & transformative* memory groups' responses resulted in 179 emotional labels (53% of all statements) and an average of 1.8 emotions reported per person. The most frequently reported emotions for this group were similar to other groups: awe, awareness, amazement, concern, need to protect, and learning. However, this group also reported the highest frequency

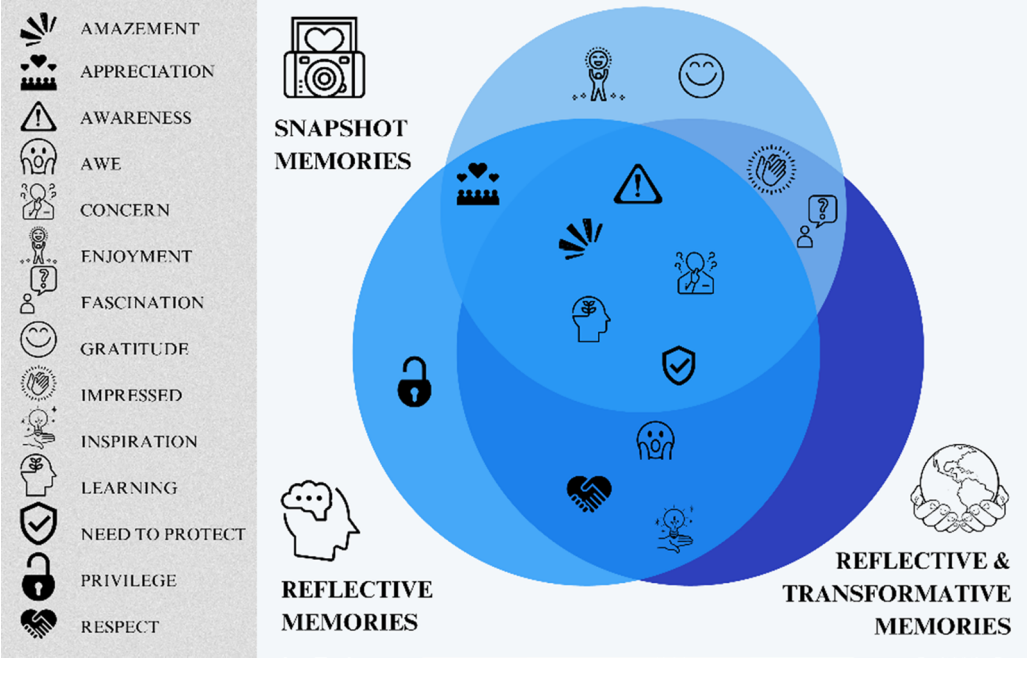

Figure 3. Top 10 emotions reported by tourists in the three autobiographical memory groups. The overlap shows that the reflective & transformative memory group also reported emotions expressed by the other two autobiographical memory groups, but typically to a higher degree.

of profound emotions related to the journey such as inspiration, bonding, transformation, privilege, and love. Examples of quotes from this category include:

> *"I will be forever changed. For the better" and "The experience was life-changing… We certainly will be ambassadors for Antarctica".*

Discussion

In this study, we identified distinct autobiographical memory profiles that result from an Antarctic tourism experience and explored the associations among memories, trip attributes, emotions, management preferences, and PEBI to determine if and how different memory profiles are linked to post-trip behavioral intentions. Several key findings emerged. First, different dimensions of memories resulted from the Antarctic tourist experience, and impactful transformative memories were less common than other types of memories. Second, trip satisfaction was a precursor to all autobiographical memory dimensions, but powerful emotional experiences were more commonly linked to memories of a transformative nature. Third, as our typology of tourists demonstrated, episodic or "snapshot" memories are unlikely to affect PEBI and management preferences, but stronger reflective and transformative memories are associated with these conservation-oriented outcomes.

The dimensionality of Antarctic tourism memories and experiential outcomes

Our PAF analysis using items adapted from the TAMS (Jorgenson et al., 2019) revealed two dimensions of autobiographical memories emerging from the Antarctic tourism experience. Over 77% of the respondents generated reflective memories, centered on rehearsal (e.g. thinking/writing about my trip), while 40% of the respondents generated transformative memories, expected to produce more significant impacts on one's life and even lead to personal transformation. These dimensions align with the results of Jorgenson et al. (2019) in their study using TAMS. The large portion of transformative memories reported by our sample suggests that Antarctica may be one of those "certain places" Morgan (2010) deemed to have the power to produce profound and life-changing memories among travelers. As Powell et al. (2012) noted, the Antarctic tourism experience is powerful, rich, and extremely complex. In addition to this transformative potential, the Antarctic journey could also trigger feelings of "eco-guilt" or "eco-shame", which may precipitate the change of eco-friendly or PEBI into actions in tourist destinations (Bahja & Hancer, 2021). Regardless of mechanisms, the formation of powerful memories (either reflective or transformative) could lead not only to an increase in awareness but also to the adoption of long-term pro-environmental beliefs and actions. In this way, memories can inspire actions that help define the still ambiguous "Antarctic ambassadorship" concept which previous studies have described but not adequately operationalized (Alexander et al., 2019).

Our results revealed positive correlations among the two autobiographical memory dimensions, trip satisfaction, emotions, management preferences, and PEBI. Strong correlations were found between reflective memories and trip satisfaction. In contrast, transformative memories showed stronger correlations with emotions (either positive or negative), management preferences, and PEBI. These findings align with past research suggesting that trip attributes and emotions, either positive or negative, can be cornerstones in fostering memorable experiences and future pro-environmental behavior (Kim et al., 2022a; Jarvis et al., 2016). Moreover, past research also revealed that the formation of memories was positively related to supporting management actions that promote the conservation of a destination (Huang et al., 2008; Tin et al., 2012). For instance, Hughes (2013) found that tourists are more likely to report increases

in their PEBI if they feel an emotional connection with what they are experiencing. In the case of Antarctica, the profound emotional connections acquired by tourists provide opportunities to transform pro-environmental intentions into the adoption of specific actions.

Our results also showed that even negative emotional experiences were associated with transformative memories, though these relationships were weaker than they were for positive emotions. Research has shown that negative emotions may contribute to positive outcomes, especially when they contribute to eudaimonic experiences by impacting people's perceived meaning in life (Nawijn & Biran, 2019). Massingham et al. (2019) found that negative emotions could act as mediators and prompt conservation engagement as these negative emotions could increase tourists' awareness of environmental issues (e.g. climate change). In the context of Antarctic tourism, negative emotions (such as sadness when realizing the effects of climate change or higher carbon footprints of polar travel) might inspire tourists to transition from intentions to actions and fight harder to protect one of the world's most imperiled environments. Hehir et al. (2023) found that last-chance tourism and experiencing a destination for the first time could act as precursors of PEBI. In the case of the Antarctic, this is relevant as most tourists (98% of our sample) reported this was their first trip to the continent while some of them also expressed an interest in seeing Antarctica before it is gone.

Responses to our open-ended question suggest that "awe" is the emotion most frequently experienced by Antarctic travelers. In the NBT experience literature, awe is considered one of the most anticipated emotional experiences for tourists (Coghlan et al., 2012). Researchers argue that "awe" could influence travelers' experiences, as the remembrance of experiences can create vivid and important memories (LeDoux, 1996). Powell et al. (2012), for instance, revealed that Antarctic travelers had experienced five dimensions of "awe": nature-human relationship, spiritual connection, transformative experience, goal clarification, and sense of feeling humbled. The emotions reported by our respondents, such as love, spirituality, transformation, bonding, commitment, and respect, generally correspond to these dimensions. These codes were also prominent across different memory groups in our sample, indicating that "awe" is one of the most powerful emotions when it comes to the formation of reflective and transformative autobiographical memories.

Emerging tourist memory groups in Antarctica

Using the two dimensions of autobiographical memories and their relative strengths among our respondents (i.e. memory profiles), we were able to identify three emerging groups of tourists. When examining the demographic attributes of tourist groups, the *reflective & transformative* memory group showed the highest percentage of respondents in the youngest age range (21 to 40 years old). Although a vast majority of Antarctic tourists are over the age of 60, this finding suggests that the Antarctic journey could be a unique opportunity to foster environmental awareness and long-term behavior changes among a new generation of Antarctic travelers that could play an active role in advocating for Antarctica's conservation in the future (Cajiao et al., 2022).

Tourists classified in the *snapshot* memory group (21%) were likely to recall specific components of their experience, but less likely to rehearse these memories and share them with others. Tourists classified in the *reflective* memory group (39%) were likely to reflect on their experience and continue thinking and talking about it into the future. The subset of tourists classified in the *reflective & transformative* memory group (40%) was likely to indicate that their experience somehow impacted them personally and altered their view of the world in some way, in addition to their strong reflective memories. Therefore, reflective memories appeared to be a prerequisite for transformative memories, as no respondents reported high transformative memory scores without also reporting high levels of reflective memories. The

autobiographical memory groups we identified constitute the first empirically-reported Antarctic memory typology. These groups are also comparable to those reported by Kaltenborn (1998) and Miller et al. (2020) in the Arctic. Like those studies, our research also suggests that the formation of stronger or more transformative memories moves through sequential phases that are significantly influenced by the uniqueness of a destination and the profound emotions and experiences that the destination generates.

While memory scores for all three groups of tourists showed significant positive correlations with trip satisfaction, positive emotions, management preferences, and PEBI, tourists in the *reflective & transformative* memory group reported the strongest relationships for all these variables. Associations between transformative memories and PEBI were especially strong. This finding adds empirical support that transformative memory formation matters because these autobiographical memories are closely linked to potential pro-environmental outcomes, both in general (Ballantyne et al., 2011b; Miller et al., 2020; Park et al., 2018; Jarvis et al., 2016, Huang et al., 2008) and in Antarctica specifically (Tin et al., 2012; Powell et al., 2012). By highlighting the value of transformative memories and how they might develop (i.e. *via* emotional connections to a place), this study provides several useful insights for tourism practitioners.

Management implications

Our results substantiate Powell et al. (2012) earlier findings that IAATO tour operators are generally effective at enhancing public awareness and conservation concerns by triggering reflective memories in a majority of Antarctic tourists. Their results also suggest that, by offering the opportunity to experience the continent firsthand, tour operators may be creating a corps of Antarctic ambassadors as purported by IAATO. As Morgan (2010), Mezirow (1997), and Soulard et al. (2021b) found, profound emotional experiences may lead to changes in behavior and the creation of transformative experiences. Antarctic tourism certainly offers this opportunity. However, achievement of broader pro-environmental outcomes is complex and not always straightforward (Miller et al., 2020). For instance, Alexander et al. (2019) pointed out that ambassadorship is not only about telling friends and showing photos once back home—common forms of rehearsal in the reflective memory group- but also about altering behaviors and taking concrete actions to defend Antarctica. In other words, ambassadorship also involves impact and transformation. In Alexander et al. (2019) words, it goes beyond "talking the talk" to "walking the walk". Our results confirm the existence of potential transformation among a subset of Antarctic travelers—those who report transformative memories following their experience - but uncertainty remains about its lasting effect. Grounded in this exploratory work, we offer some insights into specific actions that tour operators, guides, and travelers might consider maximizing the memory-making experience, inspiring more transformative memories, and solidifying long-term and tangible outcomes and impacts concerning Antarctic conservation.

Tour operators

Antarctic tourism is diversifying and increasing. Emerging markets hold an array of different motivations and interests that need to be managed (Carey, 2020). As Ballantyne et al. (2011a) argued, interpretive materials could be specifically tailored to meet the knowledge, interests, and needs of specific audiences. In the case of Antarctica, tour operators could consider developing "attractive learning packages" that could combine education with entertainment (Ballantyne et al., 2007; Knollenberg et al., 2014). This combination might facilitate the transition from the *snapshot* memory group to the *reflective* and ultimately the *reflective & transformative* memory group of tourists In addition to the Antarctic Ambassador LEAP[1] initiative sponsored by IAATO

(2022), tour operators might consider making conservation messages and opportunities more prominent following the trip. This could include the delivery of best practices and specific activities that tourists could implement back home and share within their community, thereby magnifying the conservation impacts of a single trip. Citizen science, voluntourism, and experiential learning-specific programs like *Students on Ice* are other examples of environment-centered educational approaches. In Antarctica, tour operators have been supporting tourist engagement in citizen science projects for a variety of research topics (Cusick et al., 2020). Citizen science projects provide tourists with a hands-on experience that could generate powerful memories and lasting impacts, especially if visitors can continue virtual participation in projects after their trip. Another way to get support could be involving influential stakeholders (e.g. politicians, and activists) in specific trips as they can be inspired to take political or policy-focused action in support of climate change mitigation initiatives.

Tour guides

Tour guides could leverage the power of memories by moving beyond traditional education and interpretation strategies to encourage storytelling from both staff and tourists. Soulard et al. (2021a) emphasize the power of narratives to create transformative experiences, including the use of drawings to reveal tourists' emotions and concerns. Such stories can create a direct and emotional connection with nature that resonates with diverse audiences (Miller et al., 2020). Ballantyne et al. (2011b) emphasized the importance of connecting with tourists' prior knowledge and experiences. Weaving facts into meaningful messages could enable guides to help tourists find links between their previous experiences and the issues being interpreted and learned, especially for Antarctic tourists who often hold high levels of environmental consciousness (Cajiao et al., 2022). Therefore, memories about newly gained knowledge could be reinforced and recalled with personal relevance if guides employ persuasive communication that connects conservation challenges with everyday actions. This would increase the likelihood that a trip experience leads to voluntary behavior change as seen in other contexts (Ardoin et al., 2020; Ballantyne et al., 2011a).

Tourists

Tourists could reflect on the different types of autobiographical memories that emerge following a trip and how those memories are experienced. Tourists might ask: "What is my impact, and what actions could I do to make a change?" For some tourists who merely want to reflect on the experience, they can find ways to share their travels, and lessons learned, with others. Travelers who embrace both reflective and transformative memories might seek out tangible conservation actions—either locally or globally—and engage with social networks to make memories last. Conservation projects and programs around the world are trying to inspire collective action by fostering local actions that, once scaled up, could make an impactful change (Ardoin et al., 2020). Short-term personal activities could include participating in community environmental projects and identifying solutions to tackle local environmental problems. Such actions might also be supported by businesses adopting sustainable practices that could be replicated by their clientele, helping to mobilize an environmentally conscious population inspired to generating positive impacts. Memorable tourism experiences could help to expedite this process.

Limitations and future research

This study was constrained by several limitations. First, the logistical challenges of administering surveys with only three participating tour operators and a modest sample size of Antarctic tourists

constrained the research design and sample size. Consequently, the generalizability of our findings is limited. Fortunately, our sample reflects general demographic trends among Antarctic tourists reported by IAATO (2021). Some results may be biased by our skewed market segment (e.g. the majority of Australian travelers) and our participating tour operators. Self-reporting bias could have also resulted in a ceiling effect for all variables, especially considering the pro-environmental proclivities of many Antarctic travelers (Powell et al., 2008). Furthermore, our results can only suggest that memories gained by some tourists have the potential for transformative impacts in the future. Hughes (2013) and Miller et al. (2020) described this effect of diminishing returns over time and cautioned that outcomes reported immediately after a tourism experience might not represent enduring recollections or behaviors once a traveler returns home. Thus, it is not clear if the autobiographical memories and PEBI that were reported by our sample right after the trip would translate into lasting memories or long-term actions.

Decades of research reveal that intent is often a strong precursor to behavior (Ajzen, 2012), suggesting the potentially transformative memories might indeed inspire pro-environmental thinking and action. However, longitudinal studies are needed to illuminate these long-term impacts and the associated pathways linking memories, attitudes, and behaviors and assess concrete changes from PEBI to actual behaviors (Ardoin et al., 2020; Coghlan & Gooch, 2011, Reis et al., 2015). While our work utilized an adapted version of the TAMS (Jorgenson et al., 2019), future studies should consider an expansion of memory constructs using other scales such as the Memorable Tourism Experience scale (Kim et al., 2012; Hosany et al., 2022) or the Transformative Travel Experience Scale (Soulard et al., 2021b) to assess the dimensional structure of memories. In addition to assessing how autobiographical memories are reported by tourists, studies might also investigate the electrophysiological and neural pathways through which these memories form and how they are accessed by respondents (Herweg et al., 2020). Given the powerful influence of emotion on memory formation, future research could also emphasize the operationalization and assessment of emotional experiences in tourism (Kim et al., 2022b).

Conclusion

Past tourism and outdoor recreation research have not effectively captured the essence of transformative experiences and how they are remembered by tourists, particularly in polar regions. Our research fills this important gap by exploring the relationship between reflective and transformative autobiographical memories and PEBI produced by the Antarctic journey. While more research is needed to understand the factors that fuel different types of memories in tourism and the broader impacts on participants after their trip, our study offers some initial insights into specific actions that could be considered by Antarctic tour operators, guides, and tourists themselves to cultivate memorable experiences. We illustrate how a transition from snapshot to reflective and ultimately transformative memories increases the likelihood of long-term pro-environmental outcomes—an especially important finding considering growing concerns about the environmental impacts and unsustainability of many contemporary tourism operations including those in Antarctica (Capocchi et al., 2019). By leveraging the power of memory-making in Antarctic tourism, managers would be better positioned to cultivate a robust Antarctic ambassadorship program that is much needed in the post-pandemic world with anticipated volumes of Antarctic travelers higher than ever before. Future research could also help to illustrate how memorable tourism experiences emerge and impact tourist behavior in other contexts.

Note

1. **L**oves and respects the region, **E**ducates others by sharing their Antarctic experiences, **A**dvocates for Antarctica when opportunities arise, and **P**rotects the region by making positive changes at home.

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