The Impacts of Climate Change Interpretation on Leisure Experiences: A Lab-based Experimental Design Approach

by

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Abstract

Climate change has caused rapid environmental transformations in the Canadian Rocky Mountain Parks. One of the most observable impacts has been the dramatic reduction of glacier mass throughout Jasper National Park. This reduction poses challenges to tourism operations. While commercial operators in this area have an opportunity to incorporate the story of climate change into their interpretive programs, they appear to be reluctant to do so in fear of negatively impacting their clients' leisure experiences.

The purpose of this study was therefore to examine how incorporating a climate change interpretive component into a commercial snocoach tour impacts visitors' leisure experiences at the Athabasca Glacier in Jasper National Park, Alberta. A lab-based experimental design was employed to compare the leisure experiences of an experimental group exposed to a climate change component during a simulated tour to a control group that did not receive this treatment. The simulated tour took the form of a written script of the experience supported by photographs. Sixty university students in the 18 to 25 years old cohort participated in this study, with 30 of these being randomly assigned to each group.

Results showed that incorporating a climate change interpretive component into a commercial snocoah tour resulted in a significantly more satisfying leisure experience for participants, and also provided them with a significantly improved educational experience. Results also indicated that there were no significant negative impacts on the three other dimensions of leisure experiences, namely: entertainment, escapism, and aesthetics. These findings suggest that tourism operators can introduce climate change interpretation into their commercial tours in a way that actually improves their clients' overall satisfaction with the tour.

Clients can also learn about climate change without diminishing the entertainment, escapism, and aesthetic dimensions of their leisure experience.

Preface

This thesis is an original work by Mu He. The research project, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board under the Project Name “The impacts of a climate change interpretive program on visitors' leisure experiences,” No. Pro00081550, 07/09/2018.

Dedication

I dedicate my thesis to my mother and father, Liu Ye and Yongqiang He. Their love for me was the best support that I received during the time I spent completing my Master's degree.

I also dedicate this thesis to the Canadian Rockies and the Columbia Icefield in particular. This gorgeous region has nurtured my growing passion for tourism research.

Acknowledgement

Studying in a foreign country as an international student is often characterized by: pleasure, excitement, surprises, confusion, depression, and loneliness sometimes. I am fortunate that I have received whole-hearted support from many individuals and agencies throughout my Master's program.

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Chapter 1: Introduction

The purpose of this study is to examine how incorporating a climate change interpretive component into a commercial snocoach tour impacts visitors' leisure experiences at the Athabasca Glacier in Jasper National Park, Alberta. Study results may help commercial tourism operators to make an informed decision about whether to add a climate change interpretive component into their nature-based tourism programs.

This thesis is organized in a paper based format and will feature three chapters. Chapter one contains a broad review of literature and provides the overarching rationale for the research study. Chapter two presents the manuscript that will be submitted for review to an appropriate scholarly journal. Its component parts include sections titled: introduction, literature review, methodology, results, discussion, conclusion and references. Chapter three summarizes the broader implications of the study and features more in depth discussions on the theoretical, practical, managerial and methodological implications of the study.

This introductory chapter contains five sections. Section 1.1 presents scientific evidence to demonstrate that climate change is real and poses serious risks to our planet. Focusing on tourism industry, section 1.2 discusses how climate change impacts tourism and how the tourism industry is responding to climate change. This section provides the context in which the research objective for this study was developed. Section 1.3 discusses how the climate change interpretive component was articulated for this study. Section 1.4 focuses on the concept of the visitors' leisure experience including its importance to the interests of commercial tourism operators. Drawing from these discussions, section 1.5 presents the research question that frames the

manuscript that follows in Chapter 2 and also introduces the experimental design research method adopted for the study.

1.1 The Reality of Climate Change

Climate change is defined as "a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer" (IPCC, 2012, p. 557). The Intergovernmental Panel on Climate Change (IPCC) has provided compelling evidence that the world's climate is changing (IPCC, 2014). Their studies show that average global temperatures have increased by approximately 0.85°C, from 1880 to 2012 with associated global impacts including: more extreme temperatures, diminishing volumes of snow and ice, and rising sea level along with other uncertainties (IPCC, 2014). These changes are likely to result in "severe, pervasive and irreversible impacts for people and ecosystems", thereby putting the world at risk (IPCC, 2014, p. 8). Figure 1.1 shows average annual global air temperature anomaly from 1850 to 2017, and demonstrates that global air temperature has been growing at an increasing rate since the 1980s. A temperature anomaly is defined as "the difference between the long-term average temperature and the temperature that is actually occurring" (Exploring the Environment, 2019). From 1980, the temperature anomalies have showed a positive trend reflecting the fact that the actual temperatures are warmer than normal (Exploring the Environment, 2019). Empirically based studies have confirmed that climate change is a reality in Canada and has impacted our natural environment, industrial sectors, and human well-being (Warren & Lemmon, 2014). Given such evidence, the Government of Canada (Environment and Climate

Change Canada, 2016) has declared that climate change is one of the greatest challenges of our time.

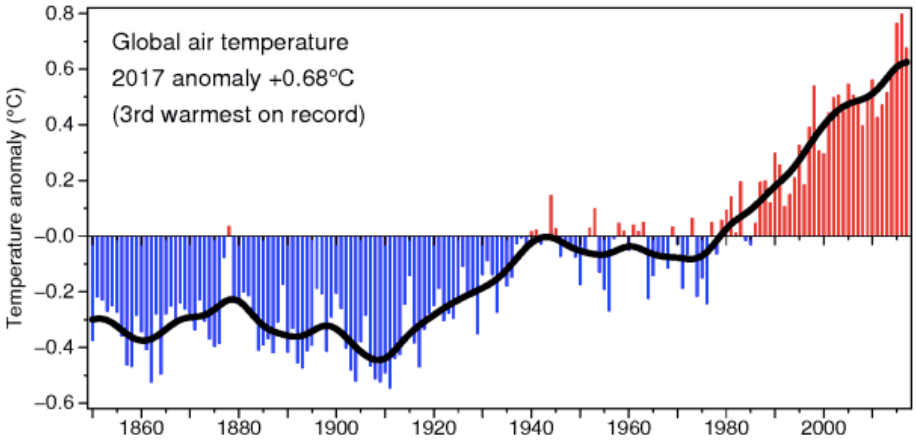

Figure 1. 1 Global air temperature anomaly (Climatic Research Unit, 2018)

Greenhouse gases, such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) have increased exponentially since 1750, when the industrial revolution began (IPCC, 2014). The 2013 report of IPCC confirmed these "Natural and anthropogenic substances and processes that alter the Earth's energy budget are drivers of climate change" (IPCC, 2013, p. 13). Research evidence indicates that natural processes alone have not led to the current changes in climate (Hall et al., 2015). In fact, the IPCC is 95% certain that human beings are the main cause of global warming (IPCC, 2014).

Although scientific evidence supports the above state of climate change, it remains a controversial topic in society (Hvenegaard, Marshall & Lemelin, 2016; Melena, 2014). Climate

change sceptics hold the view that the climate change science and its research methods are fundamentally flawed (Oldfield & Steffen, 2014; Shani & Arad, 2014). They believe that there is not enough evidence to prove that the increasing temperature is caused by human activities. Instead they see this condition as a natural process of the earth (Spencer, 2007). Such views are not science-based but remain persistent in the non-scientific community (Hall et al., 2015; Oldfield & Steffen, 2014). Based on scientific evidence, the current study takes the position that climate change is real, that it is rooted in a large part in anthropocentric activities, and that the global environment is being largely negatively impacted. As Oldfield and Steffen (2014, p. 74) summarized, "The bottom line is clear. Denying the relevance and validity of Earth System science is a highly risky, and possibly catastrophic, approach for humanity to take towards its future." For this reason, we need to act now to modify human behavior and to mitigate climate change.

1.2 Climate Change and Tourism

Tourism is a significant contributor to climate change, with estimates that it is responsible for approximately 8% of the world's greenhouse gas emissions (Dubois & Ceron, 2006; Lenzen et al 2018). In turn, tourism is also a climate-sensitive industry (Amelung, Nicholls, & Viner, 2007; Kaján & Saarinen, 2013; Scott, Hall, & Gössling, 2016). First, climate change has a direct impact on tourism because it changes the parameters of climate as an attraction or a condition found in tourism destinations including those related to temperature, precipitation, and wind (Dubois & Ceron, 2006; Fang, Yin, & Wu, 2018). For example, a shorter winter typically has negative implications for the alpine ski industry because it can result in fewer skiable days. In

response, many ski resorts are increasingly relying on artificial snow during the traditional ski seasons to meet the demand for this activity and to stay financially viable (Hewer & Gough, 2017; Hopkins, 2014; Scott, McBoyle, Minogue & Mills, 2006). Climate change also has an indirect impact on tourism, especially nature-based tourism, because it often changes the environmental parametres of tourism, such as those found in the biophysical environment (Scott et al., 2007). For example, it has been observed that glaciers throughout the world are retreating at an unprecedented rate because of climate change (IPCC, 2013; Welling et al., 2015; Palomo, 2017). This retreat has resulted in a reduction in the number and quality of glaciers as tourist attractions and has negatively impacted visitors' perceptions of ecological integrity and aesthetic quality associated with these attractions (Groulx et al., 2017; Stewart et al., 2016).

In Canada, studies have shown that climate change poses several challenges to tourism in the Canadian Mountain National Parks with new challenges likely to emerge in the future (e.g. Luckman & Kavanagh, 2000; Scott, Jones & Konopek, 2007). One of the observed glacial focal points of climate change impacts in these parks is the rapid reduction of the Columbia Icefield in Jasper National Park. For example, the Athabasca Glacier, a popular tourist attraction which flows out of the Columbia Icefield, has retreated about 1.5 km to 2 km over the last one hundred years (Parks Canada, 2017; Tennant & Menounos, 2013). Other changes attributed to climate change, such as slope destabilization of the glacier's lateral moraine, pose increasing challenges to the operation of tourism activities at this site (Hugenholtz, Moorman, Barlow & Wainstein, 2008) as does the projected disappearance of this glacier by 2100 (Clarke et al., 2015). As a result of these changes, national parks administrators and tourism operators in this region have to modify tourism provision at this site.

Two types of strategies are frequently considered in response to climate change: adaptation and mitigation (United Nations, 2018; IPCC, 2014). Adaptation refers to "the process of adjustments to actual or expected climate and its effects in order to lessen or avoid harm or exploit beneficial opportunities" (IPCC, 2014, p. 76). Adaption strategies are meant to reduce the negative impacts of climate change on industries like tourism. In contrast, mitigation refers to "the process of reducing emissions or enhancing sinks of greenhouse gases, so as to limit future climate change" (IPCC, 2014, p. 76). The priority of mitigation is to limit the negative impacts of industries on climate. Although these two strategies have different priorities, both of them can limit climate change impacts (IPCC, 2014, p. 76).

One of the options for modifying tourism products is providing interpretive programs about climate change at impacted sites because observable physical impacts make them powerful settings for climate change education. Such educational strategies can reflect mitigation as well as adaptation objectives. Despite this opportunity, not all tourism providers are keen to discuss climate change with tourists because it is controversial, complex, and potentially depressing (Goldberg et al., 2018; Hvenegaard et al., 2016; Lemieux et al., 2018; Moser, 2010). This sensitivity is especially acute for commercial tour operators as their businesses depend on providing satisfying leisure experiences to their clients. These operators are concerned that climate change interpretation will have a negative impact on their clients' enjoyment thereby undermining the financial viability of their businesses (Goldberg et al., 2018). However, no published studies have been found that test this assumption.

To address this omission, the purpose of this study is to explore how incorporating a climate change interpretive component into a commercial snocoach tour impacts visitors' leisure experiences at the Athabasca Glacier in Jasper National Park, Alberta. This study examines the

research purpose in the context of commercial snocoach tours of the Athabasca Glacier for several reasons. First, climate change affects this site, with many significant climate-driven environmental changes documented through scientific studies. The physical impacts of the change can be effectively highlighted in dramatic fashion on the site with relatively small modifications to existing snocoach tours (Parks Canada, 2017; Tennant & Menounos, 2013). Second, the Athabasca Glacier is a popular tourist destination in Canadian Rockies and is the site of a mass tourism product (i.e., snocoach tour), which currently has not officially incorporated a substantial climate change interpretive component (Parks Canada, 2017; Sandford, 2016). Third, Parks Canada, local ecotourism operators, and other researchers (Parks Canada, 2010; Swartmen, 2015) have noted the educational value of climate change interpretation at the Athabasca Glacier.

1.3 Climate Change Interpretation

It is important to carefully consider how to best communicate messages about climate change through an interpretive program aimed at mass tourists participating on a commercial tour of a nature based attraction. Climate change is a big story, which includes a complex range of information that can be presented from a broad range of perspectives including: professional, public, political, academic, commercial, indigenous, and religious (Daniels & Endfield, 2009). These stories are called narratives and need to account for the grounded experience and interests of the audience.

Climate change interpretive narratives can be constructed at both a global and local scale (Daniels & Endfield, 2009; Hallegatte, Przyluski & Vogt-Schilb, 2011). However, narratives at a global scale are often perceived as complex and distant because they involve detailed

information about politics, economics, poverty, growth, social inequality, and neoliberal theories of government as well as the basic science of climate change (Hallegatte et al., 2011; Liverman, 2009). Given the abstract nature of some narratives, audiences may not feel personally empowered to take action on climate change as the merit of individual actions are not obvious at this scale (Brownlee et al., 2013). In addition, a mass tourism context is different from a formal educational setting because learning is normally not the dominant motive for travel in this context. Therefore, interpretive messages about climate change in a tourism setting should be relatively simple and locally based. A climate change interpretive component should promote visitors' connection to the tourist destination and the climate change issue (Brownlee et al., 2013; Lemieux et al., 2018). Therefore, a simple narrative situated at a place-based (local) scale is advisable. Within the tourism literature, a limited number of empirical studies have examined how a place-based climate change interpretative strategy could impact visitor experiences in national parks (Barrett & Mowen, 2014; Schweizer et al., 2013). Details of these studies are discussed in Chapter 2.

Among the many narrative options that exist about climate change, an "everyday life narrative" is used in this study. The decision to use this narrative is based on the view that climate change should not be separated from our everyday life (Lejano, Tavares-Reager, & Berkes, 2013; O'Neill & Nicholson-Cole, 2009; Weingart, Engels, & Pansegrau, 2000). The distinguishing feature of this narrative is the transition from a "public understanding of science" to a "public engagement with science" (Lejano et al., 2013, p. 62). In this type of narrative, the audience processes the narrative based on their past. They consider climate change as an issue that impacts them personally so they actively search for a resolution at a personal level (Lejano et al., 2013). The "everyday life narrative" is, therefore, considered to be non-threatening

although it encourages self-reflection thereby making it suitable in a tourism context (Lemieux et al., 2018; Melena, 2014). The "everyday life narrative" has therefore been adopted for this study and is discussed further in Chapter 2.

1.4 Visitors' Leisure Experiences

The visitors' leisure experience is a complex psychological process and concept because it involves a person's emotional, physical, spiritual, and intellectual actions (Kleiber, Walker, & Mannell, 2011; Morgan, Lugosi, & Ritchie, 2010). According to Pine and Gilmore's (1999) idea of the "experience economy", providing a unique, memorable and satisfying visitor experience is an important way to maintain and promote sustainable competitive advantage in the tourism market (Morgan, Lugosi, & Ritchie, 2010). Commercial tourism operators are particularly sensitive to visitors' leisure experiences, as their business success depends on satisfied customers (McNicol & Rettie, 2018). For example, commercial tour operators at the Great Barrier Reef were hesitant to tell the story about climate change to their clients because they were afraid that the information would spoil what would otherwise be an enjoyable experience (Goldberg et al., 2018). Therefore, compared to public agencies such as Parks Canada, commercial tourism operators are typically very cautious about introducing controversial climate change elements to their tours.

The existing commercial snocoach tour at the Athabasca Glacier is a tourism product designed to provide visitors with satisfying leisure experiences. The company offering snocoach tours at this site promotes their product as a thrilling once-in-a-lifetime experience (Pursuit, 2019). Such promotion indicates that the leisure experience associated with the tour is meant to

be an exciting, enjoyable, and memorable one for visitors. The drivers of the massive vehicles used on the tour (i.e., the snocoaches), also serve as interpreters, providing their passengers with information about the Athabasca Glacier including its surrounding environment and history. They also introduce basic information about the snocoach. Similar to the reluctance of operators to discuss climate change during tours of the Great Barriar Reef, there appears to be a concern that providing insights into climate change during snocoach tours at the Athabasca Glacier may decrease client satisfaction with the tour. In contrast to many other types of environmental process that readily featured in such programs, climate change is a controversial topic that is characterized by: invisible causes, distant impacts, complexity, uncertainty, and unclear strategies for issue resolution (Brownlee et al., 2013; Moser, 2010). In addition, operators may feel that messages about climate change may increase worry, concern, and fear, when audiences do not receive "information that allows them to translate their feelings into remedial action" (Moser, 2010, p. 40; Salama & Aboukoura, 2018).

1.5 Research Question and Research Approach

The purpose of this study is to examine how incorporating a climate change interpretive component into a commercial snocoach tour impacts visitors' leisure experiences at the Athabasca Glacier in Jasper National Park, Alberta. Framed as a question, this study asks: *What would the impact be of incorporating a climate change interpretive component into a commercial snocoach tour at the Athabasca Glacier be on their clients' leisure experiences?* Young adults in the 18 to 25 years old cohort who were studying in the University of Alberta were targeted as research participants in this study because university students today are likely to

be the consumers of this type of attraction in the future. This claim is supported by the social demographic findings of existing research on glacier tourism that indicates that about two thirds of their research participants were university-educated (Groulx et al., 2019; Lemieux et al., 2017; Stewart et al., 2016; Weber, 2017). Visitors' leisure experience will be measured using the concept of overall satisfaction and Oh et al.'s (2007) measurement scale which originated from Pine and Gilmore's "experience economy" concepts including: education, entertainment, escapism, and aesthetics. Overall satisfaction will be measured by asking visitors how satisfied they were with the snocoach tour. The results of this study may provide further insight to commercial tourism operators of the impact of the addition of a climate change component on their clients' leisure experiences while on the simulated tour. The operator may then be in a position to make a more informed decision about the inclusion of this component to their tour.

To address the research question, an experimental design was selected. Questionnaire-based surveys are most commonly used research method in tourism and leisure studies (Fong et al., 2016; Veal, 2011). This bias for survey research leaves considerable room for tourism and leisure researchers to adopt other research methods. While experimental design methods are widely used in natural science disciplines, they are receiving increasing attention in tourism and leisure studies, especially in marketing and psychological areas (Fong et al., 2016; Jennings, 2010; Walker, Scott, & Stodolska, 2016). Generally, experimental design is believed to be a reliable research method to test the relationship of specific variables that can be manipulated by researchers during the experiment (Veal, 2011). The manipulated variables are referred to as the independent variables with the effects of these manipulations being measured relative to changes in the dependent variables (Veal, 2011). The independent variable is manipulated by the assignment of study participants into an experimental group and the control group. Random

assignment of participants to each group normally ensures that the other variables are controlled and that members of each group have similar backgrounds (Trochim, Donnelly, & Arora, 2015). Members of the experimental group receive the intervention while members of the control group do not (Trochim et al., 2015). The effects of the intervention are demonstrated by comparing responses from the two groups (Trochim et al., 2015).

Examples of the use of experimental design in studies related to climate change and tourism are relatively rare but can be found in the literature. For example, Barret and Mowen (2014) investigated the effectiveness of artistic place-based climate change interpretation. They suggested that the pre- and post-test experimental design with random assignment could be used to address similar questions in future research. Most recently, a field experimental design was successfully used to study whether information about climate change provided to zoo patrons influenced their intentions to adopt sustainable behaviors (Bueddefeld & Van Winkle, 2017). Experimental design has also been used in previous studies to examine effects of non-climate change messages in interpretive programs. For example, researchers have adopted experimental design approaches to explore: (1) the impacts of interpretation on behaviors of visitors to a World Heritage Site (Littlefair & Buckley, 2008); (2) the impacts of different interpretive messages on learning transfer (Van Winkle & Backman, 2011); and (3) the impacts of interpretation in wildlife tourism on visitor behavior (Marschall, Granquist & Burns, 2017). The above studies confirm that the experimental design is an effective way to determine how tourism based interpretive programs can impact visitor behaviour. To date, however, there does not appear to have been any studies that have use an experimental design approach to explore the impact of a climate change interpretive component on visitor leisure experiences in a mass tourism context.

Chapter 2: The Impact on Leisure Experiences of Incorporating a Climate Change Interpretive Component into a Commercial Snocoach Tour at the Athabasca Glacier

Abstract

Rapid environmental changes caused by climate change have challenged commercial tourism operators working in sensitive alpine environments. Evidence of climate change at these sites also provides an opportunity for operators to offer interpretive programs on this subject as part of their tours. However, there is a perceived risk in doing this, as the impacts of climate change interpretation on visitors' leisure experiences are unknown. Using a commercial snocoach tour at the Athabasca Glacier in Jasper National Park as a study setting, this lab-based experiment compared the leisure experiences of an experimental group of young adults exposed to climate change information during the interpretive program to participants of a control group who did not receive this information as part of their simulated tour. All other aspects of the simulated tour were identical. Results indicated that incorporating a climate change interpretation had a significantly positive impact on visitors' overall satisfaction and on the education dimension of the leisure experience. No significant negative impacts were found in terms of the other three individual dimensions of leisure experiences (i.e., entertainment, escapism, and aesthetics). These findings provide positive signals for tourism operators who may be concerned about the risks of introducing an environmental change component to their product for fear of eroding the leisure experience of their patrons. This study also contributes to tourism and leisure literature by adopting an experimental research design, which may prove useful in addressing similar types of research questions.

Keywords: climate change; interpretive program; leisure experience; experimental design

2.1 Introduction

Climate change has been recognized as one of the greatest challenges of our time with its diverse and widespread global impacts (IPCC, 2014; United Nations, 2018). Compelling evidence indicates that climate change is threatening many of the world's ecosystems (IPCC, 2014; Warren & Lemmen, 2014). It currently poses several challenges to tourism in the Canadian Mountain National Parks with new challenges very likely to emerge in the future (e.g. Luckman & Kavanagh, 2000; Scott, Jones, & Konopek, 2007). For example, the Columbia Icefield, one of the iconic destinations in Jasper National Park, has experienced rapid reduction in mass that has been attributed to increasing temperatures (Jasper National Park, 2017; Luckman & Kavanagh, 2000; Sandford, 2016; Tennant & Menounos, 2013). Parks Canada (2010, p. 1) has stated that glaciers on the Columbia Icefield are "poignant indicators of climate change", which suggests that the icefield could be valuable as an outdoor classroom for climate change education.

However, interpreting climate change is not easy because it is controversial (e.g., invisible causes, distant impacts, uncertain futures), and may be poorly received by visitors who are simply seeking an enjoyable holiday experience (Moser, 2010; Bueddefeld & Van Winkle, 2017). For example, there is a concern that messages about human-induced greenhouse gas emissions may detract from visitors' leisure experiences, which seek to entertain and educate visitors at the same time (Barrett & Mowen, 2014). This anxiety is especially true for commercial tour operators who are very sensitive to the quality of their clients' leisure experiences as the profitability of their businesses depends on their customers having positive experiences (Goldberg et al., 2018; McNicol & Rettie, 2018). The potential environmental benefits of providing climate change interpretation include: deepening visitors' connection to the

specific place, increasing visitors' awareness of the causal relationships between climate change and human behaviors, and encouraging their pro-environmental behaviour (Brownlee, Powell, & Hallo, 2012; Lemieux et al., 2018; Schweizer, Davis, & Thompson, 2013). However, no published studies have focused on how such interpretation impacts visitors' leisure experiences during a commercial tour. The purpose of this study was, therefore, to examine how incorporating a climate change interpretive component into a commercial snocoach tour impacts visitors' leisure experiences at the Athabasca Glacier in Jasper National Park, Alberta.

2.2 Literature Review

2.2.1 *Climate change and tourism at the Athabasca Glacier*

The impact that climate change has on the environment has attracted considerable attention in the tourism context (Dubois & Ceron, 2006; Kaján & Saarinen, 2013; Scott, Gössling, & Hall, 2012). In Canada, climate change has already affected the popular Canadian Rocky Mountain Region, which attracts approximately nine million visitors annually (Parks Canada, 2017). One of the best examples of climate change impacts in this region is the rapid retreat of the Athabasca Glacier in Jasper National Park [JNP] (Luckman & Kavanagh, 2000; Sanseverino & Higgs, 2018). Over the last one hundred years, this glacier has retreated about 1.5 km and has lost half of its volume due to an increase in annual temperature of 1.5°C (Parks Canada, 2017; Tennant & Menounos, 2013). This retreat has also resulted in the slope destabilization of the glacier's lateral moraines, which poses challenges to the operation of tourism activities (Hugenholtz, Moorman, Barlow, & Wainstein, 2008). Furthermore, this process of retreat appears to have accelerated since the 1980s when the average annual

temperature increased dramatically (NASA, 2018; Sandford, 2016). A time-lapse animation model suggests that if this warming trend continues, most of this glacier will disappear by the end of this century (Clarke et al., 2015).

In response to climate-induced environmental changes, tourism operators in this and similarly impacted glacial regions have modified their operations (Benur & Bramwell, 2015; Kaján & Saarinen, 2013; Lemieux et al., 2018; Stewart et al., 2016). Two studies in particular have focused on the tourism at the Athabasca Glacier. Groulx, Lemieux, Lewis and Brown (2017) explored how climate-driven environmental changes to this glacier could influence consumer behaviors using three visualized scenarios (i.e. current conditions, potential climate change impacts in 2050, potential impacts with adaptations in 2050). This study suggested that visitors' consumer behaviors were influenced by the changes in natural landscapes. Results of visitor survey indicated that climate-driven environmental changes decreased the attractiveness of the Athabasca Glacier as a tourism destination from the perspective of visitors. They also found that a desirable visitor experience at the Athabasca Glacier should be a natural experience highlighting the unique identity of the site. The authors indicated that the study respondents felt that the projected adaptations to the site detracted from the naturalness of the alpine environment. For example, the use of helicopters to provide access to the glacier under future scenarios was seen to make noise, spread dust, and release more greenhouse gases thereby accelerating climate change. These findings have implications for the development of tourism products for park managers and tourism operators. The authors suggested that protected areas agencies (e.g. Parks Canada) and related stakeholders (e.g. commercial tour operators) should consider climate change adaptation strategies in a natural way, meaning that the adaption should maintain the naturalness and ecological integrity of the setting (Groulx et al., 2017). Providing

visitors with a climate change interpretive program is consistent with this recommendation. The second study investigated tourists' motivations to visit the Athabasca Glacier (Lemieux et al., 2018). This on-site study found that "last chance tourism" was an important motivation for visiting this glacier. Furthermore, this motive was strongly associated with visitors' desire to learn about the impacts of climate change at the Athabasca Glacier (Lemieux et al., 2018). Both of these studies suggested that there is an opportunity to provide interpretive programs about climate change at the Athabasca Glacier.

However, providing interpretation about climate change may be challenging in a leisure context, as the topic is controversial, complex, and potentially depressing (Goldberg et al., 2018; Hvenegaard, Marshall, & Lemelin, 2016; Lemieux et al., 2018; Moser, 2010). From the perspective of commercial tourism operators, ensuring that clients enjoy a high quality leisure experience is a priority because the viability of their businesses relies on satisfied clients (McNicol & Rettie, 2018). It is, therefore, important to understand the potential impacts of climate change interpretation on clients' leisure experiences.

2.2.2 Climate change interpretation

Empirical studies have explored how climate change interpretation could affect visitor experiences in public settings such as national parks. For example, Schweizer et al. (2013) proposed and validated a theoretical framework for climate change interpretation in places where climate change impacts are evident such as national parks. These researchers found that national parks can provide a good stage for telling the story about climate change, and for engaging visitors in this issue. Their findings suggested that while climate change is a complex issue, it

can be discussed in a tangible, approachable, and non-confrontational way by sharing messages about local impacts of climate change, thereby, making such messages personally relevant.

Researchers have also examined audiences' perceptions of climate change interpretation. Based on the idea of "place-based climate change communication", Barrett and Mowen (2014) studied the impact of artistic interpretation (music and poetry) on audience emotion and stewardship. Study participants were assigned to either a live-music or poetry-based interpretive program in America's Glacier National Park. The content of both interpretive programs were identical and focused on climate change impacts, human roles in climate change process, and the message that personal actions can reduce climate change impacts. This interpretive program balanced the recognition of serious climate change impacts with a hopeful future. After experiencing the program, study participants were asked to complete an evaluation (Barrett & Mowen, 2014). Study results indicated that participants of both climate change interpretive programs expressed positive responses in terms of emotion, stewardship, and the effectiveness of artistic expression in communications about climate change (Barrett & Mowen, 2014). Emotional responses received the highest score among the three variables. This study suggested that climate change can be interpreted in an enjoyable and entertaining way in a tourism context. Moreover, Barrett and Mowen (2014) argued that regardless of interpretive format, first-hand experiences of climate change impacts can reduce visitors' confrontational feelings related to disagreement or doubts they may have about the discourse of human-induced climate change. This result is consistent with the findings of Schweizer et al. (2013).

Most recently, Goldberg et al. (2018) investigated how commercial tourism operators at the Great Barrier Reef (GBR) discussed the impacts of climate change with their clients. Data from interviews indicated that most commercial operators were concerned about the impacts of

climate change on the GBR. They were, however, hesitant to start a conversation about climate change with clients because they had concerns about potential negative impacts on client satisfaction with their tour experiences (Goldberg et al., 2018). If interpretive programs about climate change were to be initiated, local tourism operators believed that interpretive messages should be framed in a positive way in order to foster a good visitor experience (Goldberg et al., 2018). For example, tourism operators could give visitors messages that emphasize management interventions have been conducted to protect GBR under the threats of climate change and encourage them to support such actions (Goldberg et al., 2018).

These three studies suggest that climate change interpretation can foster visitor understanding of climate change impacts at a local scale. Moreover, the latter two studies suggested that climate change impacts can be communicated in ways that balance the serious consequences of such change with a hopeful future. In doing so, climate change interpretation is less likely to spoil visitors' leisure experiences. However, climate change is a complex process with multifaceted impacts. Responses to messages about climate change are often emotional, so the interpretive narrative needs to be carefully considered in a commercial tourism context. In this study, a climate change narrative was selected that was relevant to the visitors' everyday lives (Lejano, Tavares-Reager, & Berkes, 2013; O'Neill & Nicholson-Cole, 2009; Weingart, Engels, & Pansegrau, 2000). This type of narrative was seen as being non-threatening while encouraging self-reflection (Lemieux et al., 2018; Melena, 2014).

2.2.3 Visitors' leisure experiences

The existing commercial snocoach tour at the Athabasca Glacier is positioned as a soft adventure tourism product meant to provide visitors with satisfying leisure experiences. The company that is currently offering snocoach tours of the Athabasca Glacier promotes this leisure product as an exciting, enjoyable, and memorable once-in-a-lifetime experience (Pursuit, 2018). Drivers of the massive snocoaches used on this tour serve as interpreters for this experience, and provide visitors with information about the Columbia Icefield environment and history. The snocoach tour therefore functions as a tourism product designed to provide a leisure experience that involves entertainment, education, and an authentic encounter with this unique and beautiful glacial environment.

The visitors' leisure experience is a complex psychological process because it involves a person's emotional, physical, spiritual, and intellectual actions (Kleiber, Walker, & Mannell, 2011; Morgan, Lugosi, & Ritchie, 2010). Leisure experiences can be considered in in terms of the separate dimensions of the experience. Pine and Gilmore (1999) considered tourist experiences from a business perspective and argued that the concept of an experience economy can help companies enhance business performance (Morgan, Lugosi, & Ritchie, 2010; Oh, Fiore, & Jeoung, 2007). They argued that entertainment, education, escapism, and aesthetics are four key dimensions of this type of experience (Pine & Gilmore, 1999). The entertainment dimension refers to the enjoyment, fun, and pleasure that visitors perceive from the experience (Kang & Gretzel, 2012; Oh et al., 2007), and emphasizes the emotional features of leisure experiences. This dimension is "one of the oldest forms of experience", and it is "one of the most developed, and commonplace and familiar" dimension in the business environment (Pine & Gilmore, 1999, p. 31). Education is an important component, especially when travelling in national parks (Kang

& Gretzel, 2012; Cutler & Carmichael, 2010). This dimension reflects the idea that individuals gain knowledge and/or skills as part of their tourist experience (Hosany & Witham, 2010). It can be regarded as the cognitive dimension of the leisure experience. The escapist dimension reflects the extent to which visitors feel immersed in the environment and leisure activities, as well as the extent that they are able to escape from the constraints of daily life (Oh et al., 2007). Escape is an important motive to travel (Cutler & Carmichael, 2010; Dann, 1977). Escapism acts as a push motivation, and is thus an element that visitors seek in a travel experience. The fourth and last experiential dimension of a leisure experience is aesthetics. This is important in the context of nature-based tourism because pull motivations like aesthetics can influence visitors' travel decision about tourism destination. This experience reflects the extent visitors perceive the beauty, attractiveness, and harmony of the destination environment (Oh et al., 2007). In the context of glacier tourism, customers' willingness to visit is positively correlated with their perceptions of the aesthetics of the environmental changes (Groulx et al., 2017).

In addition to considering separate dimensions, Perceptions of the psychological outcome of the tour experience can also be evaluated through the concept of overall satisfaction. Overall satisfaction measures a visitor's general psychological outcome after an experience (Rodger, Taplin, & Moore, 2015). This concept is broader than summing up individual assessments of each attribute in an experience (Bigne, Sanchez, & Sanchez, 2001). Therefore, in this study, overall satisfaction is a broader concept than the sum of visitors' evaluations of the four experiential dimensions. It is important to measure clients' overall satisfaction because it can help commercial tourism operators to know whether they are providing high quality service and experiences to their clients. This type of insight can be used improve the experience to the benefit of their businesses (Ok, Back, & Shanklin, 2006; Prayag, Hosany, Muskat, & Del

Chiappa, 2017). This type of measurement has been commonly used in tourism studies (e.g., Bigne, Sanchez, & Sanchez, 2001; Hui, Wan, & Ho, 2007; Rodger et al., 2015; Yoon & Uysal, 2005).

2.2.4 Study participants

Young adults were the research population of interest in this study for two main reasons. First, the significance of youth visitors to natural areas is recognized by Parks Canada, which identified "strengthening youth involvement" as a goal of JNP (Parks Canada, 2010, p. vi). Second, the age cohort from 18 to 25 years is an important stage for personal development characterized by emerging adulthood and self-identity exploration (Arnett, 2000). The information that this cohort processes during a tour is likely to have lifelong impacts on them. Therefore, interpretation in national parks may have relatively more meaningful impacts on young adults.

This study specifically focused on university students as representative of this age cohort given the resource constraints and the ready availability of the population. Young adults attending university are more likely to be future participants in glacier tours than the general public, as the social demographic findings of previous research on glacier tourism indicate that about two thirds of their research participants were university-educated (Groulx et al., 2019; Lemieux et al., 2018; Stewart et al., 2016; Weber, 2017).

2.2.5 Purpose statement and hypotheses

The research question asked: *What would the impacts be of incorporating a climate change interpretive component into a commercial snocoach tour at the Athabasca Glacier be on their clients' leisure experiences?* Based on the review of literature, five hypotheses were articulated. The first is an overarching hypothesis about the relationship between the introduction of a climate change interpretive program and the leisure experience satisfaction of individuals while the following four suggest relationships between a climate change interpretive program and each of the four dimensions of experience economy measurement scale.

H_1: Incorporating a climate change interpretive component into a commercial snocoach tour will have a positive impact on visitors' overall satisfaction with the tour.

Visitors exposed to a climate change interpretive message when they are standing on the glacier and can see the direct impact of climate change are likely to: engage in self-reflection, develop a strong connection to the place, and to actively consider ways climate change can be mitigated (Barrett & Mowen, 2014; Lemieux et al., 2018; Schweizer et al., 2013). These types of reactions make for a powerful experience. Therefore, despite commercial operators' concerns of such interpretation having a negative impact on visitors' enjoyment, it is hypothesized that snocoach tours that include a climate change interpretive component would provide a better overall leisure experience for participants.

H_2: Incorporating a climate change interpretive component into a commercial snocoach tour will have a positive impact on visitors' education-related leisure experience.

The interpretive program about climate change could increase the audiences' understanding of nature and the place, and raise awareness about the issue of climate change

(Lemieux et al., 2018; Schweizer et al., 2013). Therefore, participants who are exposed to the climate change interpretation are likely to learn more about their own and others' contributions to climate change.

H_3: Incorporating a climate change interpretive component into a commercial snocoach tour will have a positive impact on visitors' entertainment-related leisure experience.

Barrett and Mowen's (2014) study suggested that the combination of first-hand experience with climate change and artistic techniques (i.e. poetry or live music) can facilitate positive emotional responses among park visitors. This finding suggests that serious messages can be entertaining if they are presented in the right way. Although climate change interpretation can be a thought-provoking topic that may produce negative emotions, the climate change interpretive narrative in this study is shaped in a positive and informative way. Therefore, the climate change interpretation in this proposed research is likely to have a positive impact on participants' entertainment-related leisure experiences.

H_4: Incorporating a climate change interpretive component into a commercial snocoach tour will have a negative impact on visitors' escapism-related leisure experience.

Climate change is an issue that can be embedded in daily life at a personal level (Bueddefeld & Van Winkle, 2017; Lejano, Tavares-Reager, & Berkes, 2013; Scannell & Gifford, 2013; Schweizer et al., 2013). The climate change interpretive component in this study attempts to explain how climate change relates to visitors, because many people still have doubts about their ability to mitigate climate change at a personal level (Bueddefeld & Van Winkle, 2017). The interpretive approach used suggests ways for participants to engage in climate change mitigation in their daily lives. For example, it suggests that each of us can take action that when

aggregated will make a big difference in limiting climate change impacts. This type of message is likely to decrease participants' ability to escape from their normal lives while participating on the tour.

H_5: Incorporating a climate change interpretive component into a commercial snocoach tour will have a negative impact on visitors' aesthetics-related leisure experience.

In a past study using climate change future scenarios, Groulx et al., (2017) indicated that if visitors are exposed to climate-induced glacial retreat and other environmental changes, they may perceive less naturalness and express a lower preference for glacier settings even though the tourist destination has not taken any adaptation measures. This suggests that if people are reminded of climate-induced environmental change in a natural setting, they are likely to perceive diminished aesthetic quality and ecological integrity.

2.3 Methodology

This study employed a lab-based experimental design to address the research question. Figure 2.1 shows the study elements of the experimental design. The dependent variable was visitors' leisure experience, and the independent variable was the presence or absence of a climate change interpretive component during the tour. In the experiment, study participants were randomly assigned to a control or an experimental group. Each group was exposed to a simulated snocoach tour of the Athabasca Glacier in the form of a written script of the experience supported by photographs. The control group scenario featured a simulated "snocoach tour" inclusive of an interpretive program without a climate change component; the experimental group scenario received the same interpretive program, with the addition of a 5-

minutes interpretive component about climate change. The time duration for the actual snocoach tour as described in the scenario was 80 minutes and the ticket price was $50 Canadian dollars. Both scenarios had five stages:

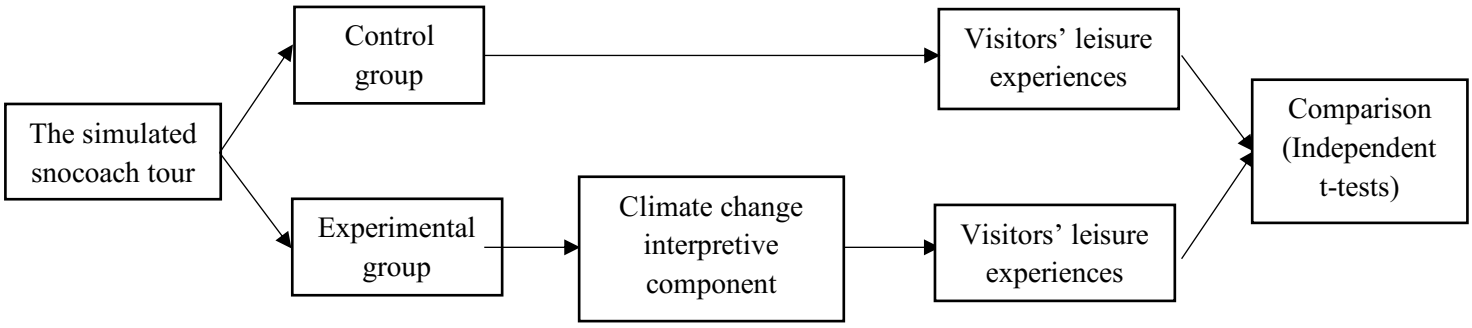

Figure 2. 1 Study elements of the experimental design

(1) Transport from the Columbia Icefield visitor centre to the snocoach transfer terminal on the lateral moraine (10 minutes by bus);

(2) Transport from the snocoach transfer terminal to the disembarkation area of the glacier (20 minutes by snocoach);

(3) Time spent on the glacier in the disembarkation area (20 minutes) – this was the stage where the climate change interpretive program was delivered to participants assigned to the experimental group;

(4) Transport from the disembarkation area back to the snocoach transfer terminal (20 minutes by snocoach);

(5) Transport from the snocoach transfer terminal back to the Columbia Icefield visitor centre (10 minutes by bus).

Based on previous studies (Barrett & Mowen, 2014; Goldberg et al., 2018; Schweizer et al., 2013), the climate change interpretive component was organized into three parts:

(1) Illustrating impacts of climate change at the Athabasca Glacier and the Columbia Icefield.

(2) Providing an example, which showed visitors how climate change impacts our everyday lives. In this study, a story about interpreter's experience of unpredictable snow conditions in cross-country skiing season was provided.

(3) Encouraging visitors to play their part in mitigating climate change (Goldberg et al., 2018).

(Full versions of the trip scenarios are included in Appendix A and Appendix B.)

The typical concern about lab-based experimental design studies is that this approach tends to lack contextual realism and generalizability (Falk & Heckman, 2009; Fong et al., 2016). Kim and Jang (2014) found that scenario-based experiments are effective ways to measure cognitive variables but they have limitations in the assessment of emotional or empathetic responses. In contrast, Falk and Heckman (2009) argued that lab-based experimental design is an important approach to explore causal relationships in social science because it can better control extraneous variables. Research has shown that the realism of scenarios can be measured by asking questions such as "how realistic is the scenario?" (Ro & Kubickova, 2013; Wang, Mattila, & Bartlett, 2009; Wei, Miao, Cai, & Adler, 2012). The participants in this study were therefore asked "to what extent do you (the study participant) think this trip scenario helped you imagine yourself on a snocoach tour on the Athabasca Glacier?"

2.3.1 Participant selection and profile

This study was conducted during the summer of 2018. Participants were recruited using convenience sampling at campus locations that were frequently used by students at a large university in Canada. In total, 60 university students completed the experiment. There were 32 females (53.3%) and 28 males (46.7%) in the sample, ranging in age from 18 to 25 years (mean = 21.82) (Table 2.1). Over two thirds of participants were undergraduate students (78.3%) while over half were Canadians (56.7%).

Table 2. 1 Profiles of Participants

Demographic	Categories	Sample *N*=60
Gender		*n*=60
	Female	32 (53.3%)
	Male	28 (46.7%)
Age		*n*=60
	Range	18-25
	Mean	21.82 (SD=1.85)
Citizenship		*n*=60
	Non-Canadian	26 (43.3%)
	Canadian	34 (56.7%)
Degree		*n*=60
	Bachelor	47 (78.3%)
	Master	11 (18.3%)
	Others	2 (3.3%)

2.3.2 Study design and procedure

This study employed a post-test only experimental design, which included three stages. Participants were randomly assigned to either the control group or the experimental group using online software, *Research Randomizer*. Although participants were advised that the study sought to understand the impacts of an interpretive program on visitors' leisure experiences, they were not informed about the climate change component. At the first stage of the experiment, participants watched a 1.5-minute video, which provided a promotional overview of an existing snocoach tour currently operating at this site. During the second stage, participants were asked to imagine their participation on a snocoach tour by reading a written trip scenario supported by photographs. The control group and the experimental group read identical scripts, with the exception that participants in the experimental group received a climate change interpretive component on the glacier while the control group did not. On completion of the simulated tour, participants were asked to evaluate their leisure experiences based on overall satisfaction and the measurement scale adopted from Oh et al. (2007). On average, the control group took approximately 21 minutes to complete the experiment while the experimental group took 27 minutes.

2.3.3 Measurement

The current study adopted the Oh et al.'s (2007) tourist experience measurement scale inspired by Pine and Gilmore's (1999) experience economy for several reasons. First, it is a comprehensive scale and includes different sub-dimensions of tourist experiences representing many components of leisure experiences (Kleiber et al., 2011). Second, this scale includes

variables to which commercial tour operators are particularly sensitive, such as visitors' perceptions of fun, pleasure, and entertainment. Finally, this scale has proven to be reliable and valid in different tourism-related settings including: lodging (Oh et al., 2007), cruise tourism (Hosany & Witham, 2010), community-based tourism (Lee & Jan, 2015; Lee, Jan, & Huang, 2015), rural tourism (Kastenholz, Carneiro, & Eusébio, 2018), festivals (Manthiou, Lee, Tang, & Chiang, 2014), and museums (Antón, Camarero, & Garrido, 2018). In addition to Oh et al.'s (2007) measurement scale, overall satisfaction with the simulated snocoach tour was also measured. Figure 2.2 shows the measurement scale of visitors' leisure experiences.

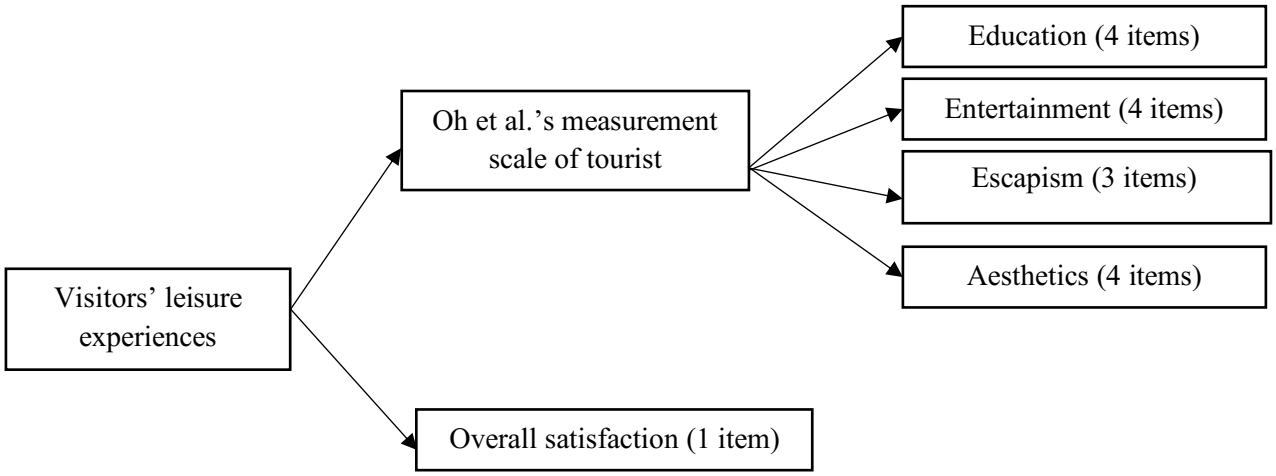

Figure 2. 2 Measurement scale of visitors' leisure experience

The questionnaire component of the experiment had three sections and took an average of 5 minutes for the participants to complete. The first section included questions about visitors' leisure experiences as a result of the simulated snocoach tour. Based on Oh et al.'s (2007) measurement scale, four dimensions of visitors' leisure experiences were measured, including

education (four items), entertainment (four items), escapism (three items), and aesthetics (four items) (See Table 2.2). The questions were derived from Oh et al. (2007), Hosany and Witham (2010), Lee and Jan (2015), Kang and Gretzel (2012), and Aşan and Emeksiz (2018). In addition, the overall satisfaction was measured by asking visitors if how satisfied they were with the snocoach tour. All items were measured using a 7-point interval scale (1=strongly disagree to 7=strongly agree).

Participants also reported their perspectives about the transferability of their simulated experiences to the real world by answering the question "To what extent do you think this trip scenario helped you imagine yourself on a snocoach tour at the Athabasca Glacier?" Their responses were indicated on a 7-point interval scale (1=not helpful at all to 7=very helpful).

The second section included questions about the participants' perceptions of climate change, including questions about: the reality of climate change (1=very sure climate change is not happening; 7=very sure climate change is happening), the role of human activities in contributing to climate change (1=very low; 7=very high), whether climate change impacted their personal lives (Yes, No, or Don't know), and; their personal level of concern about climate change (1=not concerned at all; 7=very concerned) (Groulx et al., 2017; Schweizer et al., 2013). Participants were asked to answer these questions based on the views they had prior to their participation in the simulated snocoach tour. The intent of this request was to help members of the experimental group to consciously consider their views prior to being exposed to the climate change interpretive component. Finally, Section C asked participants about their demographic and academic background including: gender, year of birth, nationality, and study program.

2.3.4 Data analysis

Descriptive statistics including means, standard deviations, and percentages were calculated. These descriptive statistics summarized the group profiles of participants, participants' evaluations of the simulated snocoach tour experience, and participants' attitudes towards climate change. Independent samples t-tests were used to determine if there were significant differences between the control and experimental groups with regard to the hypotheses related to overall satisfaction as well as Oh et al.'s (2007) four dimensions of leisure experiences: education, entertainment, escapism, and aesthetics.

2.4 Results

2.4.1 Participants' attitudes towards climate change

Questions about the participants' attitudes towards climate change were asked to determine if participants in each of the two groups held similar views. Both groups had high scores in regard their belief in the reality of climate change, with a mean of 6.50 for the control group and 6.40 for the experimental group. Similarly, both groups indicated that they believed humans played a substantial role in producing climate change, with a mean of 6.13 for the control group and 6.57 for the experimental group. The two groups did not have significantly different scores for these two variables.

The only significant difference between the two groups in terms of attitudes toward climate change were found in terms of the participants' concern about the climate change issue (F (1, 58) = 1.375, p = 0.043) with the experimental group (M=6.17) having a significantly higher score than the control group (M=5.47). This significant difference may be related to the

sequence of the experiment. In order to avoid biasing the purpose of this experiment, participants were not exposed to any information nor asked any questions about climate change before the experiment. After the experiment, participants were asked to respond to questions about their attitudes towards climate change based on their views before they participated in the simulated snocoach tour. Given the sequence of steps just described, participants in the experimental group had already been exposed to the climate change interpretive component, so their attitudes may have been influenced by the intervention (i.e. the climate change interpretive component) despite the fact that they were asked to consider their attitudes "before" their participation. This might be the reason why the experimental group showed a significantly higher concern of climate change.

2.4.2 Measurement of visitors' leisure experience

Descriptive statistics for all items related to the education, entertainment, escapism, aesthetics themes, and overall satisfaction are presented in Table 2.2. The mean scores of all visitors' leisure experiences in the control group ranged from 4.24 to 6.20, and the score of the overall satisfaction was 5.43. In the control group, aesthetics-related leisure experience received the highest score with a mean of 5.96. The mean scores of all visitors' leisure experiences in the experimental group ranged from 4.25 to 6.37, and the score of the overall satisfaction was 5.97. In the experimental group, education-related leisure experience received the highest score with a mean of 6.12.

Table 2. 2 Descriptive statistics of visitors' leisure experiences

Items	Mean		Standard deviation	
	C[a] *n*=30	E[b] *n*=30	C *n*=30	E *n*=30
Education (α=0.768)				
The snocoach tour made me more knowledgeable.	6.07	6.27	1.10	0.79
This snocoach tour was a learning experience.	5.93	6.37	0.98	0.89
I learnt many different things about the glacier during the snocoach tour.	5.70	6.20	1.06	0.96
This snocoach tour stimulated my curiosity to learn new things.	5.31	5.63	1.39	1.10
Entertainment (α=0.850)				
Attending this snocoach tour was fun.	5.73	6.03	0.91	0.89
The activities of the snocoach tour were amusing.	4.97	5.33	1.30	1.37
I derived a lot of pleasure from this snocoach tour.	5.33	5.73	1.27	0.91
This snocoach tour was entertaining.	5.70	5.97	1.21	0.96
*Escapism (*α=0.638)				
I felt like I was in a different time and place.	5.43	5.53	1.45	1.07
I felt I played a different role while on the tour than in my ordinary life.	4.24	4.25	1.79	1.71
I completely escaped from my daily routine.	4.97	5.57	1.85	1.31
Aesthetics (α=0.462)				
The setting of the glacier was attractive.	6.13	6.40	0.97	0.89
It was pleasant just being there.	6.20	6.24	0.85	0.87
The snocoach tour showed the beauty of the alpine environment in a variety of sensory ways.	5.97	6.13	1.16	1.20
I felt a real sense of harmony with the alpine environment.	5.57	5.17	1.41	1.64
Overall satisfaction				
Overall, I was satisfied with the snocoach tour.	5.43	5.97	0.97	0.81
Transferability of the scenario				
To what extent do you think this trip scenario helped you imagine yourself on a snocoach tour at the Athabasca Glacier?	5.20	5.73	1.13	0.94

[a] Control group

[b] Experimental group

The reliability of the measurement scale was determined by using Cronbach's alpha with a score of at least .70 indicating a reliable scale (Nunnally, 1978). The reliability scores for education and entertainment were .77 and .85 respectively, while the reliability scores for the escapism and aesthetics dimensions were lower at .64 and .46 respectively. The lower scores of reliability for the latter two dimensions may suggest that questions in the measurement scale may not measure escapism and aesthetics-related experiences accurately in this experimental setting as indicated by the low internal correlations between items and the specific dimension (Tavakol & Dennick, 2011).

Visitors' perspectives on the realism of the simulated snocoach tour were also explored in the questionnaire. Although escapism and aesthetics-related experiential dimensions had lower reliability scores, participants for both groups reported that they felt that the study scenario was transferable to a snocoach tour in reality, with a mean of 5.20 for the control group and 5.73 for the experimental group. This indicates that with the help of trip scenarios, participants felt comfortable that they were able to imagine the actual environment of the Athabasca Glacier and the experience of taking a snocoach tour.

2.4.3 Hypotheses tests

Independent samples t-tests were utilized to test the hypotheses by determining whether there were significant differences between the control group and the experimental group in terms of leisure experiences including: overall satisfaction and Oh et al.'s (2007) dimensions of education, entertainment, escapism, and aesthetics. Table 2.3 presents the results of the

independent sample t-tests. Based on t-tests, H_1 and H_2 were supported while H_3, H_4, and H_5 were not accepted.

Table 2. 3 Results of t-tests

	Mean		SD						
Sub-scale	C *n*=30	E *n*=30	C *n*=30	E *n*=30	t	df	p (one-tailed)	Cohen's *d*	Hypotheses results
Overall satisfaction	5.43	5.97	.97	.81	-2.311	58	**.012***	.60	Supported
Education	5.73	6.12	.86	.72	-1.849	57	**.035***	.49	Supported
Entertainment	5.41	5.79	1.07	.76	-1.503	58	.084		Rejected
Escapism	4.86	5.09	1.40	1.04	-0.690	55	.237		Rejected
Aesthetics	5.96	6.05	.76	.67	-0.465	57	.356		Rejected

* Difference is significant at the 0.05 level (one-tailed).

According to visitors' overall satisfaction, the experimental group reported a significantly higher overall satisfaction than the control group, with means of 5.97 and 5.43 respectively, F (1, 58) = 2.079, p = .012. Effect size was calculated using cohen's d (d= .60), suggesting a medium effect size (Kotrlik et al., 2011). In terms of Oh et al.'s (2007) four dimensions of leisure experiences, the only significant difference occurred in regard to education-related leisure experience. The experimental group reported a significantly higher score of education-related leisure experience, with means of 5.73 and 6.12 respectively, F (1, 57) = .460, p = .035. Effect size was .49, suggesting a medium effect size. All other results of t-tests regarding Oh et al.'s dimensions of entertainment, escapism, and aesthetics were not significantly different.

Focusing on individual items of Oh et al.'s four dimensions, scores of all items for the experimental group were numerically higher than the ones in the control group, except for one item in the aesthetics-related leisure experience. That item asked respondents to respond to the statement "I felt a real sense of harmony with the alpine environment."

2.5 Discussion

The results of this lab-based experiment indicated that the inclusion of a climate change interpretive component had significantly positive impacts on visitors' overall satisfaction and Oh et al.'s (2007) educational dimension of the leisure experience. Additionally, results also suggested that the inclusion of climate change information did not have a statistically significant impact on visitors' leisure experiences within Oh et al.'s (2007) other three dimensions of education, entertainment, escapism, and aesthetics. The positive finding in terms of the overall satisfaction and education-related leisure experience suggests that climate change can be presented to visitors in a way that not only does not have a negative impact on their leisure experience but that actually enhances it. Therefore, there appears an opportunity to provide climate change interpretation during a commercial snocoach tour in a way that improves this product.

Specifically, the significant difference between the two groups in terms of the education-related experience suggests that participants felt that incorporating a climate change interpretive component made the tour more educational. The experimental rated their education-related leisure experiences higher than the control group suggesting that they felt they had gained knowledge about climate change. This finding suggests that first-hand experience of climate

change impacts and the “on-site” climate change interpretation is likely to be an effective way to educate visitors about climate change.

The lack of support for the hypotheses related to Oh et al.’ (2007) other three dimensions of the leisure experience (i.e., entertainment, escapism, and aesthetics) merits further consideration. No significant difference was found between the two groups in terms of the entertainment-related experience. The inclusion of the climate change component did not result in a significant difference in visitors’ entertainment-related experience. The reason H_3 was not accepted might be due to the method used to deliver climate change messages. In Barrett and Mowen’s study (2014), artistic techniques (i.e., live music and poetry) were found to be effective in facilitating positive emotional responses of visitors when presenting climate change messages because the use of artistic techniques would likely have made the interpretive programs more entertaining. Unlike Barrett and Mowen’s study, the current study did not use artistic methods to communicate climate change. This may have contributed to the experimental group not reporting a significantly higher entertainment-related leisure experience than the control group. In future studies, the climate change component should be operationalized by using artistic techniques to test the impact of this strategy on the entertainment dimension of the leisure experience (Barrett & Mowen, 2014).

No difference was found between the two groups in terms of the escapism-related dimension suggesting that the climate change messages in this study did not detract from participants’ immersion in the simulated snocoach tour experience. This finding suggests that climate change component in this study may help visitors’ increase awareness of climate change issues while still fostering a leisure experience which is different from their normal lives. Compared to other three dimensions, escapism-related leisure experience was the lowest-rated

dimension. This result might be attributed to the design of interpretive messages and/or the lab-based setting.

No difference was found between the two groups in terms of the aesthetics-related dimension of the experience, which suggests that the climate change interpretation did not detract from participants' perceived beauty of the natural environment. This finding somewhat contradicts Groulx et al.'s (2017) study, which found that climate change impacts could decrease the attractiveness of the Athabasca Glacier as a tourist destination. One possible reason for this lack of difference is that participants were presented with different information about climate change impacts in these two studies. Participants in Groulx et al.'s study (2017) were provided with visual depictions of future states (i.e., current condition vs. 2050) of the Athabasca Glacier under the impacts of climate change, while participants in this study were provided with "oral" interpretation and historically comparable photos of the glacier (i.e. 1917 vs. 2011). In addition, participants in Groulx et al.'s study (2017) were directly asked to evaluate the perceived naturalness and their landscape preferences, so their participants may have been more sensitive to visible changes of the glacier. This non-significant finding of aesthetics-related experience raises the question of whether it is more appropriate to communicate climate change with visitors using written scenarios in a leisure context or visual simulations of possible futures (Grouxl et al., 2017).

Although both groups of participants indicated that the aesthetics of the natural environment were attractive, participants in the experimental group indicated less harmony with the alpine region. This may be due to the fact that participants in the experimental group were informed about the reasons behind the rapid retreat of the glacier. Groulx et al. (2017) found that visitors perceived less naturalness, and had lower landscape preferences when they were

informed that the glacier had retreated due to climate change, compared to the scenario with no climate change impacts. Moreover, they also found that the decrease in perceived naturalness and landscape preference would have a negative impact on visitors' willingness to visit the Athabasca Glacier (Groulx et al., 2017). Nevertheless, perceiving less harmony is not necessarily a bad thing (Groulx et al., 2017) as first-hand experience of climate change impacts can be a marketing tool at the Athabasca Glacier. An example of this is last chance tourism (LCT), which is a form of tourism in which visitors travel to vanishing tourist destinations to see an iconic feature before it disappears (Lemelin, Dawson, Stewart, Maher, & Lück, 2010). LCT has been recognized as a type of "uneasy benefit" which requires tourism operators to balance potentially increasing numbers of visitors with the protection of an already vulnerable landscape (Lemieux et al., 2018, p. 15). However, the perception of less harmony with the alpine region may stimulate more public conversation about climate change (Groulx et al., 2017). In doing so, the on-site experience of climate change impacts may be linked positively to public education and engagement about the issue.

Study findings also suggest which messages about climate change can be delivered to clients, and what the objective of the climate change interpretive program should be in a commercial tour context. Commercial tourism operators in national parks must ensure that visitors have quality leisure experiences and that their businesses are operated according to park policies. By doing so, they protect their long-term interests and the environment in which they operate (McNicol & Rettie, 2018). An increasing number of commercial tourism operators have paid attention to climate change issue because they have realized that they have a corporate social responsibility (CSR) for operating sustainably (Coles, Fenclova, & Dinan, 2013; Dodds & Kuehnel, 2009). Communicating climate change to visitors can be a means of demonstrating

CSR. Climate change interpretive programs presented during a commercial tour can meet the dual objectives of: (1) making sure visitors enjoy the experience, and (2) increasing visitor awareness of climate change and their ability to engage in mitigation action. The results of this study indicate that incorporating climate change interpretation into a commercial snocoach tour had a significantly positive impact on overall visitor satisfaction and also increased visitors' knowledge about climate change. This suggests that a carefully designed climate change interpretative program not only enhances the visitor experience, but may contribute to park conservation goals by encouraging visitors to adopt climate change mitigation behaviours. This favorable outcome suggested that messages which focus on place-based climate change impacts, personal stories about climate change impacts, and personal strategies that visitors can take to mitigate climate chance, should be considered by commercial tourism operators on the Athabasca Glacier and elsewhere.

2.6 Conclusion and Limitations

This study employed a lab-based experimental design to examine how incorporating a climate change interpretive component into a commercial snocoach tour impacts visitors' leisure experiences. Although the study provided valuable insight into the research question there were limitations. First, the lab-based experiment setting and written trip scenarios used in this study have limits as a simulation of a real snocoach tour. For example, the lower reliability of the measurements of the escapism and aesthetics-related dimensions of the leisure experience may indicate that further refinement of trip scenarios is needed. Future studies should take advantage of advanced technology to evoke a more realistic snocoach tour experience in an experimental

setting (e.g. video, audio, virtual reality), or adopt an on-site experimental design. Second, the questionnaire design used in this study made it challenging to assess participants' attitudes towards climate change prior to their participation in the experiment. In future studies, researchers should give further consideration to how to assess participants' attitudes towards climate change without introducing a bias to the experiment. Third, this study only tested one possible narrative for climate change interpretation. A range of different possible narratives exist (e.g. science-oriented climate change interpretation), which can be delivered through a range of different types of media (e.g. brochure, videos, etc.). Future studies could explore the impacts of climate change interpretation on visitors' leisure experiences by comparing different messages and mediums.

Notwithstanding these limitations, this study makes two key contributions to tourism literature on climate change interpretive programs and visitor experiences. First, study results indicate that research participants exposed to a climate change interpretive component during their tour (the experimental group) can have a significantly more satisfying experience than those who are not exposed to this element (the control group). Participants of the experimental group also reported a significantly higher score of educational dimension of Oh et al.'s (2007) experience measurement scale. Furthermore, there is no evidence that climate change interpretation detracts from participants' leisure experiences in other three dimensions of Oh et al.'s (2007) experience measurement scale (i.e. entertainment, escapism, and aesthetics). These findings support previous studies, which suggested that first-hand exposure to the impacts of climate change makes visitors to these types of attractions more receptive to interpretive messages on human-induced climate change (e.g., Barrett & Mowen, 2014). In practise, this finding should also encourage commercial tourism operators to introduce climate change

interpretation because it has been shown to significantly increase overall tour satisfaction and effectively help visitors understand climate change. The second major contribution of this study is that it provided further insight into the use of experimental design in the context of climate change, interpretation and leisure experience. In this experiment, the only difference between the two groups was that experimental group participants were provided with a 5-minute climate change interpretative message when they were on the glacier. This lab-based experimental design thus controlled extraneous variables (e.g. weather conditions and interpretation skills). Although, sample size (N=60) was relatively small, it provided sufficient statistical power for independent sample t-tests, providing robust findings (Fong et al., 2015). This study confirmed that the experimental design is a promising tool to address research questions that are focused on the impacts of interpretive programs on leisure experience.

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Chapter 3: Conclusion

This study examined how incorporating a climate change interpretive component into a commercial snocoach tour impacts visitors' leisure experiences. A lab-based experimental design was used to investigate this relationship. In the experiment, participants were provided with a simulated snocoach tour by way of written trip scenarios supported by visual images. A comparison was made between the resulting leisure experiences of research participants who received a climate change interpretive component (the experimental group) versus those who received the same scenario with the exception of the climate change component (the control group). These leisure experiences were measured in terms of the concept of overall satisfaction and Oh et al.'s (2007) four separate dimensions of the leisure experience (i.e. education, entertainment, escapism, and aesthetics). Five hypotheses related to the impact of the independent variable on these dependent variables were articulated and tested using independent samples t-tests.

The results of the experiment indicated that research participants who were exposed to a climate change interpretive component during their simulated tour (the experimental group) had a significantly more satisfying tour than those who were not exposed to this component (the control group). According to Oh et al.'s (2007) four dimensions of experience measurement scale, the results indicated that incorporating a climate change interpretive component offered visitors a significantly more educational tour with no significantly negative impacts on other three dimensions of the measurement scale (i.e., entertainment, escapism, and aesthetics). These findings provide further insight into climate change communication in a tourism context, and also benefit commercial tourism operators and researchers through their theoretical, practical, management, and methodological implications.

3.1 Theoretical Implications

Climate change interpretation has received academic attention in a park and tourism context but no studies were found that examined how a climate change interpretive component impacts visitors' leisure experiences within a commercial tour context. Therefore, this thesis makes a contribution to the tourism and leisure literature about climate change by providing insights into the relationship of climate change interpretation and visitors' leisure experiences. More specifically, this study found that incorporating a climate change interpretive component had a significantly positive impact on visitors' overall satisfaction. Additionally, incorporating a climate change interpretive component could also provide visitors with a significantly more educational tour with no significantly negative impacts on three individual dimensions of leisure experiences: entertainment, escapism, and aesthetics. These insights were supported through lab-based experimental evidence. Future research ought to consider testing this relationship in the context of the actual snocoach tour by way of field experiments. Another variation that should be considered is to test this relationship in the context of other demographic groups in future research.

3.2 Practical Implications

Study insights also have practical implications for commercial tourism and leisure settings. Providing information about climate change impacts is a bittersweet marketing tool for commercial tourism operators to attract visitors. On one hand, visitors to the Athabasca Glacier have expressed their interest in learning about the impacts of climate change at the site (Lemieux et al., 2018). On the other hand, previous research has suggested that visitors may have negative

feelings when they learn about how climate change negatively impacts a natural setting, such as the rapid reduction and the projected disappearance of the Athabasca Glacier (Goldberg et al., 2018; Lemieux et al., 2018; Melena, 2014). These negative feelings have the potential to undermine the leisure experiences of snocoach clients. Therefore, the literature suggests that incorporating a climate change interpretive component to tours is challenging for commercial tourism operators.

Contrary to this uncertainty, study findings indicated that a climate change interpretive component did not spoil visitors' leisure experiences in the simulated context of a lab experiment. In combination with Lemieux et al.'s (2018) earlier study, which suggested that visitors to the Athabasca Glacier have a desire to learn about climate change, the findings of this study suggest that the incorporation of a climate change interpretive component into commercial tours not only does not negatively impact the leisure experience of their clients, but actually increases it at the level of overall satisfaction and education-related leisure experience. This study demonstrates that it is possible for commercial tourism operators to include climate change interpretive components in their tours without negatively impacting their clients' leisure experiences. A good place for commercial tourism operators to start is to think about what experiences they want their clients to achieve and then to decide what information about climate change can be delivered to clients to meet this goal (Van Winkle & Backman, 2011). Based on findings of this study, the recommendation to commercial tourism operators is to: (1) use the specific place (e.g., the Athabasca Glacier) as a stage to present place-based climate change interpretation, (2) tell personal stories about climate change impacts, and (3) provide personal strategies to clients for climate change mitigation.

3.3 Managerial Implications

Findings of this study also provide implications to the management of Parks Canada. Tourism operators in national parks have to run their businesses under park-related policies to protect the park environment (Parks Canada, 2010). Given the importance of this environmental mandate and the threat that climate change poses to national parks' environment, Parks Canada should play a leadership role encouraging local tourism operators to provide interpretation about climate change.

While Parks Canada recognized climate change issues in the 2010 JNP management plan by increasing PC based interpretation about climate change, the policy did not make specific recommendations to commercial tourism operators to include climate change interpretation. There is a currently a public engagement phase for the development of new management plans for the mountain national parks. Jasper National Park in particular has listed the phenomenon of climate change as one of the key topics which needs to be addressed in the new management plan. In the new version of the JNP management plan, more suggestions or even requirements to local commercial tour operators should be considered. For example, given that study results show that a climate change interpretive component may improve the visitor leisure experience at the level of overall satisfaction and the educational dimension, Parks Canada should recommend that commercial tourism operators in JNP include a climate change interpretive component. Furthermore, Parks Canada should also provide commercial tourism operators with reliable interpretive materials about climate change. Effective policy support from Parks Canada is likely to enhance commercial tourism operators' ability to protect the environment of national parks.

3.4 Methodological Implications

In contrast to the typical survey based research on climate change interpretive programs in tourism settings, an experimental design was adopted for this study. The use of experimental design was successful in answering the research question and has led to the identification of several methodological implications. First, results of this study suggest that experimental design can be an effective method to address research questions that focus on the assessment of interventions in the programs provided by commercial tourism operators. This study examined how incorporating a climate change interpretive component into a commercial snocoach tour impacts visitors' leisure experiences by manipulating the messages that two groups of study participants (control and experimental) received on a simulated snocoach tour. In this study, the intervention was the inclusion of a climate change interpretive component (experimental group) into the otherwise identical scenario that the participants in the control group received. Since this was the only difference between the simulated experiences of the two groups, it was possible to isolate the impacts of climate change interpretive component on visitors' leisure experiences.

Second, in a true experimental design, random assignment is typically used as a strategy to make sure the control group and the experimental group consist of participants with similar backgrounds and characteristics (Trochim et al., 2015). However, this study found that random assignment may be "not guaranteed to rule out individual differences" (Fong et al., 2016, p.250). In this study, participants of the two groups expressed similar belief in the reality of climate change and belief that humans play a substantial role in producing climate change while the two groups participants expressed a significant difference in concern about the climate change issue. The reason for this significant difference may be the sequence of the experiment. The detailed results and analysis were shown in Chapter 2, section 2.4.1.

Third, a typical concern about lab-based experimental design studies is that they tend to have a low-level of contextual realism (Falk & Heckman, 2009; Fong et al., 2016). Past research about service marketing also suggested that researchers should carefully interpret results from scenario-based experiment because there is a question that to what extent those results can accurately predict real-world responses (Kim & Jang, 2014). To explore this issue, this study incorporated a separate question to obtain insight into the participants' perception of the realism of the written trip scenarios used in this lab-based experiment (Fong et al., 2016; Veal, 2014). Participants' perspectives on how well the scenarios could be transferred to the real world were measured by asking "To what extent do you think this trip scenario helped you imagine yourself on a snocoach tour at the Athabasca Glacier?", from 1 (not helpful at all) to 7 (very helpful). Participants reported that this trip scenario was transferable (Mean=5, SD=1.07). Future researchers who adopt a lab-based experimental design should consider increasing the realism of the trip scenario by hiring an actor to serve as the interpretive guide or by making a video of an actual tour with the experimental group receiving an extra segment. If resources and expertise are available, another option would be to present the scenarios through virtual reality technology.

Fourth, although the relatively small sample size was a concern in this study, the results support the view that even with a small sample size the experimental design is robust in terms of statistical analysis (Fong et al., 2016). It is recognized that a small sample size may fail to detect a statistically significant difference thereby contributing to a Type II error (Lerman, 1996). However, literature about experimental design argues that 30 subjects in a group are adequate to provide sufficient power for data analysis, such as t-tests and ANOVA (Cohen, 1992; Fong et al., 2016). Past empirical tourism research adopting an experimental design also supports the view that a small sample can provide sufficient statistical power for data analysis (Fong et al., 2016;

Rodger, Taplin, & Moore, 2015; Van Winkle & Backman, 2011). Similar to laboratory based experiments using animals where practical and ethical considerations limit the sample size (Bailoo, Reichlin, & Würbel, 2014), it is argued that 30 participants in each group (i.e. the control group and the experimental group) was reasonable in the exploration of the relationships between the independent and dependent variables in this study.

In this study, Oh et al.'s (2007) measurement scale of tourist experience served as one of the two measures to evaluate visitors' leisure experiences. This scale was developed from Pine and Gilmore's (1999) ideas of experience economy, which suggests that there are four important dimensions in customer experience namely education, entertainment, escapism, and aesthetics. In the tourism industry context this scale was originally applied in lodging settings, and has since been used to measure other types of visitor experience, such as cruise tourism and community-based tourism (Hosany & Witham, 2010; Lee & Jan, 2015; Oh et al., 2007). The main reason for choosing this scale for this study was that the concept of experience economy is well suited for business environments (Morgan et al., 2010) like a mass tourism commercial tour on the Athabasca Glacier. However, this study is the first one to apply this measurement scale in a lab-based experimental setting. Other researchers who plan to adopt this measurement scale should consider the lessons learned from this experience.

First, this study suggests that Oh et al.'s (2007) measurement scale is useful in an applied nature-based commercial tourism context. It is comprehensive and includes different dimensions of visitor experiences to which commercial tourism operators in natural areas are particularly sensitive. For example, the tourism operator who runs the existing snocoach tour describes the experience as a thrilling trip in a gorgeous natural setting (Pursuit, 2018). During this tour, a wealth of interpretive components is provided to help visitors appreciate the surrounding alpine

environment. This informative program demonstrates that the tour operator is committed to educating visitors in an entertaining way (i.e., the education-related leisure experience and the entertainment-related leisure experience). The operator wants to immerse their clients in this beautiful and unique setting (i.e., the escapism-related leisure experience and the aesthetics-related experience). The key four dimensions of the leisure experience in Oh et al.'s (2007) measurement scale are dimensions that tourism operators are interested in.

Second, in this study the scores of reliability of two dimensions were lower than .70, which is the threshold of a reliable scale (Nunnally, 1978). These two dimensions were escapism-related and aesthetics-related experiences. One of the possible reasons for this lower reliability was that questions in the measurement scale may not measure escapism and aesthetics-related experiences accurately in a lab based experimental setting. Therefore, it is important to consider changing the wording of these items or removing irrelevant items to make this scale better fit specific research settings (Veal, 2014). For example, the item "it was pleasant just being here" in the aesthetics-related experience group may have been confusing for research participants because they may not have been clear whether "here" referred to the lab setting or the alpine setting. Their confusion may have influenced their responses. Therefore, this item could be modified to "it was pleasant just being in the alpine environment".

3.5 Concluding Remarks

A lab-based experimental design was used in this study to examine how incorporating a climate change interpretive component into a commercial snocoach tour impacts visitors' leisure experiences at the Athabasca Glacier. The experimental evidence showed that incorporating a

climate change interpretive component had a significantly positive impact on visitors' overall satisfaction. The evidence also showed that incorporating a climate change interpretive component had a significantly positive impact on the education-related dimension in Oh et al.'s (2007) experience measurement scale with no significantly negative impacts on other three experiential dimensions (i.e., entertainment, escapism, and aesthetics). Future studies should test this relationship in the context of other sample populations as well as field based experiments on an actual snocoach tour. Beyond the Athabasca Glacier and glaciers in general, the relationship between these variables should be tested in the context of other commercial mass tourism products in a variety of natural settings. The observable impacts of climate change at many nature-based tourism settings present a powerful educational opportunity. While climate change interpretation has been receiving an increasing level of attention in the realm of tourism and leisure studies, more studies are needed. Tourism and leisure studies researchers need to identify the best practice of climate change interpretation because this industry has the potential to connect tens, if not hundreds of millions of visitors to the issue of climate change. In doing so, it can play a meaningful role in climate change mitigation.

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Appendix A: Written trip scenario for the control group

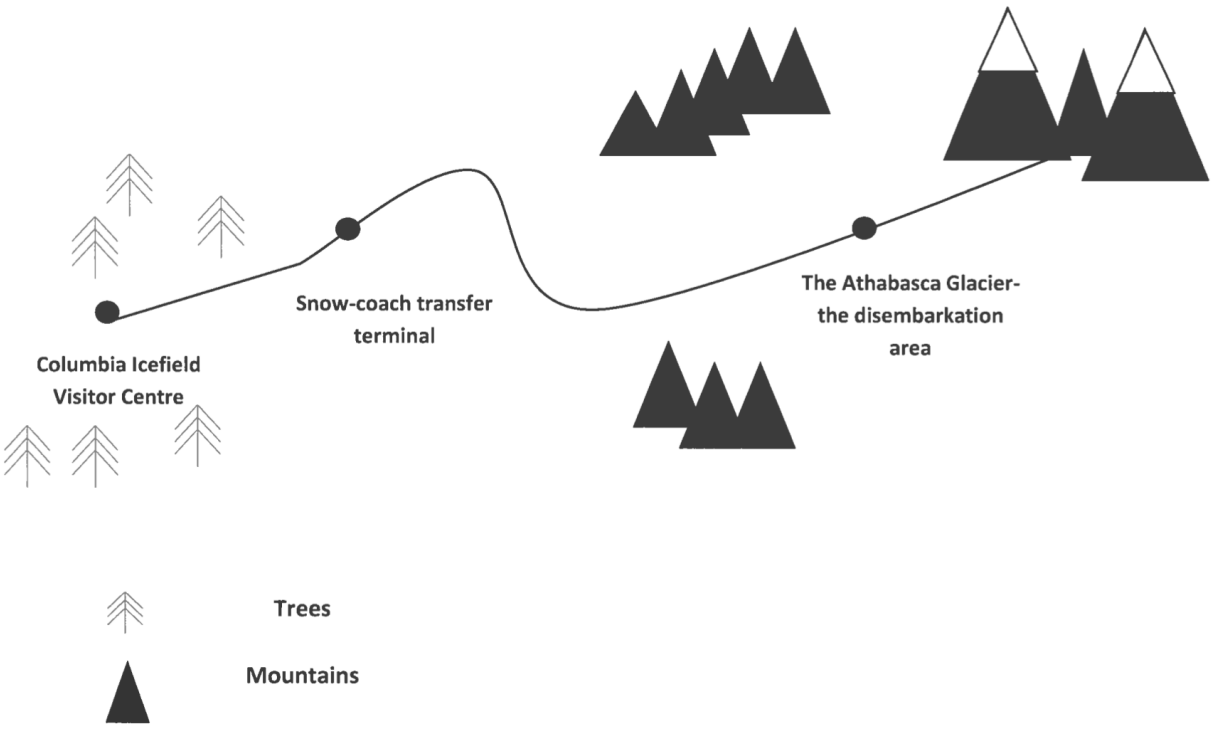
Trip Scenario of the Athabasca Glacier Snow-coach Tour

Study title: The impact of an interpretive program on leisure experiences of clients: A case study of commercial tours on the Columbia Icefield

Principal researcher: Mu He, Master's student, Faculty of Kinesiology, Sport, and Recreation

This research (**ID: Pro00081550**) has been approved by Research Ethics Office of the University of Alberta.

Map of the Athabasca Glacier snow-coach tour



Your simulated snow-coach tour has **five stages**:

- **Stage 1**: Columbia Icefield visitor centre → The snow-coach transfer terminal (By bus)
- **Stage 2**: The snow-coach transfer terminal → Middle of the Athabasca Glacier – the disembarkation area (By snow-coach)
- **Stage 3**: On the disembarkation area
- **Stage 4**: The disembarkation area → The snow-coach transfer terminal (By snow-coach)
- **Stage 5**: The snow-coach transfer terminal → Columbia Icefield visitor centre (By bus)

Your snow-coach tour of the Athabasca Glacier starts!

- *Location: Columbia Icefield Visitor Centre, Jasper National Park (Figure 1 & Figure 2)*
- *Weather: a sunny morning with soft wind in July*
- *Ticket price: $50*
- *Duration: 80 minutes (including the loading and the unloading time)*

Figure 1. Columbia Icefield visitor centre (Photo credit: Tripadvisor, 2018)

Figure 2. The full view of the Athabasca Glacier (Photo credit: Mu He, 2017)

Stage one: Board a bus that transports you from the visitor centre to the snow-coach terminal near the access point to the glacier (Figures 1, 2, 3, 4, 5 & 6)

- *Duration: 10 minutes (including the loading and the unloading time)*

(There are many people boarding the bus and the atmosphere is the one of excitement and anticipation.)

- **Tour guide + bus driver (Debbie):** Hello and welcome to the Columbia Icefield! My name is Debbie and I will be taking you to the snow-coach transfer terminal, where you will transfer to a snow-coach, that will take you onto the glacier (*Figure 3*). This snow-coach tour will be a unique experience highlighted by a stop where you can disembark the snow-coach and step onto thousand-year-old ice to personally experience the fantastic landscape of Columbia Icefield. You will also experience one of the steepest road grades in North America during your ride. Are you looking forward to the tour now?

Figure 3. Driving from the visitor centre to the snow-coach transfer terminal (Photo credit: Mu He, 2017)

- **Tour guide + bus driver (Debbie):** If you look around, you can see many trees but most of them are short (*Figure 4*). It may be hard to imagine but many of them are over 400 years old! If you are thinking it is because of the cold weather, you are right! As you can feel now, the Columbia Icefield area is cold even in summertime. Because of the short growing season, these trees are stunted. They grow just a little each year. As the tour continues, you may notice that there are fewer and fewer plants on the way. This is because most plants cannot grow under extreme weather conditions in high alpine zone.

Figure 4. The scenery from the bus during stage 1 (Photo credit: Mu He, 2017)

- **Tour guide + bus driver (Debbie):** We are close to the snow-coach transfer terminal. Actually, this transfer terminal was located on a higher place before the 2014 season. However, the ground on the higher place becomes somewhat unstable because the glacier is moving and retreating. That is why we should move down to the current place, where the ground is more stable.

  We are arriving at the snow-coach transfer terminal (*Figure 5*). You will now disembark the bus and board the snow-coach. On the snow-coach, you will have a new driver and tour guide, Jack. He will take you to the glacier. If you have garbage, please take it to the garbage can in the front. I hope you have a great time on the snow-coach and the glacier!

(Tour group disembarks the bus, and then boards the massive snow-coach.)

Figure 5. Snow-coach transfer terminal (Photo credit: Zabed Akbar, 2011)

Figure 6. Boarding the snow-coach (Photo credit: Brian Cohen, 2017)

Stage two: Depart from the terminal of snow-coach, descend on to the glacier, travel to the disembarkation area on the glacier (Figures 7, 8, 9, 10, 11, & 12)

- *Duration: 20 minutes (including the loading and the unloading time).*
- **Tour guide + snow-coach driver (Jack):** Now we are surrounded by mountains and glaciers! Welcome to the Columbia Icefield and to the Athabasca Glacier in particular. My name is Jack, and I am your snow-coach driver and tour guide for today's snow-coach tour. During the tour, we will travel for about 20 minutes to the snow-coach disembarkation area, where you will have 20 minutes to explore the glacier. On the way, I will be talking about how glaciers and icefields form, and how they impact the surrounding environment.

  We are lucky as the weather is really nice today, with sunshine and a soft and mild breeze. We are about 7, 200 feet, or about 2,100 meter above sea level now, and the temperature is lower than most other places in the Canadian Rockies. You can see the snow all year here, and the ice underneath the snow is ancient. Because we are in a very high alpine area, the air is pure and tends to be cooler. The cold weather is one of the reasons that we won't see many plants in this alpine zone (*Figure 7*). It is also hard for large animals to live in this area with the low availability of food.

  Although we cannot see large animals here, you may find fossils on the top of the surrounding mountains (*Figure 7*). If we were able to travel back in time hundreds and millions of years, everything that you currently see around would have been under water. This area of the world was the seabed of a vast ocean. As a result, you can find many marine-based fossils in this area. For example, at the very top of the mountains around here, you may find trilobite fossils in the steep rubble, and some very old fossils of ancient marine creatures, such as rugose corals. It is amazing to see them at such high altitudes.

Figure 7. Looking outside from the snow-coach (Photo credit: Mu He, 2017)

- **Tour guide + Snow-coach driver (Jack):** Glaciers are always moving and the Athabasca Glacier is no exception. As a result of the glacier's movement, some very big and steep rock piles came from the glacier and the surrounding mountains. There are two important types of moraine in this area. At the moment we are driving on is the top of lateral moraines, which are formed at the side of the glacier (Figure 8). The other type of moraine is the terminal moraine, and it can be found between the toe of the glacier and the visitor centre. The terminal moraine marks the furthest point of advancement for this glacier. These moraines have proved that glaciers not only impact plants and animals here; they also shape landscape in this area.

Figure 8. The snow-coach is driving on the steep lateral moraine (Photo credit: Pursuit Banff Jasper Collection, 2014)

- **Tour guide + snow-coach driver (Jack):** Look! Directly in front of us you can see is one of the steepest roads in North America. From this point, we have a good view of the Athabasca Glacier. Now, we have to travel down the slope to get to the ice (*Figure 9*)! Are you ready?

  Don't worry! Our snow-coach is safe even though you don't have any seat belts to wear. Nevertheless, please be seated for your safety and we will tempt fate by driving down now!

(The snow-coach is driving down slowly)

Figure 9. The steep grade (Photo credit: Brian Cohen, 2017)

- **Tour guide + snow-coach driver (Jack):** This monster snow-coach is called an Ice Explorer, which is built by Foremost, a company in Calgary. This vehicle can accommodate 56 passengers and it handles deep slopes very well because the massive tires and advanced engine keep us going nicely and slowly. Our top speed of this vehicle is 18 kilometers per hour. Ice Explorers had been used in the complex terrain of the Columbia Icefield for over 20 years to allow millions of visitors to explore the glacier. They have proven to be effective

for glacier travel. Currently, we have 20 snow-coaches at the Columbia Icefield, with only other two snow-coaches that are operated in Antarctica for the transportation of researchers. One is owned by U.S. and the other one is owned by Australia.

(After a successful descent, the snow-coach climbs on the ice)

- **Tour guide + snow-coach driver (Jack):** The water on both sides of the ice road we are on is meltwater from the glacier (*Figure 10*). On a sunny day like today, we will see a lot of meltwater flowing by midday. The meltwater from the Columbia Icefield flows to three oceans: The Pacific, Arctic, and Atlantic by the way of Hudson Bay. Right ahead is a tire wash for snow-coaches, fed by glacier melt water. The snow-coach's tires will take a shower here to wash tires thereby ensuring we don't take too much dirt on to the beautiful glacier. Make sure your windows are closed! We will be going into the one and the only Columbia Icefield tire wash!

Figure 10. Tire wash in the melting water (Photo credit: Pursuit Banff Jasper Collection, 2018)

- **Tour guide + snow-coach driver (Jack):** The snow-coach is now on the ice and we are approaching the snow-coach disembarkation area (*Figure 11*).

  In the Canadian Rockies you can see many dramatic natural landscapes characterized by high mountains and deep valleys. But as you can see around, the dominant feature in this area is the Columbia Icefield and its many glaciers. Now is the time for me to explain what the icefield and glaciers are and how they formed. Let's use a bowl, something we use every day, to understand how the icefield and glaciers form. There is a lot of space to form a large natural bowl between the high peaks. In wintertime, there is heavy snowfall in this area. During the formation of glaciers, much of the accumulated snow failed to melt away because of the low temperatures at this high altitude location. As a result, more and more snow accumulated in the natural bowl over a long time. As its weight grew, it began to flow downhill into the surrounding valleys. In the higher valleys, this snow and ice accumulation became glaciers while in the lower valleys, the ice melts to form rivers. It is through this process that the snow in the natural bowl and surrounding glaciers formed the Columbia Icefield. Therefore, we can say that the Columbia Icefield feed glaciers. One of them is the Athabasca Glacier.

Figure 11. Snow-coach operating on the ice (Photo credit: Pursuit Banff Jasper Collection, 2018)

- **Tour guide + snow-coach driver (Jack):** Normally, it takes up to 5 years for snow to turn into glacial ice. The depth of the ice at the Athabasca Glacier is between 270 to 1, 000 feet or 90 to 300 meters. While the ice is very strong, please remember that the glacier is dangerous. Because the glacier is constantly shifting and moving, this process creates some very deep and hidden cracks known as crevasses that can be extremely dangerous. For this reason, you are only permitted to walk within the designated area that has been inspected for safety hazards.
- **Tour guide + snow-coach driver (Jack):** We are just arriving at the snow-coach disembarkation area (*Figure 12*). When you are on the glacier, you can take pictures, walk around within the designed area, drink the meltwater from the ancient ice, read interpretive signs, or chat with our staff here. Please remember, don't go beyond boundaries of the designated area. It is 10:40 AM now, and our departure time is 11:00 AM. About 5 minutes before we leave, I will walk around and hold a red flag as a signal to remind you. Again, my name is Jack, and the snow-coach number is 007. You can disembark the snow-coach and walk around now. See you soon and have a great time on the glacier!

Figure 12. Arriving at the centre of the glacier (Photo credit: Pursuit Banff Jasper Collection, 2018)

Stage three: On the glacier (Figures 13, 14, 15, 16, & 17)

- *Duration: 20 minutes (including the loading and the unloading time).*
- *There is no formal interpretive program on the glacier. You can spend 20 minutes independently exploring the designated visitor area on the glacier! There are many activities you can do on the glacier, including those shown in the following images:*

Figure 13. Walking in the designated area (Photo credit: Mu He, 2017)

Figure 14. Taking photos (Photo credit: Pursuit Banff Jasper Collection, 2018)

Figure 15. Collecting melting water (Photo credit: Pursuit Banff Jasper Collection, 2018)

Figure 16. Reading interpretive signs (Photo credit: Mu He, 2017)

Figure 17. Touching ice (Photo credit: Pursuit Banff Jasper Collection, 2018)

Stage four: Snow coach ride back to the transfer terminal (Figures 18 & 19)

- *Duration: 20 minutes (including the loading and the unloading time).*
- *The interpreter is quieter than before but continues to entertain you with good humor.*
- **Tour guide + snow-coach driver (Jack):** Welcome back! Isn't the scenery amazing? As we make our way back to the transfer terminal, we will talk a bit about the colour of the glacial ice and the weather in this area. I will be quieter than before but feel free to ask me questions if you have. I will try my best to answer them.

  As you can see and feel, the Athabasca Glacier is huge, at about 6 km long and 1 km wide for an area of 6 square kilometers. But as I mentioned before, the Athabasca Glacier is a part of the Columbia Icefield. In fact, it is only about 2% of the Columbia Icefield. The Columbia icefield is the largest body of ice in the Canadian Rockies. It sits on the boundary of 2 provinces: Alberta and British Columbia. The presence of the Columbia Icefield is one of the reasons why the United Nations listed Canadian Rocky Mountain Parks as the UNESCO World Heritage site since 1984.

- **Tour guide + snow-coach driver (Jack)**: If you look at the glacial ice, do you notice that some of them appear to be blue instead of white or totally transparent like the frozen water that you might store in your freezer (*Figure* [illegible])? It is a magic show performed by glacial ice and sunlight. Now, let me explain for you. You may be familiar with rainbow that we can see when it is raining. When sunlight shines on a raindrop, the light colours get separated because they have different wavelengths. Our eyes can see them separately. The same phenomenon occurs in the glacial ice when sunlight shines on it. The long wavelengths, like red light, will be absorbed by ice, while the short wavelengths, like blue, can be refracted. When the ice is thicker, it is bluer. However, the reason why we cannot see rainbow in the glacial ice is that gaps between the ice particles is very small compared to raindrops.

Figure 18. Blue glacier ice (Photo credit: Mu He, 2017)

- **Tour guide + snow-coach driver (Jack):** We are at the steep hill again (*Figure 19*)! This time we need to climb it from the valley. But don't be worried. Our Ice Explorer is perfectly able to cope with such extremes because it is equipped with a powerful engine, automatic brakes and power steering. Now, lets' do it!

(The snow-coach approaches the transfer terminal after successfully completing the climb)

Figure 19. The steep grade (Photo credit: Brian Cohen, 2017)

- **Tour guide + snow-coach driver (Jack):** Although today is a warm and sunny day, there is always a possibility for a severe and very cold "katabatic wind" to blow through. This type of wind is caused by the cold air from the top of glaciers sinking into the valley below. In winter, the wind speed often reaches over 60 kilometers per hour. Because of the katabatic wind, the temperature of -30 degrees or below are common here. This is a major reason why the snow-coach tour operates in summertime only when the temperature is generally warmer.

  Now we are back to the snow-coach transfer terminal again. It is my pleasure to have you on board the snow-coach and have the unique experience together. I hope you enjoyed your time on the glacier and your visit to the Canadian Rockies!

(Tour group transfers from the snow-coach to the bus for the ride back to the visitor centre.)

Stage five: Transfer to a bus and drive back to the visitor centre (Figure 20)

- *Duration: 10 minutes (including the loading and the unloading time)*
- *The driver/interpreter causally chats with participants and wishes everyone well when they leave the bus.*
- **Tour guide + bus driver (Debbie):** Welcome back! Now we are heading back to the visitor centre. We just talked about environmental features of the Columbia Icefield and the Athabasca Glacier, but do you know about the important cultural role of the icefield to Indigenous people? They describe the Columbia Icefield and the glaciers in this area as the mother and the heart because this area is their source of water. They recognize that where water goes, life follows. The name of "Athabasca" is from the local Cree indigenous language, meaning "place where the reeds grow".

  Long before the construction of Icefields Parkway in 1940, Indigenous people passed through the Columbia Icefield area regularly for thousands of years and crossed over mountains and valleys to hunt and trade (*Figure 20*). This was an important pass, which connected them to other places. When the early European travellers came, Indigenous people guided scientists, fur traders, and tourists in this area. To summarize, it is clear that Indigenous people have played an important role in shaping the cultural landscape of the Columbia Icefield and the Athabasca Glacier.

Figure 20. Icefields Parkway (Photo credit: Mu He, 2017)

- **Tour guide + bus driver (Debbie):** I hope that during this snow-coach tour, you have learned more about how the Columbia Icefield and its glaciers shape environment, landscape, and culture in Canadian Rockies.

  Now we are arriving at the visitor centre. I hope that you have had a wonderful experience today. Enjoy the rest of your time in Canadian Rockies and we look forward to seeing you the next time you are in this beautiful place.

Your simulated Athabasca Glacier snow-coach tour has done.

Please tell me about your leisure experiences!

Appendix B: Written trip scenario for the experimental group

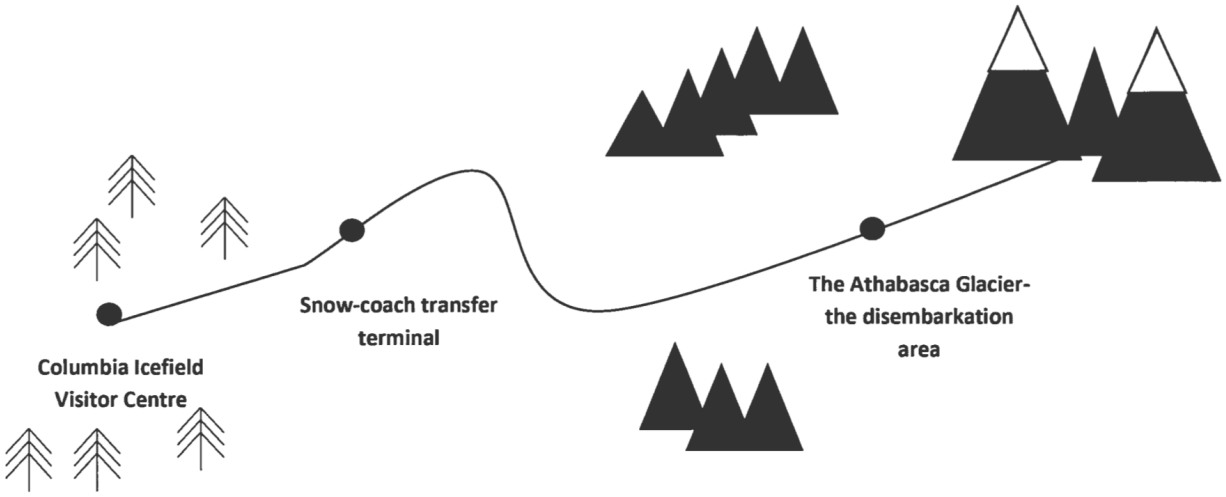
Trip Scenario of the Athabasca Glacier Snow-coach Tour

Study title: The impact of an interpretive program on leisure experiences of clients: A case study of commercial tours on the Columbia Icefield

Principal researcher: Mu He, Master's student, Faculty of Kinesiology, Sport, and Recreation

This research (**ID: Pro00081550**) has been approved by Research Ethics Office of the University of Alberta.

Map of the Athabasca Glacier snow-coach tour



Trees

Mountains

Your simulated snow-coach tour has **five stages**:

- **Stage 1**: Columbia Icefield visitor centre → The snow-coach transfer terminal (By bus)
- **Stage 2**: The snow-coach transfer terminal → Middle of the Athabasca Glacier – the disembarkation area (By snow-coach)
- **Stage 3**: On the disembarkation area
- **Stage 4**: The disembarkation area → The snow-coach transfer terminal (By snow-coach)
- **Stage 5**: The snow-coach transfer terminal → Columbia Icefield visitor centre (By bus)

Your snow-coach tour of the Athabasca Glacier starts!

- *Location: Columbia Icefield Visitor Centre, Jasper National Park (Figure 1 & Figure 2)*
- *Weather: a sunny morning with soft wind in July*
- *Ticket price: $50*
- *Duration: 80 minutes (including the loading and the unloading time)*

Figure 1. Columbia Icefield visitor centre (Photo credit: Tripadvisor, 2018)

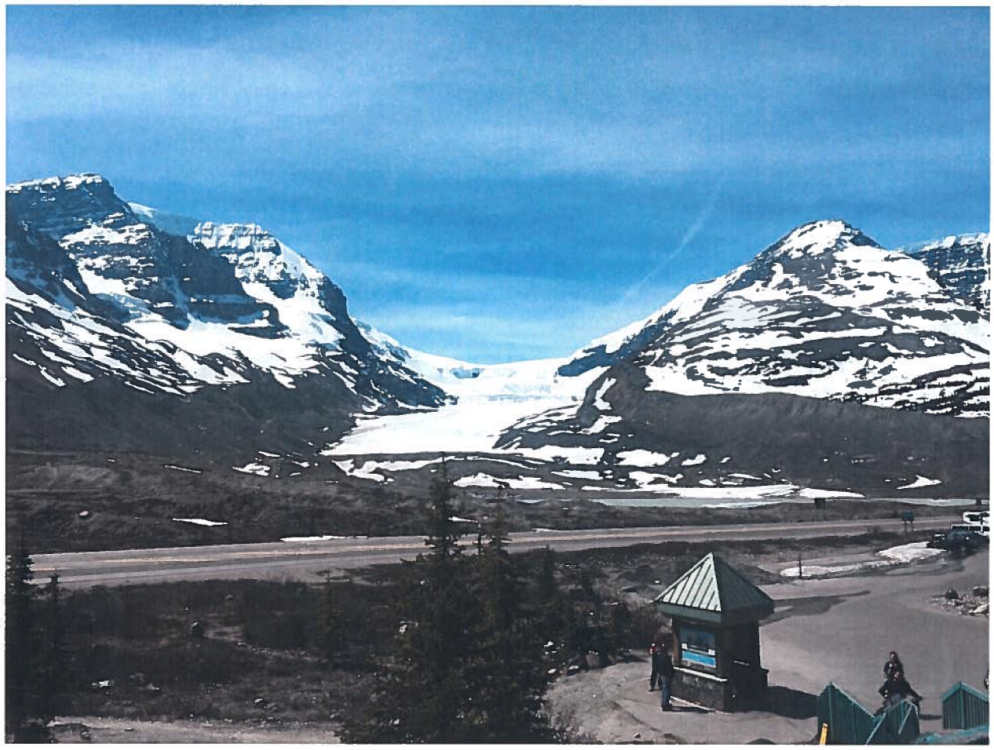


Figure 2. The full view of the Athabasca Glacier (Photo credit: Mu He, 2017)

Stage one: Board a bus that transports you from the visitor centre to the snow-coach terminal near the access point to the glacier (Figures 1, 2, 3, 4, 5 & 6)

- *Duration: 10 minutes (including the loading and the unloading time)*

(There are many people boarding the bus and the atmosphere is the one of excitement and anticipation.)

- **Tour guide + bus driver (Debbie):** Hello and welcome to the Columbia Icefield! My name is Debbie and I will be taking you to the snow-coach transfer terminal, where you will transfer to a snow-coach, that will take you onto the glacier (*Figure 3*). This snow-coach tour will be a unique experience highlighted by a stop where you can disembark the snow-coach and step onto thousand-year-old ice to personally experience the fantastic landscape of Columbia Icefield. You will also experience one of the steepest road grades in North America during your ride. Are you looking forward to the tour now?

Figure 3. Driving from the visitor centre to the snow-coach transfer terminal (Photo credit: Mu He, 2017)

- **Tour guide + bus driver (Debbie):** If you look around, you can see many trees but most of them are short (*Figure 4*). It may be hard to imagine but many of them are over 400 years old! If you are thinking it is because of the cold weather, you are right! As you can feel now, the Columbia Icefield area is cold even in summertime. Because of the short growing season, these trees are stunted. They grow just a little each year. As the tour continues, you may notice that there are fewer and fewer plants on the way. This is because most plants cannot grow under extreme weather conditions in high alpine zone.

Figure 4. The scenery from the bus during stage 1 (Photo credit: Mu He, 2017)

- **Tour guide + bus driver (Debbie):** We are close to the snow-coach transfer terminal. Actually, this transfer terminal was located on a higher place before the 2014 season. However, the ground on the higher place becomes somewhat unstable because the glacier is moving and retreating. That is why we should move down to the current place, where the ground is more stable.

  We are arriving at the snow-coach transfer terminal (*Figure 5*). You will now disembark the bus and board the snow-coach. On the snow-coach, you will have a new driver and tour guide, Jack. He will take you to the glacier. If you have garbage, please take it to the garbage can in the front. I hope you have a great time on the snow-coach and the glacier!

(Tour group disembarks the bus, and then boards the massive snow-coach.)

Figure 5. Snow-coach transfer terminal (Photo credit: Zabed Akbar, 2011)

Figure 6. Boarding the snow-coach (Photo credit: Brian Cohen, 2017)

Stage two: Depart from the terminal of snow-coach, descend on to the glacier, travel to the disembarkation area on the glacier (Figures 7, 8, 9, 10, 11, & 12)

- *Duration: 20 minutes (including the loading and the unloading time).*
- **Tour guide + snow-coach driver (Jack):** Now we are surrounded by mountains and glaciers! Welcome to the Columbia Icefield and to the Athabasca Glacier in particular. My name is Jack, and I am your snow-coach driver and tour guide for today's snow-coach tour. During the tour, we will travel for about 20 minutes to the snow-coach disembarkation area, where you will have 20 minutes to attend a climate change interpretive program and explore the glacier. On the way, I will be talking about how glaciers and icefields form, and how they impact the surrounding environment.

  We are lucky as the weather is really nice today, with sunshine and a soft and mild breeze. We are about 7, 200 feet, or 2, 100 meters above sea level now, and the temperature is lower than most other places in the Canadian Rockies. You can see the snow all year here, and the ice underneath the snow is ancient. Because we are in a very high alpine area, the air is pure and tends to be cooler. The cold weather is one of the reasons that we won't see many plants in this alpine zone (*Figure 7*). It is also hard for large animals to live in this area with the low availability of food.

  Although we cannot see large animals here, you may find fossils on the top of the surrounding mountains (*Figure 7*). If we were able to travel back in time hundreds and millions of years, everything that you currently see around would have been under water. This area of the world was the seabed of a vast ocean. As a result, you can find many marine-based fossils in this area. For example, at the very top of the mountains around here, you may find trilobite fossils in the steep rubble, and some very old fossils of ancient marine creatures, such as rugose corals. It is amazing to see them at such high altitudes.

Figure 7. Looking outside from the snow-coach (Photo credit: Mu He, 2017)

- **Tour guide + Snow-coach driver (Jack):** Glaciers are always moving and the Athabasca Glacier is no exception. As a result of the glacier's movement, some very big and steep rock piles came from the glacier and the surrounding mountains. There are two important types of moraine in this area. At the moment we are driving on is the top of lateral moraines, which are formed at the side of the glacier (Figure 8). The other type of moraine is the terminal moraine, and it can be found between the toe of the glacier and the visitor centre. The terminal moraine marks the furthest point of advancement for this glacier. These moraines have proved that glaciers not only impact plants and animals here; they also shape the landscape in this area.

Figure 8. The snow-coach is driving on the steep lateral moraine (Photo credit: Pursuit Banff Jasper Collection, 2014)

- **Tour guide + snow-coach driver (Jack):** Look! Directly in front of us you can see is one of the steepest roads in North America. From this point, we have a good view of the Athabasca Glacier. Now, we have to travel down the slope to get to the ice (*Figure 9*)! Are you ready?

  Don't worry! Our snow-coach is safe even though you don't have any seat belts to wear. Nevertheless, please be seated for your safety and we will tempt fate by driving down now!

(The snow-coach is driving down slowly)

Figure 9. The steep grade (Photo credit: Brian Cohen, 2017)

- **Tour guide + snow-coach driver (Jack):** This monster snow-coach is called an Ice Explorer, which is built by Foremost, a company in Calgary. This vehicle can accommodate 56 passengers and it handles deep slopes very well because the massive tires and advanced engine keep us going nicely and slowly. Our top speed of this vehicle is 18 kilometers per hour. Ice Explorers had been used in the complex terrain of the Columbia

Icefield for over 20 years to allow millions of visitors to explore the glacier. They have proven to be effective for glacier travel. Currently, we have 20 snow-coaches at the Columbia Icefield, with only other two snow-coaches that are operated in Antarctica for the transportation of researchers. One is owned by U.S. and the other one is owned by Australia.

(After a successful descent, the snow-coach climbs on the ice)

- **Tour guide + snow-coach driver (Jack):** The water on both sides of the ice road we are on is meltwater from the glacier (*Figure 10*). On a sunny day like today, we will see a lot of meltwater flowing by midday. The meltwater from the Columbia Icefield flows to three oceans: The Pacific, Arctic, and Atlantic by the way of Hudson Bay. Right ahead is a tire wash for snow-coaches, fed by glacier melt water. The snow-coach's tires will take a shower here to wash tires thereby ensuring we don't take too much dirt on to the beautiful glacier. Make sure your windows are closed! We will be going into the one and the only Columbia Icefield tire wash!

Figure 10. Tire wash in the melting water (Photo credit: Pursuit Banff Jasper Collection, 2018)

- **Tour guide + snow-coach driver (Jack):** The snow-coach is now on the ice and we are approaching the snow-coach disembarkation area (*Figure 11*).

  In the Canadian Rockies you can see many dramatic natural landscapes characterized by high mountains and deep valleys. But as you can see around, the dominant feature in this area is the Columbia Icefield and its many glaciers. Now is the time for me to explain what the icefield and glaciers are and how they formed. Let's use a bowl, something we use every day, to understand how the icefield and glaciers form. There is a lot of space to form a large natural bowl between the high peaks. In wintertime, there is heavy snowfall in this area. During the formation of glaciers, much of the accumulated snow failed to melt away because of the low temperatures at this high altitude location. As a result, more and more snow accumulated in the natural bowl over a long time. As its weight grew, it began to flow downhill into the surrounding valleys. In the higher valleys, this snow and ice accumulation became glaciers while in the lower valleys, the ice melts to form rivers. It is through this process that the snow in the natural bowl and surrounding glaciers formed the Columbia Icefield. Therefore, we can say that the Columbia Icefield feed glaciers. One of them is the Athabasca Glacier.

Figure 11. Snow-coach operating on the ice (Photo credit: Pursuit Banff Jasper Collection, 2018)

- **Tour guide + snow-coach driver (Jack):** Normally, it takes up to 5 years for snow to turn into glacial ice. The depth of the ice at the Athabasca Glacier is between 270 to 1, 000 feet or 90 to 300 meters. While the ice is very strong, please remember that the glacier is dangerous. Because the glacier is constantly shifting and moving, this process creates some very deep and hidden cracks known as crevasses that can be extremely dangerous. For this reason, you are only permitted to walk within the designated area that has been inspected for safety hazards.
- **Tour guide + snow-coach driver (Jack):** We are just arriving at the snow-coach disembarkation area (*Figure 12*). When you are on the glacier, you will have 5 minutes of climate change interpretive program first and then 10-15 minutes of free time. You can take pictures, walk around within the designed area, drink the meltwater from the ancient ice, read interpretive signs, or chat with our staff here. Please remember, don't go beyond boundaries of the designated area. It is 10:40 AM now, and our departure time is 11:00 AM. About 5 minutes before we leave, I will walk around and hold a red flag as a signal to remind you. Again, my name is Jack, and the snow-coach number is 007. You can disembark the snow-coach and follow the interpreter Laura to start the climate change interpretive program now. See you soon and have a great time on the glacier!

Figure 12. Arriving at the centre of the glacier (Photo credit: Pursuit Banff Jasper Collection, 2018)

Stage three: On the glacier (Figures 13, 14, 15, 16, 17, 18, 19, 20, 21, 22 & 23)

- *Duration: 20 minutes (including the loading and the unloading time).*
- *You start your visit on the glacier by participating in a 5-minute interpretive program about climate change. After the climate change interpretive program, you can spend the final 15 minutes independently exploring the designated visitor area on the glacier!*

Figure 13. Standing on the glacier to attend the climate change interpretive program (Photo credit: Mu He, 2017)

- **Tour guide on the glacier (Laura):** Welcome to the Athabasca Glacier and thanks for joining the climate change interpretive program (*Figure 13*). My name is Laura, the climate change interpreter.

  You might already know that the Athabasca Glacier has been greatly affected by climate change. According to scientific data, the Athabasca Glacier has been melting for the last 125 years. Please look at these two photos (*Figures 14 & 15*). The photo of the Athabasca Glacier taken in 2011 shows that the glacier is only a fraction of the size that it was a century earlier. But the glacier not only retreats in length, but also shrinks in thickness. Every year, the Athabasca Glacier has been found losing at least 2 meters in depth. To give you an idea of how much the glacier melts every year, you can compare the 2 metres to your heights.

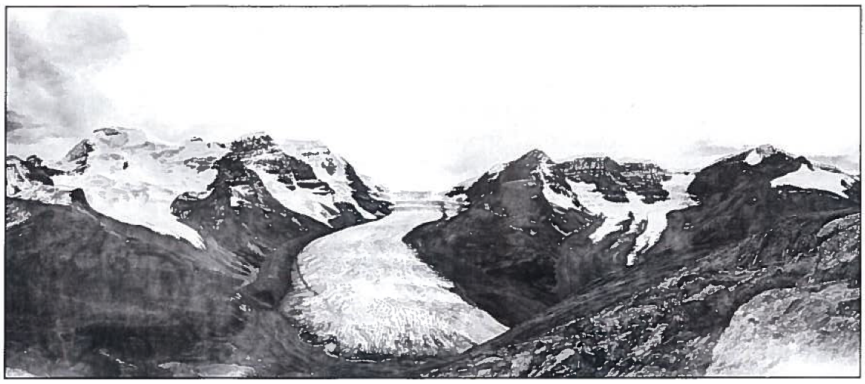


Figure 14. Supporting material: The Athabasca Glacier in 1917 (Photo credit: A.O. Wheeler, 1917)

Figure 15. Supporting material: The Athabasca Glacier in 2011 (Photo credit: Mountain Legacy Project, 2011)

Tour guide on the glacier (Laura): Moreover, it has been noticed by scientists that glaciers have been melting faster over the past 30 years as the average annual temperature has dramatically increased *(Figure 16).* This speed-up is mainly because of the greenhouse gas emissions from human activities. Between the margin of the glacier and the visitor centre, there is an access trail where you can see markers which indicate that where the toe of the glacier was at a variety of dates during this period (*Figure 17*). These markers indicate that the glacier is receding at an accelerated rate. At this rate, the Athabasca Glacier that we are standing on is very likely to disappear by the end of this century. In fact, we lost as many as 300 glaciers in the Canadian Rockies between 1920 and 2005. As you look around the alpine landscape, most of these glaciers are receding. Here, you can get first-hand experience of how climate change impacts our environment.

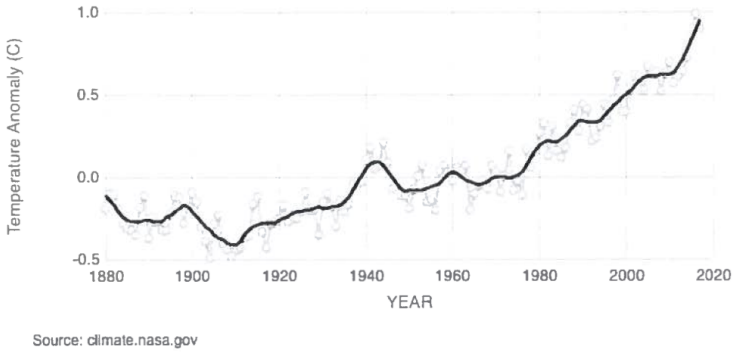


Figure 16. Supporting material: Global temperature anomaly (NASA's Goddard Institute for Space Studies, 2018)

Figure 17. Supporting material: The marker of where the toe of glacier was in 1992 (Photo credit: Andy Skuce, 2014)

- **Tour guide on the glacier (Laura):** There has been a lot of discussion about climate change, but we are often unaware of how it has been affecting our lives. When I was a student I learned about climate change in school. Nevertheless, I did not really understand what was going on until recently.

  I was born and grew up in Edmonton. In my memory, the winter was cold all the time. But recent winters have been weird with more fluctuation in temperature. As a result, climate change has modified my scheduling for outdoor activities in line with these changes of seasonal weather conditions. I am an outdoor person and I like cross-country skiing with my family and friends in winter. But during the last five years, the snow condition in Edmonton and surrounding areas have been unpredictable. In December of 2017, a cross-country ski race in Edmonton was canceled because of the above-zero temperatures (*Figure 17*). It was really frustrating. After that, I realized that climate change is impacting me directly. Now I am trying to do something to slow down the rate of which the average temperature is rising.

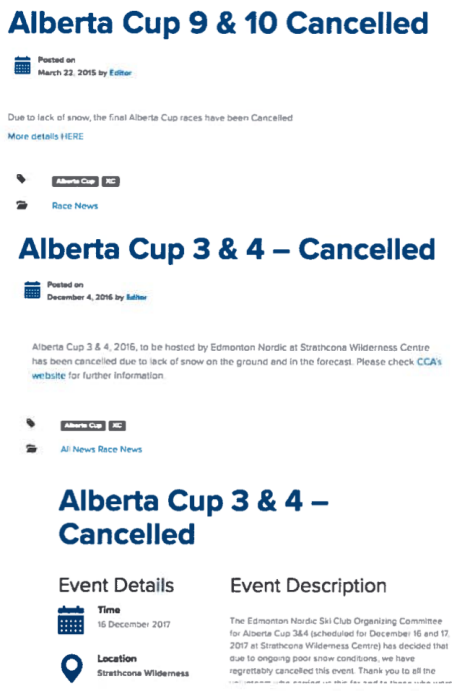


Figure 18. Supporting material: Notices of race cancellation (Edmonton Nordic Ski Club, 2015-2017)

- **Tour guide on the glacier (Laura):** Our tour company has implemented a range of environmental stewardship practices to mitigate climate change, and to protect this beautiful but sensitive area. Every week a bus takes recycled materials to a recycling plant in the neighboring town of Jasper. By doing so, we make extensive efforts to recycle everything that can be recycled.

  Do you want to join us in saving the glacier landscapes? Each of us can take action in our personal lives to make a big difference in limiting climate change impacts. We can reduce greenhouse gas emissions, or, in other words - our carbon footprint. As individuals, recycling is a relatively easy action that we can take in our daily lives. We also can consider walking or cycling to nearby areas.

  You might be surprised to find out that such relatively small actions can contribute to climate change mitigation. But it is true, especially when more and more people get involved. We can all play our part to reduce our negative impacts on the planet.

  Thank you again for participating in our climate change interpretive program. Have a great time on the Athabasca Glacier!

(The climate change interpretive program has finished. You can spend your time freely now!)

- *After the climate change interpretive program, there are many activities you can do on the glacier, including those shown in the following images:*

Figure 19. Walking in the designated area (Photo credit: Mu He, 2017)

Figure 20. Taking photos (Photo credit: Pursuit Banff Jasper Collection, 2018)

Figure 21. Collecting melting water (Photo credit: Pursuit Banff Jasper Collection, 2018)

Figure 22. Reading interpretive signs (Photo credit: Mu He, 2017)

Figure 23. Touching ice (Photo credit: Pursuit Banff Jasper Collection, 2018)

Stage four: Snow coach ride back to the transfer terminal (Figures 24 & 25)

- *Duration: 20 minutes (including the loading and the unloading time).*
- *The interpreter is quieter than before but continues to entertain you with good humor.*
- **Tour guide + snow-coach driver (Jack):** Welcome back! Isn't the scenery amazing? As we make our way back to the transfer terminal, we will talk a bit about the colour of the glacial ice and the weather in this area. I will be quieter than before but feel free to ask me questions if you have. I will try my best to answer them.

  As you can see and feel, the Athabasca Glacier is huge, at about 6 km long and 1 km wide for an area of 6 square kilometers. But as I mentioned before, the Athabasca Glacier is a part of the Columbia Icefield. In fact, it is only about 2% of the Columbia Icefield. The Columbia icefield is the largest body of ice in the Canadian Rockies. It sits on the boundary of 2 provinces: Alberta and British Columbia. The presence of the Columbia Icefield is one of the reasons why the United Nations listed Canadian Rocky Mountain Parks as the UNESCO World Heritage site since 1984.

- **Tour guide + snow-coach driver (Jack)**: If you look at the glacial ice, do you notice that some of them appear to be blue instead of white or totally transparent like the frozen water that you might store in your freezer (*Figure 24*)? It is a magic show performed by glacial ice and sunlight. Now, let me explain for you. You may be familiar with rainbow that we can see when it is raining. When sunlight shines on a raindrop, the light colours get separated because they have different wavelengths. Our eyes can see them separately. The same phenomenon occurs in the glacial ice when sunlight shines on it. The long wavelengths, like red light, will be absorbed by ice, while the short wavelengths, like blue, can be refracted. When the ice is thicker, it is bluer. However, the reason why we cannot see rainbow in the glacial ice is that gaps between the ice particles is very small compared to raindrops.

Figure 24. Blue glacier ice (Photo credit: Mu He, 2017)

- **Tour guide + snow-coach driver (Jack):** We are at the steep hill again (*Figure 25*)! This time we need to climb it from the valley. But don't be worried. Our Ice Explorer is perfectly able to cope with such extremes because it is equipped with a powerful engine, automatic brakes and power steering. Now, lets' do it!

(The snow-coach approaches the transfer terminal after successfully completing the climb)

Figure 25. The steep grade (Photo credit: Brian Cohen, 2017)

- **Tour guide + snow-coach driver (Jack):** Although today is a warm and sunny day, there is always a possibility for a severe and very cold "katabatic wind" to blow through. This type of wind is caused by the cold air from the top of glaciers sinking into the valley below. In winter, the wind speed often reaches over 60 kilometers per hour. Because of the katabatic wind, the temperature of -30 degrees or below are common here. This is a major reason why the snow-coach tour operates in summertime only when the temperature is generally warmer.

  Now we are back to the snow-coach transfer terminal again. It is my pleasure to have you on board the snow-coach and have the unique experience together. I hope you enjoyed your time on the glacier and your visit to the Canadian Rockies!

(Tour group transfers from the snow-coach to the bus for the ride back to the visitor centre.)

Stage five: Transfer to a bus and drive back to the visitor centre (Figure 26)

- *Duration: 10 minutes (including the loading and the unloading time)*
- *The driver/interpreter causally chats with participants and wishes everyone well when they leave the bus.*
- **Tour guide + bus driver (Debbie):** Welcome back! Now we are heading back to the visitor centre. We just talked about environmental features of the Columbia Icefield and the Athabasca Glacier, but do you know about the important cultural role of the icefield to Indigenous people? They describe the Columbia Icefield and the glaciers in this area as the mother and the heart because this area is their source of water. They recognize that where water goes, life follows. The name of "Athabasca" is from the local Cree indigenous language, meaning "place where the reeds grow".

  Long before the construction of Icefields Parkway in 1940, Indigenous people passed through the Columbia Icefield area regularly for thousands of years and crossed over mountains and valleys to hunt and trade (*Figure 26*). This was an important pass, which connected them to other places. When the early European travellers came, Indigenous people guided scientists, fur traders, and tourists in this area. To summarize, it is clear that Indigenous people have played an important role in shaping the cultural landscape of the Columbia Icefield and the Athabasca Glacier.

Figure 26. Icefields Parkway (Photo credit: Mu He, 2017)

- **Tour guide + bus driver (Debbie):** I hope that during this snow-coach tour, you have learned more about how the Columbia Icefield and its glaciers shape environment, landscape, and culture in Canadian Rockies. Also, I hope this experience can help you understand the global issue, climate change.

  Now we are arriving at the visitor centre. I hope that you have had a wonderful experience today. Enjoy the rest of your time in Canadian Rockies and we look forward to seeing you the next time you are in this beautiful place.

Your simulated Athabasca Glacier snow-coach tour has done.

Please tell me about your leisure experiences!

Appendix C: Questionnaire

UNIVERSITY OF ALBERTA
FACULTY OF KINESIOLOGY, SPORT, AND RECREATION

Leisure experiences of the Snocoach tour at the Athabasca Glacier

Thank you for giving your consent to participate in this study. The data collected from you will be used to understand how an interpretive program impacts young adults' leisure experiences while attending a simulated snocoach tour on the Athabasca Glacier. It will take you **approximately 5 to 10 minutes to complete the questionnaire**. You can decline to answer a particular question without consequences. Just leave it blank or circle "Don't know".

Section A: Evaluations of leisure experiences

Section A1: The following questions ask your opinions about leisure experiences of the simulated snocoach tour in which you just participated. Please indicate the degree to which you would agree or disagree with the following statements, from 1 strongly disagree to 7 strongly agree. (Please circle one answer per row only)

	Strongly disagree						Strongly agree	
The setting of the glacier was attractive.	1	2	3	4	5	6	7	☐Don't know
It was pleasant just being there.	1	2	3	4	5	6	7	☐Don't know
The snocoach tour made me more knowledgeable.	1	2	3	4	5	6	7	☐Don't Know
The snocoach tour showed the beauty of the alpine environment in a variety of sensory ways (seeing, touching, hearing, tasting, and so on).	1	2	3	4	5	6	7	☐Don't Know
Attending this snocoach tour was fun.	1	2	3	4	5	6	7	☐Don't Know
This snocoach tour was a learning experience.	1	2	3	4	5	6	7	☐Don't Know
The activities of the snocoach tour were amusing.	1	2	3	4	5	6	7	☐Don't Know
I felt like I was in a different time and place.	1	2	3	4	5	6	7	☐Don't Know
I derived a lot of pleasure from this snocoach tour.	1	2	3	4	5	6	7	☐Don't Know

I learnt many different things about the glacier during the snocoach tour.	1	2	3	4	5	6	7	☐Don't Know
I felt I played a different role while on the tour than in my ordinary life.	1	2	3	4	5	6	7	☐Don't Know
This snocoach tour stimulated my curiosity to learn new things.	1	2	3	4	5	6	7	☐Don't Know
I completely escaped from my daily routine.	1	2	3	4	5	6	7	☐Don't Know
I felt a real sense of harmony with the alpine environment.	1	2	3	4	5	6	7	☐Don't Know
This snocoach tour was entertaining.	1	2	3	4	5	6	7	☐Don't Know

Section A2: The following question asks your opinions about the overall experience of the snocoach tour that you just attended. Please indicate the degree to which you agree or disagree with the following statement, from 1 strongly disagree to 7 strongly agree. (Please circle one answer per question only)

	Strongly disagree						Strongly agree	
Overall, I was very satisfied with the snocoach tour.	1	2	3	4	5	6	7	☐Don't Know

Section A3: The following question asks about the extent to which the trip scenario helped you imagine yourself on a snocoach tour on the Athabasca Glacier. From 1 Not helpful at all to 7 very helpful. (Please circle one answer per question only).

	Not helpful at all						Very helpful	
To what extent do you think this trip scenario helped you imagine yourself on a snocoach tour on the Athabasca Glacier?	1	2	3	4	5	6	7	☐Don't Know

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Section B: Perceptions of climate change

Section B: The following questions ask your opinions about climate change. Please respond based on your views **before you participated in the simulated snocoach tour**. Indicate the degree to which you agreed or disagreed with the following statements. (Please circle one answer per question only).

Climate change refers to a long-term shift in weather conditions, including changes in temperature, precipitation, winds, and snowfall. Climate change can involve both changes in average conditions and extreme weather events.

1. How sure were you about the reality of climate change?

Very sure it is not happening 1 2 3 4 5 6 7 Very sure it is happening ☐Don't Know

2. Assuming that climate change is happening, what role did you think humans have played in contributing to the raising temperature?

Very low 1 2 3 4 5 6 7 Very high ☐Don't Know

3. Did you think your life is affected by climate change?

☐ Yes ☐No ☐Don't Know

Please explain (Optional): _____

_____

4. How concerned were you about climate change as a global issue?

Not concerned at all 1 2 3 4 5 6 7 Very concerned ☐Don't Know

Section C: Academic and Demographic Information

Section C: The following questions ask about your demographic and academic background.

1. In what year you were born? _____

2. What is your gender? _____

3. What is your nationality? _____

4. What university degree are you currently pursuing? (for example, Bachelor of Education, Master of Science)

_____

Thank you for your participation!!