A Picture is Worth [More Than] a Thousand Words: Visualizing Local and Tourist Perceptions of Greenland through Social Media Photo Mapping

Tracy Michaud, Colleen Metcalf & Matthew Bampton

The old adage "a picture is worth a thousand words" is apt when examining social media photo posts. The Volunteered Geographic Information (VGI) embedded within social media photos from online sites such as Flickr provides depths of information for tourism managers beyond the image itself. This research analyzes Flickr VGI from photos of Kalaallit Nunaat or Greenland, from 2004-2020 within a netnography framework and cultural geographic approach. This theoretical outlook argues that geo-visualizations create novel impressions of what tourists and local people value, give insights into how people perceive a destination, and influence sense of place. Greenlanders, although familiar with exploration and colonization, have only recently begun to deal with a growing number of tourists. While the tenants of responsible tourism management include a strong local voice in conversations on tourism development, results show Flickr images of Greenland are dominated by tourist photos, especially those in cruise ship ports, many likely taken from the ship. Furthermore there appears to be distinctly different photo patterns between locals and visitors. These dichotomies suggest the need for more conversation within broader tourism planning work around how the world "sees" Greenland, how it might affect the quality of life of locals, and sustainable tourism development for travelers. As visitation increases in Greenland, and in Polar regions in general, VGI provides an efficient, cost-effective way to visualize perceptions of various stakeholders, which can guide conversations in tourism management, and serve as a reminder to acknowledge and prioritize local voices.

Introduction

Volunteered Geographic Information (VGI) and "Big Data"

The old adage "a picture is worth a thousand words" is apt when examining patterns of social media photo posts within a location, but not in the way one might think. A single picture captured by a tourist's camera and posted on a public social media platform, such as Flickr, provides depths of information beyond the image itself. The Volunteered Geographic Information (VGI) embedded within social media photos can indicate exactly where a photo is taken and where the

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photo taker is from. VGI is defined as voluntarily generated geo-spatial content produced by online users (Goodchild, 2007) and is increasingly used to assess consumer behavior and tourism's impact in a destination. VGI can be aggregated into "big data" involving sets of sometimes millions of data points. This type of data is now regularly used by data analytic companies and researchers, allowing the analysis of large amounts of very detailed and specific information (McAfee & Brynjolfsson, 2012; Safegraph, 2021).

Recent research has shown that VGI from social media sites such as Flickr produces accurate and significant patterns of tourist movement (Ding & Hongchao, 2019; Donaire et al., 2014; Elwood et al., 2013; Flanagin & Metzger, 2008; Girardin et al., 2008; Kadar, 2014; Wood et al. 2013; Zhen et al., 2017), even in rural places with smaller datasets (Michaud et al., 2021). When mapped, VGI from online photos can show where tourists move on the landscape through time (Cao et al., 2010; 2012; Runge et al., 2020) and can be compared to patterns of local populations. There has been little use of VGI data analysis in the Arctic to look at visitor movement and the patterns of various users on the landscape (Leung, et al., 2013; Runge et al., 2020). Runge et al. (2020) uses Flickr photos to show increases and changes in tourist distribution through time in the Arctic. The research in this paper builds on and contributes to this type of work by analyzing VGI from images of Greenland on Flickr from 2004-2020 guided by a netnography methodology within a cultural geographic framework. This theoretical approach suggests that visualizations create novel impressions of what tourists and locals value and gives insights into how people perceive a destination, which ultimately influences sense of place. The goal of the research in this paper is to uncover patterns through time of where and how visitors take and share photos of Greenland, in order to show who is influencing the way the outside world "sees" Greenland. This information can help guide conversations in tourism management.

Tourist photographs and social media

Photographic pictures verify a person's presence at a distinct time and place (Hillman, 2007) and have been used to document aspects of life from the mundane to the extraordinary for almost two centuries. One aspect that photos have become intricately linked with is travel and tourism (Cedarholm, 2004; Chalfen, 1979; Gretzel, 2017; Jenkins 2003; Lo et al., 2011). Photographs are used to market destinations (Cedarholm, 2004; Jenkins, 2003), create souvenirs, and capture memories of travel (Berger et al., 2007). Tourists take photos to create records of their visit. It is proof they consumed an experience (Garrod, 2009; Jenkins, 2003; Kadar, 2014; Larsen, 2006; Urry, 1990). The act of taking photographs is recognized a part of the tourist experience and has been studied from numerous host/guest perspectives over the years (Chalfen, 1979; Garrod, 2008; Jenkins, 2003; MacCannell, 2001, Urry & Larsen, 2011). Jenkins (2003) shows that photos by tourists and those from iconic destinations inform and influence one another. "Tourist photos are a very relevant indicator of the perceived image of a destination" (Donaire et al., 2014: 32). They give insights into how different groups of people reflect a destination and ultimately influence and inform how the place itself is defined (Chalfen, 1979; Garrod, 2009; Urry, 1990).

Widespread access to new technologies such as digital cameras, smart phones, free WIFI, and photo apps, coupled with the extensive popularity of social media, have made the taking and sharing pictures and videos easy, and photo sharing has increased dramatically in the last two decades (Dinhopl & Gretzel, 2015; Donaire et al. 2014). In the past, photos taken by a non-digital camera needed to complete a relatively lengthy and expensive process by experts before results

were seen by anyone, today it is mere seconds before digital images can be taken, reviewed, edited and shared with everyone. This had led to an explosion of documentation of everyday life through social media images, as well as much more detailed travel imagery (Donaire et al., 2014; Lo et al., 2011).

The trend toward the dominance of user-generated, visual content over professional textual content on the web has been noted through time (Buhalis & Law, 2008; Du et al., 2020; Hays et al., 2013; Munar et al., 2013; Munar & Jacobsen, 2014; Volo, 2010) and visual online content is considered a new channel for the creation and public consumption of meaning in tourism experiences (Munar & Jacobsen, 2014). Participatory culture, especially among millennials, has enabled and encouraged tourists to instantly share their travel experiences on social media platforms (Du et al., 2020) and this sharing activity influences the perceptions and experience of a place (Shanks and Svabo, 2013). Du et al.'s (2020) research in China has shown how TikTok, an online video sharing platform, has increasingly played a role in shaping tourist behavior and destination image. In theoretical discussions of the post-tourism world (Jansson, 2018), the expansion of these web-based social media platforms reinforces and accelerates the dynamic of explorers finding and sharing unique, untouched, and authentic experiences, which due to their visiting, ultimately leads to the erosion of the pristine places, extraordinary experiences, and unique identities they were seeking in the first place (Jansson, 2007; Tribe & Mkono, 2017). This conundrum is a real risk to emerging destinations in the Arctic.

Starting when people are just dreaming of travel on platforms such as Pinterest (Gretzel, 2021), researchers agree that social media strongly influences knowledge creation, tourism culture, and how tourists interact with a destination (Amsdorffer et al., 2012; Chalkiti & Sigala, 2008; Dinhopl & Gretzel, 2015; Paris, 2012; Zeng & Gerritsen, 2014). The growing influence of social media on how destinations are constructed, viewed and appropriated means that the connection between user generated content and commercial interests (booking systems, hotels, tour operators, accommodation sharing sites, and other hospitality services) is increasing (Frith, 2017; Jansson, 2018; Månsson, 2011; Tribe & Mkono, 2017; van der Hoeven, 2017). These commercial interests (Stiphas, 2015; Van Dijck & Poell, 2013) rarely have social issues, such as a community well-being, at the center of their logic. As tourists increasingly contextualize their experiences through messages communicated by commercial-focused social media with user-generated content (Du et al., 2020; Gretzel, 2021; Jansson, 2002), understanding who is creating the content and where they are creating it matters more than ever for the communities involved in emerging destinations.

While content analysis and immersive exploration of social media images and videos (Du et al., 2020; Gretzel, 2021) has been ongoing, there is valuable social information to be gained beyond the image. Cao et al. (2012,) argue that the act of geotagging digital photos is a recommendation in and of itself for that destination. The visual power of photographs can be harnessed in maps of geo-tagged photos to create new ways to investigate what tourists and locals' value within a destination, and how the world sees and understands the place. Social media VGI provides hands-off, publicly accessible, immediate data that is increasingly important in a world where a global pandemic can restrict access to in-person data collection techniques. For these reasons, Flickr.com, an online photo sharing site, with a strong research literature showing it can act as a proxy for tourist and local movement and behavior, was chosen as the photo source for this analysis (García-Palomares et al., 2015; Girardin et al., 2008; Kadar, 2014; Runge et al., 2020).

Cultural geography, sense of place, and quality of life

As tourism is by nature geographic, the value in using a social geographic lens to research tourism management issues is recognized. Tourism occurs in a place, and involves movement between spaces, which has been viewed in the past as something different than mundane life (Carr, 2002; Graburn, 1989; Larsen et al., 2006; Jennings & Nickerson, 2006). While recent research argues that the boundaries between tourism and everyday life experiences is becoming more porous due to modern technology (Chang & Gibson, 2011; Du et al., 2020; Jansson, 2002; Jansson, 2018; Larsen 2008; Ribeiro & Yarnal, 2008), it is still useful to understand the tourism experience within a geographic framework. Social geography focuses on human society and its relationship to space, in particular how society determines and structures space and how spatial conditions influence societies (Hall, 2013). Cultural geography is a subset of social geography, viewing tourism not as an isolated activity but one that is part of a broader life or culture. At the center of this paper's analysis is a cultural geography theoretical perspective, the concept that tourism not only consumes a place, but also contributes to and constructs a sense of place at a destination (Aitchison, 2006; Larsen et al., 2006; MacCannell, 2001). By studying local and visitor perceptions of Greenland through social media, this work builds on research unveiling the blurring of boundaries between tourism and mundane life.

Sense of place is a label that tries to capture the relationship between a spatial setting and people's feeling or perception they have about the place (Agnew & Duncan, 1989; Altman & Low, 1992; Tuan, 2013). Sense of place is directly related to the concept of quality of life. Quality of life is composed of an individual's perception of their health, comfort, and happiness within the context of their cultural position in life, and argued by researchers to be affected (positively and negatively) by tourism (Adanan et al., 2010; Kim et al., 2013; Steenholdt & Chimirri, 2018). While tourism researchers have shown that quality of life might improve with the income and infrastructure tourism brings to a community, there are equal long-running concerns that Indigenous cultures are losing (or have lost) their sense of place due to influences like tourism and climate change (Basso, 1996). This can potentially reduce their quality of life. Both factors are distinctly at play in the Arctic. As places like Greenland become more focused on developing tourism and climate change makes the place more accessible, making sure the impacts of any changes are understood and guided by Greenlanders, in order to preserve their sense of place, if that is what they want. These conversations are important in maintaining or improving quality of life for local communities, and vital for the tourism industry itself as it recognizes an increasing interest from travelers around minimizing not just their negative environmental impact but their cultural impact as well (Runge et al., 2020; Visit Greenland, 2021).

Some research on local and visitor perceptions of place has focused on ways perceptions are similar, for instance, Munoz et al. (2019) shows that local and visitor values of protected landscapes in Norway overlap. Munro et al. (2017) indicate that while maritime areas often have contested values associated with different groups of people, in the Kimberly, Australia coastal region, residents and non-residents were more alike in their values and management preferences than not. However, it was noted there still could be differences in policy priorities between the groups. Other research shows stronger differences between where locals and visitors are found within a destination. For instance, Dongying et al. (2018) studied urban tourists in ten US cities through mapping Flickr VGI and concluded that tourists tended to cluster around city centers and locals were more dispersed

throughout the city. There has been scant research in the Arctic looking at local and visitor patterns and perceptions through social media VGI, and this research aims to begin to fill this gap.

Arctic tourism

For several decades the Arctic has been undergoing significant changes in environment, culture and economy, straining an already stressed human and economic environment (Nuttall & Callaghan, 2000; Stewart & Draper 2009). Arctic tourism's visibility has rapidly increased (Maher, 2017; Saarinen & Varnajot, 2019), helped by the proliferation of striking social media images of wild and frozen landscapes (Runge et al., 2020). The Arctic as a destination has been studied from various scales and viewpoints through time. Stewart et al. (2017) compiles the research into eight themes: development, management, experience, global change, governance, impact, community, and reviews (Ciaputa & Salwicka, 1997; Davis, 1998; Enzenbacher, 1994; Johnston, 1998; Kaltenborn, 2000; Kaltenborn & Emmelin, 1993; Mason, 1997; Mason & Mowforth, 1996; Scott, 2001; Smith, 1994; Splettstoesser & Folks, 1994; Storehouse, 1990). The dominant sub-theme is managing cruise tourism, as that is the most popular mode of transport for tourists to polar regions, and has long been connected to environmental and cultural issues in the Arctic and beyond (Bertram et al., 2008; Hall et al., 2010; Huijbens, 2015; Lamers & Pashkevich, 2015; Lasserre & Têtu, 2015; Lynch et al., 2010; Stewart & Draper, 2009; Wright, 2008). Bystrowska and Dawson (2017) argue that Arctic cruise itineraries have significant impact in creating tourism destinations and diversifying tourism space throughout the Arctic. Their research creates a typology of perceived values of a tourism destination and shows that decisions on choosing a cruise ship destination is based primarily on sailing conditions, shipping logistics, and perceived risks, with social factors (and hence impact on local communities) less important. Integrated management strategies of cruise tourism in the Arctic are suggested in order to make development more socially equitable and environmentally responsible to local communities (Stewart & Draper, 2009).

Previous research has also noted that the images of the Arctic are often dominated by outsider photos of unpopulated natural areas (Saarinen & Varnajot, 2019). The way the Arctic is marketed creates a set of expectations for tourists as visiting a frozen, empty, and wild place (Buhalis, 2000; Runge et al., 2020). These images influence local and regional tourism development objectives and policy. As social media becomes a strong marketing tool, what photos, who is posting them, and where, should raise questions on how this changes the sense of place and quality of life for those living in increasingly urban environments in the Arctic. There needs to be more research focused on cultural sensitivity, taking into account local community voice and local perspectives in Arctic tourism and polar research in general (Kaján, 2013; Lemelin et al., 2012; Stewart & Draper, 2009; Stewart et al., 2011; Stewart et al., 2015; Runge et al., 2020). Stewart et al. (2017) suggests conducting research in changing tourism demand, understanding new polar actors, governance and regulation, global change, and the influence of new technology in tourism management. Saarinen & Varnajot (2019) argue that acknowledging alternative views and diversity around the concept of Arctic tourism, outside those externally constructed views and perceptions of the region as cold, harsh, wild and empty, could produce positive development paths that better serve increasingly urban-based Arctic communities. The research in this paper contributes to this work through photo-sharing technology that allows new comparisons of external and internal "view" points, laying the groundwork for conversations about perceptions of place and tourism management.

Greenland as an emerging tourism destination

Greenland is the largest island in the world. Most of the island is under an icecap with few roads and airports connecting settlements along the coast. With a population around 56,000, it has the smallest density of people of any country. Greenland has self-rule under the Kingdom of Denmark. Eighty percent of Greenlanders are of Inuit decent, the rest are mostly Danish. Most have public jobs in municipalities and government, followed by hunting (seal, whale, reindeer, and musk ox), fishing (prawn, mackerel, cod, and halibut) and agriculture (sheep and tame reindeer). Fishing dominates the economy, with tourism and mining also contributing significantly. Many Greenlanders maintain a subsistence lifestyle, and are more likely to own boats than cars. They are increasingly urbanizing with 60% of the population now living in the five largest towns (Statistics Greenland, 2021).

Greenlanders, although familiar with exploration and colonization, have only recently began to deal with a growing number of tourists. Primarily driven by climate change, tourism in Greenland has increased since the 1990s despite the often harsh weather conditions, expense, extreme isolation of communities, and lack of tourism infrastructure. Spectacular scenery and wildlife and lower-cost cruises and other accommodations has led to bucket list tourism or "Last Chance Tourism" growing in the polar regions (Eijgelaar et al., 2010; Lamers, 2009; Lemelin et al., 2012; Runge et al., 2020; Stewart et al., 2017).

In Greenland, like other places in the Arctic, tourism development has been undertaken as a way to diversify and build the economy (Johnston, 2011). It is viewed as a viable alternative to direct natural resource extraction options such as fishing and mining (Nuttall, 2008; Ren & Chimirri, 2018). Greenland has looked to neighboring Iceland for models, lessons, and perhaps warnings, on tourism development following Iceland's dramatic increase of mass tourism in little over a decade (Government of Iceland, 2020; Ren & Chimirri, 2018).

Unlike Iceland, tourism growth has been tempered by the fact that Greenland has had only one major passenger airport in Kangerlussuaq, few roads, and a general lack of accessibility compared to other nearby destinations (Kaae, 2006). However this is likely to change as infrastructure and airports are updated and built (Runge et al., 2020). Sustainability issues for the environment and local cultures is a concern and something recognized as important to address during the tourism development process (Government of Iceland, 2020). Controlling "Arctification" has been discussed. This refers to the changes in social, economic, and political relations from tourism processes in the Arctic due to experiences like a temporary concentration of tourists in popular attractions, leading some local communities to experience over-tourism and potentially decrease their sense of place (Lundmark, 2020).

Like other polar destinations, cruise ships are the way a majority of tourists visit Greenland (Eijgelaar et al., 2010). Before 2020, when the COVID-19 pandemic essentially stopped tourism around the world, cruise passengers to Greenland rose relatively steadily between 2004 to 2019, from just over 15,000 to just over 45,000 (Statistics Greenland, 2021). During 2008-2019, international flight passengers in Greenland totaled 70,000-90,000 annually (Statbank Greenland, 2021), making cruise ship passengers an increasing proportion of international visitors to Greenland (see Figure 1).

Figure 1. Cruise Ship passengers from 2004-2020 in Greenland (Statistics Greenland, 2021).

Cruise passengers in Greenland
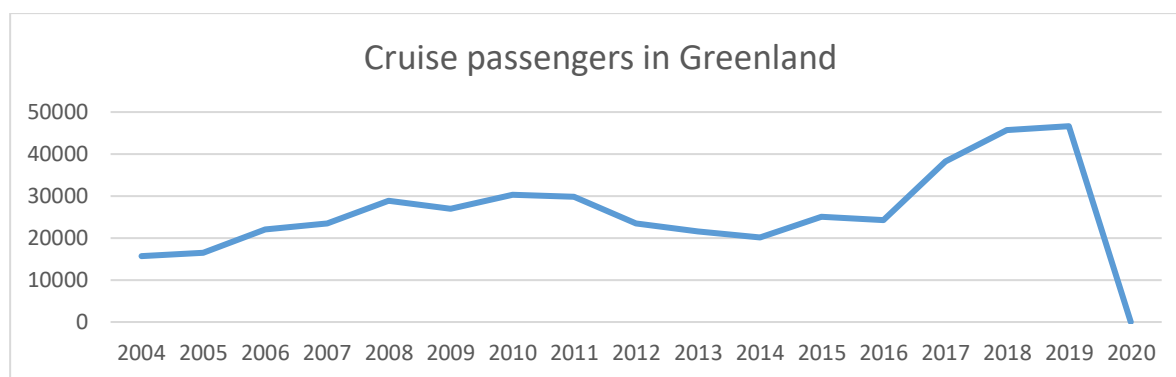
Visiting a place from a cruise ship or an airplane (almost all visitor excursions into the center of Greenland is by plane), could provide an extremely different perception of the place from Greenlanders who live there. Since photos and other visualizations influence how the place itself is defined by the outside world (Runge et al., 2020) and tourism growth influences Arctic landscapes and culture, mapping and analyzing VGI from social media photographs of Greenland on Flickr by locals and tourists from 2004-2020 allows a direct assessment of who dominates the images of Greenland that the world sees. This research looks at where photos are taken, how, and by whom, in order to develop groundwork for discussions on local sense place, quality of life, control, and how this interacts with tourism development (Runge et al., 2020).

Methodology

This research is connected to the netnography framework, which refers to qualitative ethnographic methods used to gain deeper cultural understand from the web, social media and digital apps, including the "big data" that online communities such as Flickr generate (Kozinets, 2015; 2020b). While initially used in marketing research, it is beginning to be applied to other industries and in eTourism research (Gretzel, 2017; Kozinets, 2020a; Tavakoli, 2018; Whalen 2018). The research in this paper is guided by the investigative netnography methodology, which involves the ethical, systematic collection of existing digital data (Kozinets, 2020b) in order to begin the investigation of the social and cultural meaning of the data, in this case through geo-visualizations of Flickr VGI in Greenland.

VGI from social media photos offers researchers increased granularity when studying peoples' interactions with their environment (Bugs et al., 2010; Li et al., 2018; Liu et al., 2015). These photos are considered a modern form of public communication as people are intentionally posting their information (Girardin et al., 2008). While Flickr is not as large as other social media platforms such as Instagram and Facebook, Flickr VGI is free, relatively easy to access, and is publicly available unlike other platforms (Kadar, 2014). Research shows that social media users tend to be younger, better educated, and earn higher incomes than those that do not (DiMinin et al., 2015; Li et al., 2013; Lo et al., 2011; Nov & Ye, 2010). Flickr users in particular are usually well-travelled and tech savvy, and Flickr is used by more professional photographers than other photo sharing platforms (Girardin et al., 2008). Despite this specific demographic, most research indicates that Flickr activity acts as a reliable proxy for visitor activity, providing significant information on broader travel patterns and consumer behavior (Heikinheimo et al., 2017; Michaud et al., 2021; Runge et al., 2020; Wood et al., 2013).

Locational data from social media posts in past studies indicate representative and accurate movement patterns of both tourists and local populations in a destination (Ding & Hongchao, 2019; Elwood et al., 2013; Flanagin & Metzger, 2008; Zhen et al., 2017). A strong correlation has been shown between the number of tourists visiting a destination and the number of photos taken, with several studies accurately estimating the levels of visitation from Flickr photo data comparative to other sources such as survey and travel logs (Kadar, 2014; Levin et al., 2015; Wood et al., 2013). Heikinheimo et al. (2017) and Wood et al. (2013) argue that social media user origins generally correspond to information about visitor origins from other sources as well. Flickr data has been shown to be an accurate representation of movement patterns of visitors from different countries (Gao et al., 2017; Jiang et al., 2015; Lansley & Longley, 2016; Lloyd & Chesirer, 2017). Ding & Hongchao's (2019) discussion of Flickr photos in London indicates a 97% accuracy of geolocation information from photos tagged to landmark buildings. Chen et al. (2019) argues high densities of Flickr photo posts reflect a consensual view that the aspect being photographed is of interest (Hu et al., 2015) or valued by visitors. The research in this paper builds on these previous conclusions that social media activity, namely Flickr photo posts, can act as a proxy for human behavior within tourism management studies, making it a relevant dataset to use within the methodology. The specific methods for retrieving the data are discussed below.

Flickr VGI

VGI data was gathered from the Flickr API on April 25, 2021. Geotagged photos of Greenland from January 1, 2004 to December 31, 2020 were downloaded as this represented all the photos available on Flickr up to that point and provides 16 years of evidence to set baseline patterns for future analysis. The metadata from Flickr photos were obtained from the Flickr Application Programming Interface (API). Flickr is a photo sharing site with over 100 million unique users posting tens of billions of photos annually (Flicker.com, 2021). The Flickr API allows users to interact with its database to pull or manage data for free. To interact with the API, software was downloaded from the Python Package Index. Flickrapi is an open source python interface for the Flickr API (Stuvel, 2018). The flickr.photos.search function allows researchers to search for publicly shared photos. Geographical bounding boxes were chosen to encompass all of Greenland and the ocean surrounding it for 80 kilometers. This was to capture images of Greenland taken on nearby boats and ships. Attributes selected include accuracy, latitude, longitude, owner (Flickr user ID), date taken, title, and tags. The initial data set contained 26,910 photos and 711 users. The data was further processed to remove photos outside the selected boarder and eliminate duplicate photos to reduce contribution bias. Duplicate photos were defined as photos that have the same owner, latitude, and longitude. Note that in 2020, during the COVID-19 pandemic when there were global travel restrictions, there was only one photo of Greenland posted on Flickr, so the vast majority of photographs in this dataset were posted before the pandemic, representative of "normal" travel years.

One well-established technique to identify the origin of a Flickr user involves the retrieving of the user's self-identified location from their profile (Girardin et al., 2008; Li et al., 2017; Liu et al., 2018). Once a user's location is determined, (Flickr.people.getinfo), users can be separated into categories for further study. During the analysis of local versus tourist photo location densities, photos that did not have a user identified location were dropped from the dataset. Users were then categorized by Greenlandic resident (local) and non-resident (tourist). After all these data cleaning processes were instituted, the data had 9,361 photos and 302 geo-tagged users. Density-based

spatial clustering maps and graphs of various groups of Flickr photos in Greenland were created and analyzed to indicate where the highest clusters of photos were located.

Next, tags of Greenlandic Flickr photos were analyzed. "Tagged" photos are a unique phenomenon in online information sharing. They are comprised of two types, the geotag and the user tag. Geotags are latitude and longitude coordinates that are attached to a photo, usually by a device at the time the photo was taken. With the correct settings enabled, the geotagging process can be automated and achieved with little to no effort from the user. Other tags are chosen and added by the user. They are terms or keywords that mark the photo's content with meaningful descriptions (Deng et al., 2014). Flickr users upload and tag photos with the intent to share information publicly. A study of motivations found that public photo tagging was ranked as the most important motivation for using Flickr (Nov & Ye, 2010).

The action of attaching tags to photographs is a direct communication from the user and assigns meaning and context to the objects and places in the photo (Deng et al., 2014). When a place or attraction is tagged by many users with similar interests, it is assumed they are semantically related (Wu et al., 2006). The consensus of Flickr user tags enables a deeper meaning of a place to be derived. The most popular tags attached to photographs are related to photo subjects, content, time, components, and places (Deng et al., 2014). In this study, geotags and user tags are used to indicate the mode the photo was taken whether it be on land, in the air, or from the water. The process of grouping the Greenlandic Flickr photos to land, water and air was complex as sometimes geotags were right on the edge of water and land, or user tags indicated something different than the geotag. When the tag was not definitive, it was labeled as "unclassified" and added to the land group.

Figure 2: Density Map of Flickr photos in Greenland 2004-2020 (26,910 photos from 711 users).
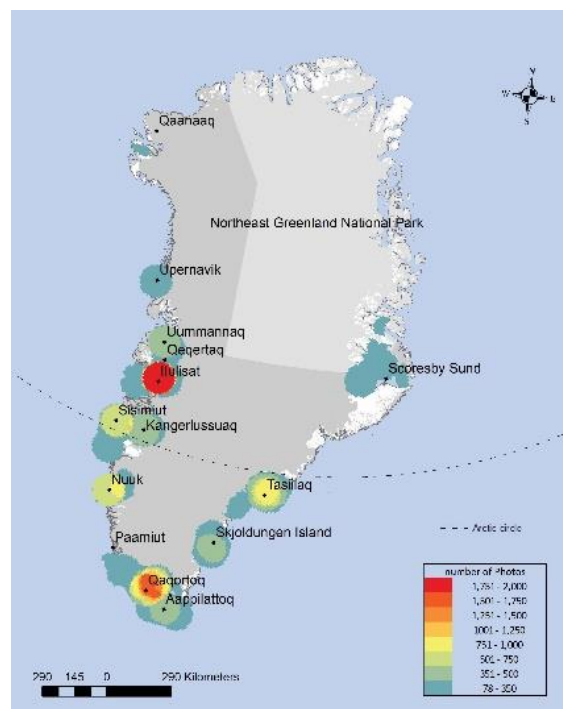
Results

Flickr photo posts from 2004 to 2020 are found in the highest densities along the south coasts of Greenland, although there are photos in the interior and a number out to sea. Figure 2 (above) is a density map of Flickr photos, with orange and red circles indicating "hotspots" or the areas of highest densities. The results show two distinct hotspots of Flickr photos in Greenland from 2004 to 2020 in Qaqortog and Ilulissat, both popular tourist areas on the southwest coast. Figure 3 (below) represents photos posted only by visitors (Flickr users whose origins were outside Greenland). This map shows the same pattern as Figure 2 likely due to the fact that photos by tourists in Greenland from 2004 to 2020 encompass 99.5% of the total Flickr photos dataset (9309 out of 9361). Hotspots in the density maps indicate areas of highest photo density in Qaqortog, the largest cruise ship port in Greenland, and Ilulissat or Disko Bay, another popular cruise ship port and UNESCO World Heritage Site.

Figure 3: Density Map of Visitor Flickr Photos in Greenland 2004-2020 (9309 photos from 297 geotagged users).
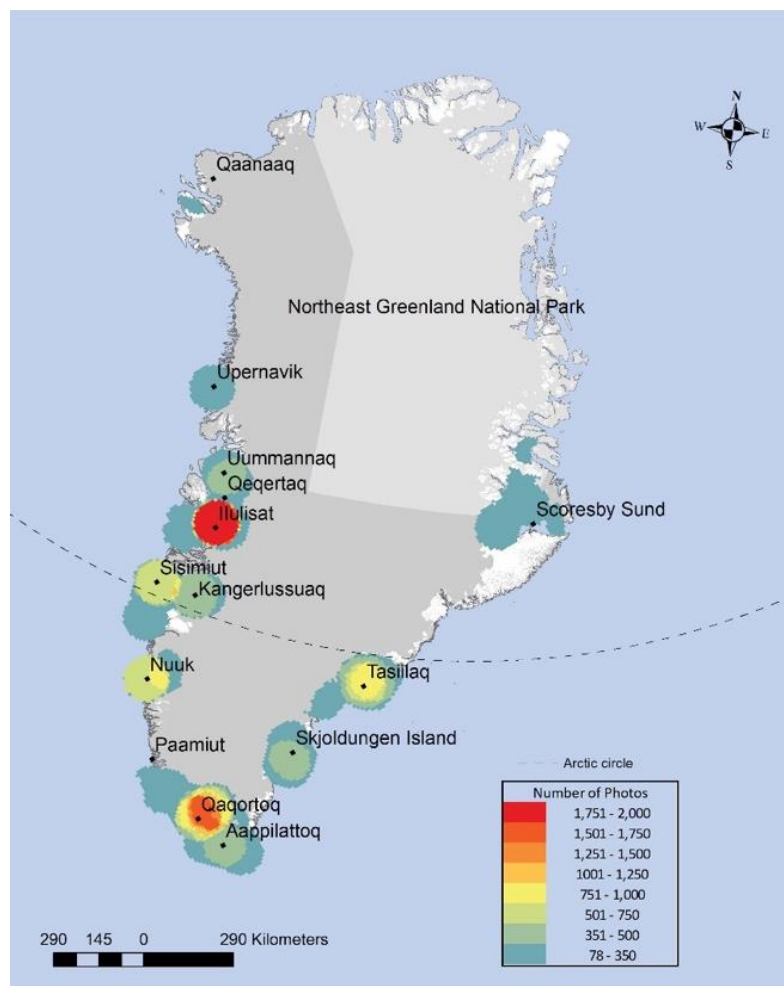
In Greenland, there was found to be a strong correlation between tourist Flickr photo VGI locations and cruise ship ports. Figure 4 shows the relationship between high densities of cruise ships (larger black dots) and high densities of Flickr photos (yellow, orange, and red circles).

Figure 4: Map of 2004-2020 visitor Flickr photo densities overlaid with scheduled cruise ship visits for 2021. Note the largest black dots represent places with the most scheduled cruise ship visits in 2021. These cruise ship locations correlate to the largest densities of Flickr activity (yellow, orange, red).
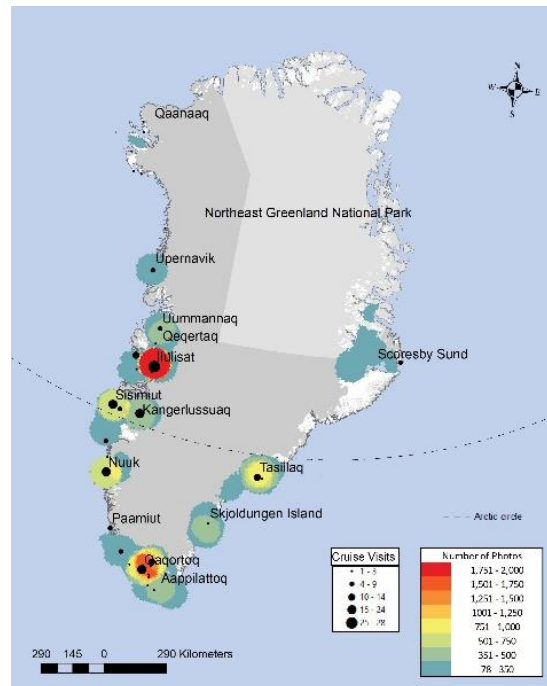

It is important to note the small amount of Flickr photos posted by local Greenlanders from 2004-2020 with only 52 photos and 5 users. With such a small dataset (representing .5% of the total photos posted) those images are not definitively representative of broader photo posting patterns of Greenlanders on social media. However, in terms of Flickr users, Figure 5 suggests that there might be different hotspots of Greenlanders when compared to tourists, with areas of highest photo density around Qeqertaq, Sisimuit, and Nuuk. The latter two are the largest communities in Greenland, where a large percentage of the population lives. This is different from the nature-based cruise ship locations tourists are photographing and posting on Flickr.

Figure 5: Density map of local Flickr photos in Greenland 2004-2020 (52 photos and 5 users). Red/orange hotspots indicate areas of highest photo density in Qeqertaq, Sisimuit, and Nuuk.

When both geo-tags and user tags of the Flickr photos are analyzed, this provides more understanding in how people are likely experiencing the place. The brown dots in Figure 6 represent 394 photos from 2004-2020 in Greenland tagged to flights including "air, sky, airplane, plane, flight, fly" tags; the blue dots represent 5,199 photos from 2004-2020 geotagged to water; the green dots represent 3,588 photos from 2004-2020 geotagged to land and not user-tagged to "flights", as well as the 165 photos from 2004-2020 unclassified. Of the 9,346 photos from 2004-2020, 40% are from land/unclassified, 56% water, 4% air, showing photos from water dominate the dataset. Note all interior photos of Greenland are taken from the air.

Figure 6: Flickr photos of Greenland from 2004-2020 tagged from air, water, land/unassigned
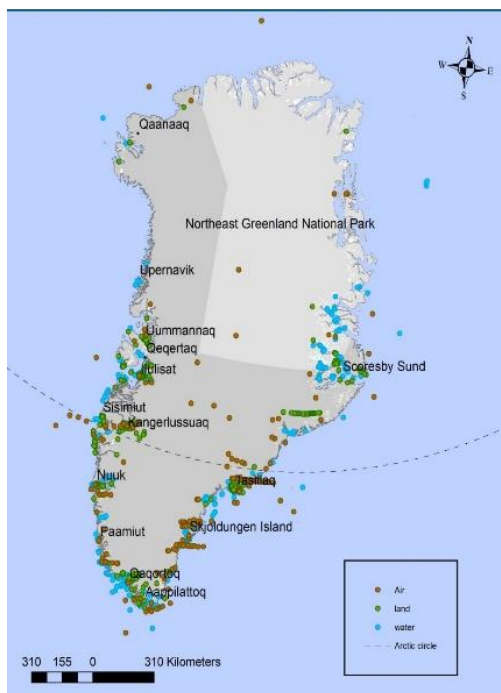
When the percentage of land, water, and air photos are further categorized by locals and tourists, their patterns are once again different. See Figure 7 for comparison pie charts. For visitors to Greenland from 2004-2020, 56% posted Flickr photos from water, 4% from the air, and 40% from land. For locals, only 23% posted from water, 0% from the air, and 77% from land. Even though the local photos are a small percentage of the total Flickr photos, where local people live on land make up most of the local photos, whereas the data shows that the view from the water, likely from cruise ships, dominates tourist photos and hence the overall photos of Greenland.

Figure 7: Tourists and local Flickr photo tag percentages from water, air, land in Greenland 2004-2020
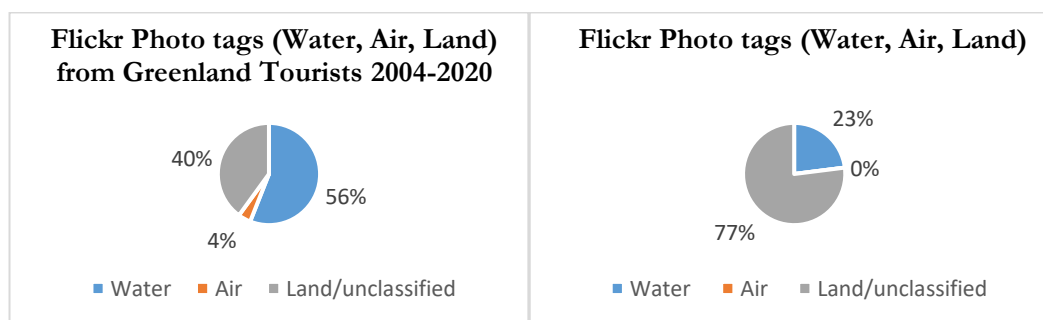
To further investigate the impact of cruise tourism on images posted by tourists, Figure 8 compares the distribution and density of Flickr photo posts in Greenland through time, from 2004-2012 with 1814 photos to 2013-2020 with 7532 photos. The overall number of photo posts increase dramatically through time and photo density hotspots move to cruise ship destinations Qaqortaq and Ilulisat. Of note is the more dispersed overall distribution of photos along the south coast in the 2013-2020 map. This is in contrast to the 2004-2012 map which had more photos in the northern regions of Greenland and less dispersion of photos along the south coast. This movement is in line with research conducted by Runge et al. (2020), indicating an increasingly wider distribution pattern of tourists throughout the Arctic, with photo densities strongly connected to cruise ship landings. It also supports previous photo maps in this research (Figure 6) indicating the large amount of photos taken from water are likely from cruise ships (Figure 4).

Figure 8: Flickr Photo Densities in Greenland from 2004-2012 Compared to 2013-2020. Note a changing pattern to higher densities and more widespread along the south coast correlated to cruise ship routes.
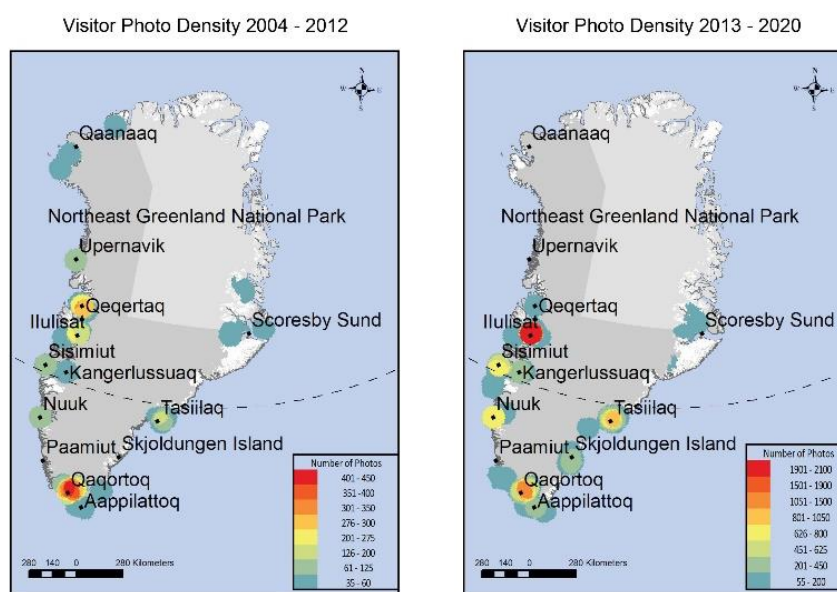
Discussion

Geo-visualizations of the overall Flickr VGI suggest that local Greenlanders have a strikingly different photo posting pattern than Greenlandic tourists, with photos in more urban areas, where most Greenlanders live, not in the nature-based tourist destinations. Another pattern revealed in the data is the high percentage of tourist photos coming from places not on land, likely cruise ships and airplanes. While the correlation between cruise ship landings and Flickr photo densities might not be surprising, what is interesting from the tag analysis was the large amount of total visitor photographs specifically taken from the water (56%). This percentage again differs from local Flickr users who mostly post photos from land (77%). This could mean that Greenlanders, known to spend much time on the water hunting and fishing, don't have time or the inclination to take pictures and post to Flickr while working. It is highly likely that locals value the maritime perspective, but perhaps not in the same way as tourists using the Flickr platform.

Unlike destinations where tourists have most of their time exploring on land, the lack of land-based infrastructure sets the tourist experience apart from the local living experience, setting the stage for tourists to potentially miss the cultural, community, and more urban aspects of Greenlandic life

that is becoming more common in lieu of the wild, empty, natural aspects of this destination. For instance, hunting and fishing on the water is a distinct part of life for many Greenlanders that might be overshadowed by images of icebergs and casually observed maritime wildlife by tourists on cruise ships. This could be determined to be a positive tourism development direction (keep the tourists in the nature-based tourist areas viewing wildlife from afar) or not (integrate local cultural understanding into the tourist experience so they learn more about hunting wildlife for subsistence and life in more urban villages) depending on the goals and wishes of Greenlanders to preserve and protect their sense of place. The dichotomy shown in the data between tourist photos from water and air and local photos from land is something Greenlanders need to discuss as part of shaping how tourism develops and grows in tandem with their everyday life.

The 52 Flickr photos from Greenlanders represent less than 1% of total Flickr photos from 2004-2020, therefor definitive conclusions cannot be made on local perceptions of Greenland based on this small dataset. However, the fact that the number of local Flickr photo posts is so small shows that tourist images in Greenland almost completely dominates the Flickr platform, indicating a likely domination of the outsider's images and hence perceptions of Greenland on other social media platforms as well. Since visitor behavior can be significantly shifted due to social media content, polices that affect local quality of life can be implemented to serve visitors above locals, which might pose issues.

As the blurring between travel and mundane life occurs, the disparate but dominant tourist perception could disproportionately end up shaping the lives and culture of Greenlanders. Understanding implications of social media photo posting trends and their potential effects on Greenlandic sense of place, is not only important to discussing how to preserve and improve local quality of life, but also because issues of tourism's impact on cultures are becoming more important to travelers as well, with many cruise ships starting to incorporate some aspect of cultural understanding in their excursions. Seeing how visitor's social media photo posts of Greenland compare to local patterns is useful in pointing out where visitor perceptions might be dominating in order to remind tourism managers that discussions on sustainable tourism must be inclusive. Local voices should be involved in assessing "image" and perception dichotomies, if they are acceptable, and if not, what to do about it. Since images themselves strongly influence sense of place within a destination, and social media can immediately influence how visitors interact with a destination, this research supports the strengthening of the local voice in framing the conversation around how the world "sees" Greenland.

Future research and conclusions

By analyzing the location of Flickr photo densities in Greenland of tourists through time and comparing them to local patterns, dominances and dichotomies were uncovered that should be researched further. To start, what do Greenlanders take pictures of and how does this inform their perception of their homeland? While the thousands of Flickr tourist photos in the dataset created a good sense of how they perceive Greenland (nature-based landscapes viewed from cruise ships), future work needs to be done creating geo-visualizations from other types of social media that Greenlanders might participate in more, to investigate local Greenlander's perceptions of place more in depth, and to see if the patterns suggested from Flickr VGI, are similar. Future research should also compare the percentages of local and visitor Flickr posts from other destinations in the North Atlantic and Arctic to see if tourist photos dominate to the extent they do in Greenland,

and if not, why? Finally, while this research was investigative in nature, a more immersive data collection strategy could add additional relevant information about sense of place through in depth content analysis of the Flickr images and interviews with users (Whalen, 2018).

As visitation is poised to increase in Greenland, a cultural geography approach within a netnography methodology, using publicly available social media photo VGI is useful. VGI from photos posted on Flickr provides an efficient, cost-effective way to rapidly visualize perceptions of and interactions with the landscape of various people (locals and visitors) and can be accomplished remotely if need be. These pictures from Flickr (and the geo-locational data they hold) are worth more than a thousand words in this conversation on responsible tourism development in Greenland and other emerging tourism destinations in the Arctic.

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