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Keeping up with the Drones! Techno-social Dimensions of Tourist Drone Videography

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Abstract

Tourists are increasingly using drones on vacation, but how they use them and the nature of the videos that they produce are not well understood. Conceptual advances in the study of tourist videography have produced a new model of these practices which is applied here to explain the nature of tourist videography with drones. An international sample of 351 vacation drone videos was subjected to content analysis, and an analysis of their metadata. The results show a significant variation in the content, technological and social practice of production of vacation drone videos depending on the type of video creator and, therefore, empirically validate and expand extant knowledge of drone videography as an emerging visual practice in tourism contexts. The findings establish that analysing the videos from the perspective of videography generates insights that are of value to destination management organisations and tourist businesses. We conclude that destination management organisations should see vacation drone videos as a new type of user-generated content for their destinations, as well as a potential source of innovative marketing ideas, and that they should engage more proactively with vacation drone videographers to maximise the impact of this opportunity.

Keywords: Drone; tourist videography; destination management; marketing; visual turn; user generated content

Introduction

Tourists have always been eager to use newly introduced technologies to capture their experiences [1, 2]. With the advent of Web 2.0 and the omnipresence of smartphones and smart environments [3, 4], documenting tourist experiences (taking photos and recording videos) and sharing these on general social media and on specialist travel platforms, has become a standard travel behaviour for many people [5, 6]. Separately from traditional tourist photography, and due to its specificity in relation to technological and social practices, tourism videography has emerged as a separate media form and travel-related activity [7, 8, 9]. Further, with the rapid advancement of mobile-phones and digital cameras, tourists are now equipped with powerful

tools which require more knowledge and skills to use well [10], leading to device-based specializations, such as rituals and practices forming around the use of *GoPro* cameras [11, 12]. Another type of device that is gaining prominence in tourist videography is drones, which allow tourists to break terrestrial limitations, and the constraints of eye-level perspectives to get a wider picture of a destination and to add new dimensions to the recording of their experiences. This paper explores the anatomy of drone videos taken by tourists during their vacations.

The term 'drone' is used in a very broad way to refer to any type of unmanned aerial vehicle (UAV) that is either pre-programmed to fly or which is controlled remotely by its user [13]. Drones can be controlled by apps, on smartphones or tablets, or controlled from more sophisticated base-stations, and they are frequently equipped with cameras and other hardware to allow for the live-streaming and recording of their flights [14]. Indeed, using drones is becoming a popular leisure activity which is reflected in the large number of drone videos that are uploaded and shared on social media every day [15, 16, 17]. Driven by the search for extraordinary, shareworthy footage [11], this leisure pursuit often spills over into the tourism realm, with drones being frequently brought on vacation, although not all destinations are necessarily drone-friendly [18].

When compared to the use of other traveller-facing technologies, making drone videos is a relatively complex activity since it requires more active engagement in trip preparation, activities during the trip, and later in the video processing phase [19]. Along with the obvious shift in perspective, there are several technical and social specificities that drone filming has brought to tourist videography. For instance, it has allowed amateurs to access previously un-shootable locations, and videos can now be enhanced with recordings that use different kinds of sensors, making them more useful for various purposes (for example making maps or 3D renderings) [19]. Consequently, a new genre in aerial filming has emerged [20]. At the same time, consumers making videos with drones face various regulatory limitations (e.g. no-flight zones, limitations on operating a drone over densely populated areas or large groups of people, ethical and privacy issues) and technical difficulties (e.g., flight time limitations, necessary flight conditions, the need to maintain visual contact between pilot and a drone) [21, 22, 23, 24, 25].

Importantly, in a similar way to other specialist devices, the emergence of drones has also led to the creation of online communities of amateurs, professionals and expert authorities [26], which are grouped around the need for additional expertise, and the desire to showcase or watch the drone videos of others. Apart from tourists who use drones irregularly on

vacations, two significant groups of creators can be found in these communities – influencers and professional drone pilots. Influencers emerged as a consequence of social media development. As trendsetters, many have embraced drone video making to attract more followers and to amplify the reach of their work [27]. In most cases, they derive direct financial interests from filming drone videos in a particular destination, but the destination image projections from their videos usually resemble user-generated content by focusing on a storytelling approach, rather than professional videos produced by official destination management organisations or tourism firms [28]. Drone filming experts employ drones as their main profession, and they usually carry drones on vacation to create videos, mainly intending to showcase their professional skills and work, and they do this without formal support from destination management organizations (DMOs) or businesses. In essence, they produce professional-style videos that are free for destinations but also independent of the desired image the destination wants to project [19].

Despite the recent spike in destination drone videos created by consumers, there is very little information on the technical and social practices [29] that constitute this genre of tourist videography [30]. A recent paper [42] focused on destination location factors and identified unique user-generated content characteristics of shared aerial drone videos and their spatial distribution based on YouTube meta-data. Despite the novelty of the approach, the paper came with several limitations. It did not include a content analysis of drone videos, and the sample included all videos geo-referenced to a place, not just those created during vacations. Further, from a social media perspective, most vacation drone videos can be classified as user-generated content (UGC), and as such, are created freely, largely depending on user preferences rather than the characteristics of destinations. Given this important role of creators that is unrelated to destination features, although still constrained by different regulatory limitations and other accompanying issues for drone filming, this paper seeks to produce a better understanding of the social and technological dimensions of vacation drone videos made by typical creators. In that respect, three basic types of UGC creators can be distinguished – tourists, influencers, and professional drone pilots.

This exploratory research therefore has two aims: Firstly, based on recent conceptual advances in the understanding of tourist videography, to test several measurable variables to determine the technical and social dimensions of drone vacation videos. Secondly, to explore the differences between videos produced by the three most common types of drone vacation video creators. This study situates tourist drone videography within the context of destination

management and marketing and pinpoints the main areas for further theoretical and practical research in this emerging field.

Research background

The roles of drones in tourism

As an emerging technology, drones have begun to penetrate many areas of society, including public safety, news reporting, the military, agriculture, and many different industrial settings [31, 32, 33, 34], including tourism. The consumer market for drones can be broken down in two ways. First, by the configuration of the drone as either fixed wing, rotary bladed, or as a hybrid type of the two. Of these, the rotary blade type is by far the most prevalent [35]. An alternative categorisation is by the way in which the drone is intended to be used. This splits consumer drones into: aerial photography drones; toy drones; FPV (first person view) and racing drones, and hobbyist/hacker/developer drones [36]. The commercial drone market is estimated to be worth between $3.45bn and $5bn [37, 38] and despite forecasts of some shrinkage during 2020 due to the COVID-19 pandemic, this market is expected to grow at a CAGR of 19.09% by 2023 [37]. It is predicted that by 2023, the market for commercial drones will be worth $14.3bn, with 32% of sales in North America, 29% in the Asia Pacific region and 23% in Europe [39].

Research into the use of drones in tourism, and especially by tourists themselves, is limited but increasing in scope. Hay [40] carried out the first study undertaken to classify the use of drones in tourism and hospitality and concluded that tourists had a more advanced understanding of the potential uses of drones than tourism businesses. However, most research has focused on the commercial rather than consumer use of drones in tourism [41]. For example, Stankov et al. [42] presented two main scenarios in which drones are impacting the tourism industry. The first of these is the use of drones to provide services to tourists such as tour guiding or delivery [16, 43]. The second involves using drones to capture images or data through photography, video or sensors, that can be used for the management and marketing of tourist destinations. DMOs have begun to make greater use of drone technology, with an early example being the way in which New Zealand's DMO used drones to launch its successful 'ultimate holiday selfies' campaign [7, 44]. More recently, massed drones have increased in popularity, especially in China, for creating lightshows during events [45]. In the context of the COVID-19 pandemic, destination managers have also begun to use drones to spray aerial disinfectants, broadcast public health messages, and monitor the size and behaviour of tourist crowds on beaches [46, 47, 48].

Tourists who create drone videos can make use of cutting-edge technology to create sophisticated professional quality videos of destinations and attractions [49, 50]. For example, virtual reality goggles are now frequently sold alongside high-end consumer drones for the direct streaming of live imagery from flights, allowing for the simultaneous capturing, control and editing of video [51], and emphasizing the novel experiential immediacy [52] associated with drones in tourist videography. It is not only amateur drone footage taken on holiday that is having an impact on the tourism industry. Influencers, as indicated above, are an important new channel in digital tourism marketing [53], and constitute another way in which drone video content for tourism destinations and attractions is produced, with large numbers of influencers promoting themselves specifically in this field [54]. In addition, professional drone pilots can often shoot videos whilst on vacation, helping to promote their work through the inclusion of new and dramatic content. The use of drones on vacation is something that remains subject to a number of international and national legislative and regulative frameworks, which mostly relate to their use within restricted areas such as urban centres and sensitive locations, and their general safety, including their airspace interactions, e.g. [55, 56, 57]. The restrictions on their use during travel experiences, and the specialist nature of the technical knowledge that is required to operate them, further cement them within the elaborate practices of videography, rather than the more casual nature of tourism photography [8].

Dimensions of drone tourist videography

The tourist gaze [58, 59] has become increasingly mediated through the consumption and creation of images, accompanied by the growth of digital technologies and social media [60, 61]. The images that tourists create on holiday, and the ways that they then share these with others has been the focus of research into tourist behaviour [62] and tourism experiences [63], primarily with a focus on photography [64, 65, 66]. Photography, already considered a core part of the tourist experience, has become increasingly commonplace as a part of travel, as it has in everyday life, thanks to the near ubiquity of camera-enabled smartphones [67, 68, 69]. Only more recently has attention been given to the videographic practices of tourists as a distinct area of research [8, 70, 12]. However, despite frequent calls for researchers to make use of both tourist- and researcher-created videos to develop new knowledge about tourist behaviours and experiences [71, 72, 52, 73], insights regarding the technological and social dimensions of videography remain scarce [29]. Tourist videography is a set of consumer practices that is distinct from photography in several ways. Dinhopl and Gretzel [8]

conceptualised these differences in terms of technology dimensions, social practices and experience mediation.

Technological dimension

Technological aspects refer to the extent and manner in which a particular medium adds richness to the representations [8]. When comparing videography to tourist photography technological differences are firstly that video allows tourists to (re)present a visually continuous experience, rather than a snapshot. For this reason, videography is not understood as including the very short videos of the kind that are frequently shared by tourists on Instagram or TikTok [74, 75], which are better understood from the perspective of photography. Video also allows for the integration of multiple cues to convey meaning, such as voice-overs, music and subtitles, as well as non-diegetic sound [76]. In addition, videography permits the capture of motion [70], in a way that a still photograph can only imply, and the use of new perspectives on its subject, such as those offered by wearable technology and drones [19].

Social dimension

The second set of differences between tourist videography and photography are explained by [8] as being concerned with the social practices of representation associated with each medium. For instance, the nature of editing associated with video and photo is very different, both in terms of the technology used and presentation of the finished product, as well as the inherent need for editing in the production of video that aims to create representations of a continuous experience. Tourist videos require editing, and there is a social expectation that high quality videos that are shared with other people will feature skilful editing techniques, as the modern ritual of sharing holiday images with friends develops in line with the emergence of new technologies [52, 77]. This editing results in the creation of composite experiences that can integrate moments captured over time, with the connections between them highlighted in the video production process. Related to this is the concept of ‘digital distance’ [8 p401]. Photography frequently aims to capture a sense of immediacy and of ‘being there’ [66]. Although this can be the focus of video in some forms (for example, in a documentary), the widespread availability of digital editing software and the prevalence of storytelling narratives in video means that a greater sense of digital distance from a live event is expected by video audiences. Both editing and digital distance distinguish videography in critical ways from travel livestreaming Additionally, in terms of social practices, the ability to capture the

interactions of tourists and the dynamic aspects of their experiences [78, 72], helps to distinguish tourist videography from the snapshot content of tourist photography [5].

Mediation dimension

The final area of distinction between tourist videography and photography explained by Dinhopl and Gretzel [8] is that of mediation. Photographic practices create an intermediary layer between the experience and its representation of it, for both the tourist taking the photo and looking through a device, and for the later viewers of the photo who see a two-dimensional representation of a vivid experience and have to carry out the imaginative work of re-creating it [62]. Contemporary videography, however, can utilise unobtrusive recording devices that help the tourist to remain immersed in the experience [12]. The tourist experience always contains elements of performativity, as tourists create and recreate social identities on the move [79, 65], and traditional photography interrupts these performances by asking participants to pose and adopt particular roles of interest or value to the photographer. In contrast, the 'always-on' nature of videography, opens up the possibilities for capturing the 'ongoing stylised performativity' of tourists [8 p404] and integrating this into the narrative created for the final video. The final aspect of mediation considered by Dinhopl and Gretzel [8] is the way in which videography can collapse the linearity of the tourist experience. Tourists who plan to engage in videography during their trips will frequently consider this at the planning and destination choice stages of their vacations, as well as during their trips and on return, during the editing process, and finally when sharing their productions. The persistence of videography practices throughout the different stages [80] of holiday experiences collapses the boundaries between different stages of the experiences, in particular blending experience and documentation [81, 82].

Methodology

Data gathering

To obtain relevant videos for analysis, i.e., videos created by individuals during vacations, the automatic video scraping software *Webometric Analyst* (http://lexiurl.wlv.ac.uk/) was used to retrieve links to *YouTube* drone vacation videos. YouTube was chosen as it currently represents the largest collection of videos for the promotion of destinations from the viewpoint of users, destination marketing organizations, and influencers [28]. Several combinations of keywords were tested to search for videos (drone + vacation, drone + travel, drone + trip, etc.), and the combination of "drone vacation" returned the highest number of potentially relevant videos –

630. The same software was then used to download metadata for the channels on *YouTube* for the creators of these videos and *YouTube Statistics*, an open-source software application was used to collect the metadata for the *YouTube* videos. The data were collected from YouTube on June 1st, 2020.

Content analysis

A content analysis of all videos and their metadata was then carried out to reconfirm that all videos were created during a vacation. Next, a working classification of drone vacation creator types (tourists, influencers, professional drone pilots) was developed and this was used to classify the videos into groups (Table 1), determined based on the judgement of three analysts and an examination of the creators' *YouTube* channel videos. For example, professional drone pilots and influencers had links to their websites or other social media accounts, while tourists did not. Three analysts separately observed the *YouTube* channels and applied the creator classification. In the case of a mismatch in judgment, all three analysts had to agree on the most appropriate creator type to assign.

[Table 1 near here]

After the initial data check, 351 videos remained. Most of the excluded videos were professionally created by destination management organizations or other travel companies, while some were related to tutorials on how to make drone videos during vacations.

The next step was a video content analysis based on quantified dimensions of the technological and social practices of travel videography, inspired by the work of Dinhopl and Gretzel [7, 9]. Measurable indicators were developed based on the observation of both the technological dimensions of representation in vacation drone videos and of the social practices involved in their production and presentation (Table 2). The mediation dimension was only implicitly considered as the data did not allow us to determine how the use of drones to record videos on a vacation mediates and influences tourist experiences. For example, drone piloting disrupts immersion in the experience in contrast to unobstructive equipment-mounted video-technology, but at the same time it creates a new type of engagement and interaction with the digital screen for the pilot. Thus, this dimension can be traced through the type of filming techniques, which we place within the technological dimension, or through the activity featured in a video, which we consider as part of the social dimension. Similarly, to the previous

procedure, the three analysts observed all videos and assigned appropriate values to observable characteristics, agreeing on a value through discussion when a mismatch appeared.

[Table 2 near here]

Data were transferred into SPSS Statistics V27 for further descriptive statistical analysis. A *chi-square* test for independence was used to determine the existence of associations between the three groups of drone vacation video creators and the technical and social dimensions of the videos.

Sample characteristics

Figure 1 summarizes the basic metadata characteristics of vacation drone videos in the sample. A simple country overview indicates that the spatial distribution was not equal, as three global hotspots appeared: Europe, the Americas (with Central America as the epicentre), and South and South-East Asia. A detailed inspection of the types of destination (based on the video locations scaled to a destination – a city or a region) showed that more than half of the videos were filmed at coastal destinations or on islands. Every fifth video was filmed at multiple destinations, so no dominant type could be determined. Cities, as well as natural sites (protected areas or landmarks) featured in approximately every 10th video. Other types of destinations were represented in less than 3% of the sample.

[Table 1 near here]

Results

Technological dimension of representation

Making videos consisting of multiple moments from a vacation is the prevailing practice. No significant association between type of creators and vacation segments was found. Around two-thirds of creators used time manipulations (e.g., time-lapse or slow-motion) to emphasize certain scenes, in combination with real-time shots. Here, there were significant associations between types of creators and frequencies of time-manipulated videos, as drone professionals used real-time significantly more than expected, that is, they manipulated time less. None of the creators used just the compression or expansion of time in their videos.

[Table 3 near here]

Using music as a background for drone vacation videos was a dominant practice, and every fifth video contained narration with music. Other combinations of audio processing were extremely rare. In the case of professional drone pilots, the use of music was almost exclusive, that is, they did not frequently combine narration with music. The majority of creators excluded drone take-off and landing segments in videos, while drone professionals almost never used those aspects in their videos. Here, among all videos drone take-off was present in every fifth video, while drone landing was present in less than 3%.

[Table 4 near here]

Amongst the different filming techniques, the most frequent were fly-over and aerial shots. Pull-back, crane, and bird's eye shots were also very common. Tracking, as a feature of only certain drones, was less used, whilst reveal shots, a classic cinematography technique, were the least used. As expected, drone professionals used more reveal shots, as well as aerial and crane shots. The difference here is statistically significant and substantial.

[Table 5 near here]

Dimension of social practice

None of the creators from the sample used explicit video alterations (e.g., unnatural colour alterations and/or video animations), while introduction scenes were used in less than a fifth of the videos. The vast majority of creators used implicit time references (such as 'last summer', 'this year's vacation') in the video description. As expected, almost all videos were filmed during one vacation, not as a combination of two or more vacations.

Around 40% of videos were created from scenes filmed exclusively by drones, while the rest used these in combination with videos filmed on the ground. It must be noted that this was not the case with drone professionals, who used terrestrial videos in only about 20% of the cases. Approximately, every 10th video was created using a narrative storytelling script (e.g.,

giving a story behind a vacation, and/or an explanation of its progression), again except for professional drone pilots who rarely employed storytelling.

[Table 6 near here]

For both tourists and influencers, showing activities in drone vacation videos was a practice in approximately half of the videos, while for drone professionals this was less important. The appearance of drone creators and their companions was also a frequent practice for tourists and influencers, in contrast to professional drone pilots. To sum up, for all these three variables, tourists exhibited higher than expected frequencies compared to the other creator groups, while professional drone pilots exhibited low levels of these.

A clear majority provided additional creator information in their video's description, or they provided it in both the description and in the video. Here, we see that influencers more frequently provided creator information in both places. As expected, providing drone information was important to the majority of creators, and they provided it in most cases in the description. There were no statistically significant associations between creator type and the provision of drone information.

[Table 7 near here]

Filming exclusively natural sites was a generally predominant practice (Table 8), while approximately one third used a mix of natural and some other thematic areas. Tourists filmed natural sites more than the other creator groups, and fewer cultural and man-made attractions. Professional drone pilots filmed significantly more cultural and man-made sites. A focus on just a hotel facility, excluding the main destination attraction, was recorded in less than 5% of videos.

[Table 8 near here]

Additional analysis - The influence of the type of video creator on the level of user engagement

Linear regression was performed to check the influence of creator type on user engagement (the number of vacation drone video likes, dislikes, video views and comments on YouTube).

Vacation videos by tourists as creators showed a significantly higher number of video views than videos created by drone professionals (β =213109.97, p = 0.004). When comparing tourists and influencers as creators, there was no significant difference in the number of video views. Similarly, when comparing influencers and drone professionals as creators, videos created by influencers showed a significantly higher number of video views (β =167862.5, p = 0.005) (Table 9).

[Table 9 near here]

In case of the number of likes and dislikes, again videos created by tourists showed a significantly higher number of likes (β =2245.4, p = 0.005) but also dislikes (β =50.9, p = 0.016) than videos created by drone professionals, indicating higher user engagement. Videos created by influencers did not significantly differ in the number of likes and dislikes compared to videos created by drone professionals and tourists (Tables 10 and 11).

[Table 10 near here]

[Table 11 near here]

When it comes to the number of comments, videos created by tourists (β =157.4, p = 0.002) showed a significantly higher number of comments compared to videos created by drone professionals. Similar results were obtained when comparing videos created by influencers and drone professionals (β =141.2, p <0.015).

[Table 12 near here]

Overall, it can be observed that videos created by tourists and influencers are similar in terms of user engagement. This suggests that reactions to these more personal and less professional drone video storytelling practices are comparable and that there is a greater likelihood that neo-tribal communities form around the visual contents and practices of these two types of creators.

Discussion and Implications

Based on the above results, a series of theoretical and practical implications were identified. The following section highlights these implications and compares them to the findings of another relevant research.

Theoretical implications

The theoretical implications of this research for tourist videography can be grouped in the areas of *consumer-technology interaction on vacation*, *virtual tourism,* and *user-generated content on social media*.

Undoubtedly, using drones on vacation has become a global trend [83]. Based on this analysis of vacation drone videos on *YouTube*, results suggest that this practice occurs globally. In particular, destinations that offer much open-air space, such as coastal destinations or islands are the most welcoming for this kind of practice [84], confirming that regulatory issues significantly determine areas or destinations where drones will be employed the most. This is also supported by the fact that professional drone pilots more frequently film cultural and man-made attractions that require special permissions or more expertise than exhibited by amateur drone pilots or influencers.

In general, the social dimension of tourism drone videos plays a more important role in differentiation between creators than the technological dimension, confirming the value of applying a practice-based tourist videographic analysis [8] to understand consumer use of this technology. All types of creators, in relatively equal proportions, provide information on the drone used for filming, confirming that these facts are also an important component of vacation drone videos for most creators. Tourists and influencers, as drone vacation video creators, are more oriented to self-promotion, by showing themselves and others in their videos, as well as various tourist activities in a destination, and sometimes they present the whole vacation in a form of storytelling with the addition of narration to music. Also, they mix drone videos with terrestrial videos to better present their experiences. By doing so, they create an online identity that allows them to better associate with specific drone video groups, providing evidence for a networked neo-tribal gaze like the one established for the *GoPro* community [85].

As a new type of user-generated content [86] in tourism, the specific nature of shared vacation drone videos has only recently begun to be acknowledged [17] meaning that the technological, social representative and mediative [8] aspects of the phenomenon are not yet well understood. Although this study did not focus on the sharing of the videos, it examined elements of social practice (such as providing description of a creator, destination or a drone), meaning that it has value for future analyses featuring drone videos. Furthermore, better knowing the characteristics of vacation drone videos contributes to our understanding of the visual turn in social media, and especially in social media marketing, with destinations and attractions being increasingly represented by complex visual materials [61]. Vacation drone

videos, seen as data, are a new, important source of information for developing insight into the sense of a place, navigation, or for further analysis as a new source of data about tourist destinations [19]. Acknowledging the creation, editing and sharing practices of different creator groups is critical for correctly interpreting this data.

The main theoretical framework employed to analyse the social and technical practices related to vacation drone videos was a conceptual proposal by Dinhopl & Gretzel [8]. It highlighted the characteristics of tourist videography as a novel form of tourism practice by comparing it to the traditional practice of tourist photography. The present paper represents the first empirical exploration of this conceptual proposal in the case of vacation drone videos, thus further contributing to the overall body of knowledge concerning tourist videography as a visual practice, and specifically to the understanding of drone videography in vacation contexts.

Practical implications

The results from this exploratory study could be of use for marketing and management activities carried out by DMOs or tourism businesses, and for national tourism organisations.

Using various social media sites, consumers now can easily search tourist videos posted by other tourists and individuals, or by official DMOs, before making travel decisions [66]. According to a USA-based study, two out of three consumers watch online travel videos when they are seeking information about their trips [87]. The importance of vacation drone videos is particularly noteworthy, since they are created by actual tourists (despite the potential bias from the financial interest of influencers, and the work-related motivations of professional drone pilots). In addition, drone videos are still a novel and attractive media form that creates an extra WOW effect among spectators [42]. Based on the results of this research, three practical implications can be pinpointed.

As a globally recognised consumer trend it could be catered for more, in terms of different countries, regions, and destinations that lag behind in enabling and supporting drone video recording by consumers (e.g., providing drone landing platforms, drone charging and sharing facilities, drone lessons/experts on site, etc.), but also in terms of facilitating drone use away from isolated open-areas, if that practice does not conflict with justified restrictions on their use [24]. Here, some social cues could also be used to encourage drone filming (for example, recognizing drone creators on official DMO sites or similar). These additional initiatives to support consumer uses of drones in destinations would work in parallel with the facilitation of

drones by DMOs as part of smart-tourism approaches to destination management [88], as well as where their use has also been prompted by the COVID-19 pandemic [46].

Music is often a necessity in vacation drone videos to cover the drone noise. However, to provide content-rich destination vacation videos that would appeal more to viewers, and to convey greater information about the destination, the use of narration and real-time videos should be encouraged. This could include, for example, the gamification of drone filming or creating engaging online platforms (e.g. drone maps) for uploading geo-tagged videos and providing audio or textual comments to support their co-creation [11, 61, 19].

Although vacation videos created by drone professionals will not convey as much detail as destination-related productions, they will still be more visually appealing due to their use of techniques such as reveal, aerial, or crane shots, which could also leave a strong impression on the viewers [89, 90]. This is especially important in relation to other findings that show that the value of UGC for destinations is highly dependent on its quality [91].

Finally, virtual tourism, in the form of augmented reality or the exploration of remote landscapes in real-time is often associated with the use of drones [49, 92, 16]. Understanding the characteristics of different creators' drone vacation videos could greatly help in the development of aerial immersive mixed reality [93], since tourists and influencers, guided by entertainment [94] or financial subsidies, with less technical knowledge, produce videos that focus on different practices when compared to professional drone pilots. In this case, if an online community is created around these videos, it would be expected that creators already engaged with drone usage on vacation would be drawn more to aerial immersive mixed reality production.

Limitations and further research

This paper presents exploratory research and the results come with several limitations. First, the conclusions about drone vacation videos were based on the final products of their creators, that is, videos published on *YouTube.* This was a justifiable approach, as the main aim of the paper was to explore an already existing trend. However, that left the results without direct confirmation of the creators' motivation to film and post a video in the first place, or an understanding of their interaction with drones during a trip, or the preparation and on-site travel phases. Another important limitation is that the research observed individual videos in isolation, not all the videos of one creator. Thus, the results of this study focus on overall characteristics/dimensions of vacation drone videos, rather than individual practices.

The absence of sophisticated tools to automate content analysis has limited the sample to 351 videos. Although this sample is large enough for content analysis in exploratory work, further research should make use of a larger number of drone vacation videos, and preferably include the use of semi-automatic approaches to video content analysis. The sample mostly included popular destinations, as the results of the *YouTube* searches were limited to the most relevant videos. Further research could use regional analyses and investigate different types of destinations. As noted previously, some destinations are more suitable for the employment of drones in tourism experiences [95], resulting in the accumulation of videos for the most popular, or the most suitable, for drone video filming. Further research could be focused, for example, on urban destinations, since the use of drones is popular in urban-recreational areas, and it would be interesting to see what kinds of social practices are apparent there, especially in light of recent calls to further restrict the use of drones by consumers [96].

As a starting point for the content analysis, a relatively new conceptual framework of tourist videography was used to observe relevant characteristics and quantify elements of the technical and social dimensions of vacation drone videos. However, the framework is not exhaustive, and future approaches could be developed using alternative or yet to be developed frameworks. Such conceptual development will require deeper insights into drone production, editing, sharing, viewing, and engagement practices, and will, thus, depend on data gathered through interviews, observations, or participant observation.

Further development of drone video production might allow for new filming techniques and new ways of video development and sharing, creating a necessity for these new approaches. Some of the variables used in this research may be considered to convey both technological and social dimensions. For example, providing an introduction scene to a video or drone information could be seen as a standard technical procedure (similar to *GoPro Hero* introduction videos) or as an element of social practice, indicating the need for further developments in measuring elements of tourist videography in novel ways. Thus, an important avenue of research could be a netnographic investigation [97] of drone communities and how they discuss the technology and related social practices.

Most importantly, to provide tourist organizations with data-driven recommendations, a further examination of viewers' engagement with drone vacation videos is of paramount importance. DMOs should see vacation drone videos as a potential resource and they should be tracking them to gain valuable consumer preference data and product development ideas. It would be interesting to determine if there is a particular type or set of filming techniques that appeals to viewers more than others, or a certain type of destination whose drone videos attract

more viewers. However, user engagement on social media is influenced by various factors, not just content itself [98], thus more complex methodologies have to be employed to measure the contributing value of every factor.

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Table 1. Distribution of vacation drone video creator types in the sample

Creator	Description	Frequency	Percent
Tourists	Use drone primarily for entertainment and sharing tourist experiences, with no financial interest. Typically have a low number of subscribers compared to influencers and professional drone pilots.	177	50.4
Influencers	Use drones to enhance video presentation of a destination; usually have a financial interest, either related to the destination or to promote other products. Typically have the highest number of subscribers when compared to tourists and professional drone pilots.	87	24.8
Professional drone pilots	Use vacations to showcase their main profession without financial interest related to the destination; the number of subscribers varies.	87	24.8
	Total	351	100.0

Table 2. Technological/Social dimensions of drone vacation videos with observable characteristics

The technological dimension of representation			The dimension of social practice		
Conceptual dimension	Observable characteristics	Values	Conceptual dimension	Observable characteristics	Values
(I) Visual continuity and time	Vacation segments	▪ One segment ▪ Multiple segments	(I) High-profile editing	Evident video alterations	▪ Yes/No
	Time manipulations	▪ Time is expanded ▪ Real-time ▪ Time is compressed ▪ A mix of real-time and time manipulations		Intro scene of drone video maker	
(II) Multiplicity of cues	Audio processing	▪ Narration ▪ Music ▪ Narration with music ▪ Real-time audio (*sounds of nature or drone noise*)	(II) Digital distance	Time reference	▪ Explicit time ▪ Relative time
(III) Motion	Drone motion	▪ Drone taking off ▪ Drone landing ▪ Both available ▪ None of the above	(III) Composite experience	Number of vacations featured	▪ One vacation ▪ More than one
				A mix of drone and terrestrial scenes	▪ Yes/No
(IV) Perspective	Filming techniques	▪ Reveal Shot ▪ Bird's eye ▪ Aerial Pan Shot ▪ Fly Over/ Trough ▪ Tracking Shot ▪ Pull back shot ▪ Crane shot	(IV) Storytelling inherent in the media form	Narrative storytelling approach	
			(V) Importance of practices (activity)	*Destination related*	
				The activity featured in a video	▪ Yes/No
				Drone creator visible	
				Drone creator companions	
				Main setting	▪ natural settings ▪ man-made attraction ▪ hotel settings ▪ a mix
				Drone production-related	
				Creator information	▪ Embedded in video ▪ In video description ▪ Both available
				Info about drone	▪ Not available ▪ Embedded in video ▪ In video description ▪ Both available

Table 3. Frequency of videos using vacation segments and time manipulations.

Creators	(I) Visual continuity and time			
	Vacation segments		Time manipulation	
	One segment	Multiple segments	Real-time	A mix
Tourists	6.2%	93.8%	28.2%	71.8%
Influencers	11.5%	88.5%	27.6%	72.4%
Professional drone pilots	6.9%	93.1%	54.0%	46.0%
Total	**7.7%**	**92.3%**	**34.5%**	**65.5%**
N	*351*		*351*	
Pearson Chi-Square	*2.39*		*19.58*	
df	*2*		*2*	
p	*0.3*		***<0.001*****	

***significant at <0.001 level*

Table 4. Frequency of creators using audio processing and time drone motions.

Creators	(II) Multiply of clues - Audio processing					(III) Motion – Drone motions			
	Narration	Music	Narration with music	Real-time or drone sounds	No audio	Drone take-off	Drone landing	Both	None
Tourists	0.6%	72.9%	24.9%	0.6%	1.1%	20.3%	3.4%	4.5%	71.8%
Influencers	0.0%	69.0%	29.9%	1.1%	0.0%	20.7%	4.6%	5.7%	69.0%
Professional drone pilots	0.0%	95.4%	3.4%	0.0%	1.1%	4.6%	0.0%	2.3%	93.1%
Total	**0.3%**	**77.5%**	**20.8%**	**0.6%**	**0.9%**	**16.5%**	**2.8%**	**4.3%**	**76.4%**
N					*351*				*351*
*Pearson Chi-Square with **Fisher's Exact Test***					*30.58*				*21.30*
p					***<0.001****				***<0.001****

***significant at <0.001 level*

Table 5. Frequency of videos that employ different filming techniques.

Creators	(IV) Perspective - Filming techniques						
	Reveal	Bird's eye	Aerial	Flyover	Tracking	Pull-back	Crane
Tourists	14.7%	59.3%	76.3%	91.0%	45.2%	66.7%	66.1%
Influencers	13.8%	71.3%	85.1%	96.6%	39.1%	75.9%	69.0%
Professional drone pilots	26.4%	70.1%	93.1%	94.3%	31.0%	78.2%	90.8%
Total	**17.4%**	**65.0%**	**82.6%**	**93.2%**	**40.2%**	**71.8%**	**72.9%**
N	*351*	*351*	*351*	*351*	*351*	*351*	*351*
Pearson Chi-Square	*6.62*	*5.00*	*11.99*	*3.08*	*4.93*	*4.51*	*18.95*
df	*2*	*2*	*2*	*2*	*2*	*2*	*2*
p	***0.04****	*0.08*	***<0.001****	*0.21*	*0.08*	*0.08*	***<0.001***

***significant at <0.001 level; *significant at <0.05 level*

Table 6. Frequency of videos using high-profile editing, expression of digital distance, composite experience, and storytelling

Creators	(I) High-profile editing		(II) Digital distance -Time reference		(III) Composite experience			(IV) Narrative storytelling approach
	Evident video alteration	Intro scene			Number of vacations		Mix with terrestrial videos	
			Explicit	Implicit	One	Multiple		
Tourists	0	18.6%	35.6%	64.4%	98.9%	1.1%	72.3%	11.3%
Influencers	0	21.8%	25.3%	74.7%	95.4%	4.6%	69.0%	10.3%
Professional drone pilots	0	11.5%	11.5%	88.5%	97.7%	2.3%	23.0%	1.1%
Total	**0**	**17.7%**	**27.1%**	**72.9%**	**97.7%**	**2.3%**	**59.3%**	**8.5%**
N	-	*351*	*351*		*351*		*351*	*351*
Pearson Chi-Square	-	*3.44*	*17.35*		*3.14*		*63.30*	*8.17*
df	-	*2*	*2*		*2*		*2*	*2*
p	-	*0.18*	***<0.001***		*0.21*		***<0.001***	***0.02****

***significant at <0.001 level; *significant at <0.05 level*

Table 7. Frequencies of different creators' practices

Creators	(V) Importance of practices (activity)									
	Destination-related			*Drone production-related*						
				Additional creator information			Drone information			
	The activity featured in a video	Drone creator visible	Drone creator companions	Embedded	Description	Both	Not available	Available in av video	Available in description	Both available
Tourists	57.6%	83.6%	77.4%	6.2%	70.6%	23.2 %	39.0%	0.6%	58.2%	2.3%
Influencers	54.0%	78.2%	65.5%	3.4%	56.3%	40.2 %	31.0%	0.0%	66.7%	2.3%
Professional drone pilots	27.6%	29.9%	26.4%	8.0%	65.5%	26.4%	34.5%	0.0%	64.4%	1.1%
Total	49.3%	68.9%	61.8%	6.0%	65.8%	28.2 %	35.9%	0.3%	61.8%	2.0%
N	*351*	*351*	*351*	*351*			*351*			
Pearson Chi-Square	*22.10*	*83.24*	*64.86*	*9.5*			*3.29*			
df	*2*	*2*	*2*	*4*			*6*			
p	***<0.001***	***<0.001***	***<0.001***	***0.05****			*0.77*			

***significant at <0.001 level; *significant at <0.05 level*

Table 8. Frequencies of different creators' practices related to main drone vacation video setting.

Creator	(V) Importance of practices (activity)			
	Destination related (main setting)			
	Natural site	Cultural and man-made	Hotel facility	A mix
Tourist	59.9%	4.5%	4.5%	31.1%
Influencer	47.1%	12.6%	4.6%	35.6%
Professional drone pilots	48.3%	17.2%	3.4%	31.0%
Total	53.8%	9.7%	4.3%	32.2%
N	*351*			
Pearson Chi-Square	*13.83*			
df	*6*			
p	***0.03****			

**significant at <0.05 level*

Table 9. Regression coefficients -type of video creator effect on video views

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		β	Std. Error	Beta		
1	**Constant - Tourists**	44782.853	42463.948		1.055	0.292
	Influencers	45247.423	73971.208	0.034	0.612	0.541
	Professional drone pilots	213109.974	73971.208	0.162	2.881	0.004**
1	**Constant - Influencers**	90030.276	60568.578		1.486	0.138
	Professional drone pilots	167862.552	85656.905	0.127	1.960	0.050*
	Tourists	-45247.423	73971.208	-0.040	-0.612	0.541

a. Dependent Variable: video views. ** $p < 0.01$, * $p <= 0.05$

Table 10. Regression coefficients - type of video creator effect on video likes

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		β	Std. Error	Beta		
1	**Constant - Tourists**	491.520	459.887		1.069	0.286
	Professional drone pilots	2245.365	801.112	0.157	2.803	0.005**
	Influencers	456.446	801.112	0.032	0.570	0.569

a. Dependent Variable: Likes. **p <= 0.005

Table 11. Regression coefficients -type of video creator effect on video dislikes

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		β	Std. Error	Beta		
1	**Constant - Tourists**	14.311	12.056		1.187	0.236
	Professional drone pilots	50.942	21.001	0.137	2.426	0.016*
	Influencers	28.207	21.001	0.076	1.343	0.180

a. Dependent Variable: Dislikes. *p <= 0.016

Table 12. Regression coefficients - a type of video creator effect on comments

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		β	Std. Error	Beta		
1	**Constant - Tourists**	54.446	28.606		1.903	0.058
	Professional drone pilots	157.404	49.830	0.177	3.159	0.002**
	Influencers	16.209	49.830	0.018	0.325	0.745
1	**Constant- Influencers**	70.655	40.802		1.732	0.084
	Professional drone pilots	141.195	57.702	0.158	2.447	0.015*
	Tourists	-16.209	49.830	-0.021	-0.325	0.745

a. Dependent Variable: Comments. ** $p < 0.002$, * $p <= 0.015$

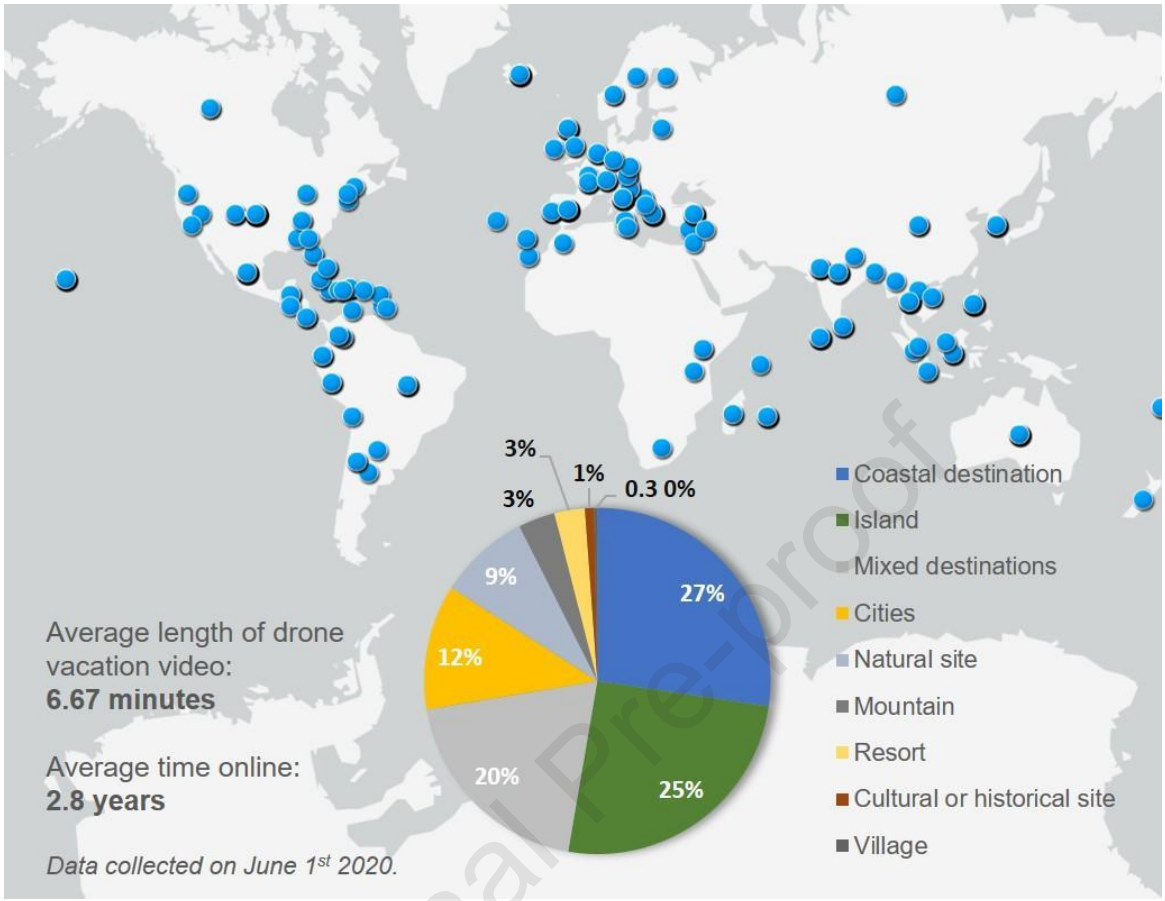

Figure 1. Spatial distribution of the drone vacation video sample and types of destination.

Highlights

- Vacation drone videos are new type of user-generated content used for innovative destination marketing
- Content analysis of vacation drone videos supported by analysis of metadata
- The social dimension of tourism drone videos plays a more important role in differentiation between creators than the technological dimension
- Tourists and influencers, as drone vacation video creators, are more oriented to self-promotion