ANTHROPOMORPHISM AND POPULARITY OF NATURAL HISTORY DOCUMENTARIES: A CONTENT ANALYSIS

A Thesis

by

JUSTIN RICHARD AGAN

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Chair of Committee,	Yasha M. Hartberg
Committee Members,	Barbara Gastel
	Johanna L. Dunaway
Head of Department,	Todd M. O'Hara

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ABSTRACT

Today, a popular message can go “viral” in minutes. Some can even gain so much attention that they effect large changes. One factor influencing popularity can be how relatable the message is. Human beings have long used anthropomorphism to relate to and understand non-human entities. With a focus on natural history documentaries, this study attempted to determine whether an association exists between anthropomorphism and popularity. A content analysis was done on a selection of nature and wildlife documentary videos posted on YouTube by Discovery, National Geographic, and PBS Nature. Ninety videos posted between 2018 and 2020 were analyzed. Each video’s YouTube-provided data on Views and Likes was recorded, and content was coded for any instances of anthropomorphism. The measure of popularity was each video’s total Likes per total Views. Association between anthropomorphism and Likes per Views was measured with linear regression. Each company’s videos were also compared with each other with analysis of variance. Contrary to expectation, relatively little anthropomorphism was present in this study set. No significant associations were found between Likes per Views and anthropomorphism. Correlations between Likes per Views and anthropomorphism were also very low. These results suggest that anthropomorphism did not affect popularity. While this study did not find significant associations, it did reveal a possibly negative relationship between anthropomorphism and Likes per Views. Repetition of the study with a larger sample could help determine whether a statistically significant relationship exists. The lack of

anthropomorphism present in this study seemed to align with the scientific community's recommendations against its usage. While some may find it helpful in making scientific content relatable, any beneficial effects of anthropomorphism may be limited to certain demographics.

DEDICATION

This thesis is dedicated, first and foremost, to my wife, Kristina. Even from the earliest stages of our relationship she has not only voiced but shown tremendous support for me. She has sacrificed, moved halfway across the country, worked full-time, and finished her own degree while supporting our family. She went all-in with her investment into my future and even at every setback, and there have been many, she has always doubled down.

She has been constantly supportive of this project from the beginning, often offering advice and ideas, even though she had not seen the work-in-progress. I can only hope that our future pays her back for everything she has done for me and our family tenfold.

This work is also dedicated to our very own anthropomorphized pets. They are not even pets to us, they are family and especially Caesar, who has worked the last seven years as our service dog. Even after multiple surgeries on both of his hind legs, he has remained steadfast by our sides with comfort and care beyond any expectations.

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Contributors

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NOMENCLATURE

A#	Anthropomorphism (number of anthropomorphism instances)
A# = 0	Videos with no instances of anthropomorphism
A# > 0	Videos with one or more instances of anthropomorphism
A#/min	Instances of anthropomorphism per min
Anthropomorphism	The attribution of human characteristics to non-human subjects
Anthropocentrism	The regard for humankind as the central, most important entities in existence over all others
ANOVA	Analysis of variants
L/V	Likes per Views ratio, expressed as a decimal
MS	Mean squares
RNG	Random number generation
StD	Standard deviation

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1. INTRODUCTION

1.1. Rationale

In today's highly connected world, an important message can reach millions of people in seconds. Whether that message produces a social movement depends on many factors. Social movements that quickly gain popularity can effect change. Popularity of the message indicates how widely it is spread and could affect the audience's willingness to act on that message. A message's popularity could be influenced by how well an audience relates to it. One factor in that regard can be anthropomorphism. Anthropomorphism is the attribution of human characteristics to non-human subjects (Epley et al., 2007) and is a common way humans connect with the natural world (Serpell, 2002). Anthropomorphism could influence the connection viewers perceive to the content they are watching, which could affect behavior or lead to actions for change (Epley et al., 2007).

Anthropomorphizing nature or wildlife can also lead to greater feelings of efficacy in dealing with environmental crises that might otherwise seem too large for individual contributions to help. The stronger a person's ties to nature are, the more effective they feel their actions can be in combating environmental crises (Tam, 2014).

Anthropomorphism could also affect anthropocentric views in people. Anthropocentrism is the regard for humankind as the central, most important entities in existence over all others. For example, people who view animals, plants, and minerals as resources for human exploitation would be considered more anthropocentric. In a study

of science teachers (Quinn et al., 2016), those with more anthropocentric views tended to have more negative attitudes toward nature. Anthropomorphism was shown to be associated with lower levels of anthropocentrism in study subjects. Anthropocentric perspectives could have negative consequences for conservation efforts if human interests do not align with the interests of nature. Quinn, Castéra, and Clément also found that anthropomorphizing was associated with less anthropocentric views and concluded that anthropomorphism and anthropocentrism did not statistically coexist in the same subject of this study. So, according to this study, the more one anthropomorphizes, the more likely one is to have non-anthropocentric views.

1.2. Background

The tendency to view the natural world with anthropomorphic viewpoints can take many forms and be found in a variety of science communication. For example, a meteorologist could say "a cold front is *walking* across the country," or an astrophysicist might describe a black hole *swallowing* a star. Those would be examples of behavioral anthropomorphism. While anthropomorphizing is largely frowned upon in peer-reviewed scientific literature (Sealey & Oakley, 2013)—because of its inherent lack of objectivity—popular media, specifically nature and science documentaries, has been known to use anthropomorphism as a technique to engage its audiences. Still, some anthropomorphism can be seen in peer-reviewed literature such as reports of animal behavior studies (Reggente et al., 2016), but in these instances it seems to largely be used in attempts to understand animal behaviors better. However, it is also easy to

misconstrue comparisons of animal behavior to human behavior as anthropomorphisms when they technically are not.

The concept of anthropomorphism has long existed, as has the controversy on its usage. George Henry Lewes—a mid-19th century, English writer, actor, philosopher, and scientist—is credited as the first to use the term in relation to animals in 1858, around the time Charles Darwin presented his theory of evolution by natural selection (Wynne, 2006). Before that, the term was mostly used in connection with religious figures or deities. Wynne stated that Darwin never used the term himself, but Darwin did believe that humans and animals could share "many psychological qualities" (Wynne, 2006). This belief was expanded on and championed by his direct successor and friend, George Romanes, an evolutionary biologist and psychologist (Romanes, 1883).

Later critics like Conway Lloyd Morgan and Edward Thorndike attempted to set rules for using anthropomorphism in relation to animals. Some considered some forms of anthropomorphism more acceptable than others. Anthropomorphism that potentially led to verifiable study results and advanced understanding of animal behavior, called "critical anthropomorphism," tended to be deemed more acceptable. Untested anthropomorphic assumptions that were blindly accepted ("naïve anthropomorphisms") tended to be deemed less acceptable (Wynne, 2006). Other writers like John B. Watson, Nikolaas Tinbergen, and Konrad Lorenz found all anthropomorphism unacceptable.

The decades following Darwin's work saw more theories and methods proposed in animal psychology and behavior, each of them attempting to address, constrain, or outright condemn anthropomorphism. Darwin and his successors' *mentalism* (that

concentrated on mental phenomena like thinking and feelings) gave way to *behaviorism* (in which subjects were objectively studied through observable behavior), which in turn, was supplanted by *comparative psychology* and *ethology*. Today, most animal studies can trace their roots to either *comparative psychology* (in which animals are studied in laboratory-controlled conditions) or *ethology* (in which animals are studied in situ.) Both disciplines have been highly critical of anthropomorphism (Jarrett, 2020; Ken, 2016; Wynne, 2006).

The ongoing debate on anthropomorphism has established that anthropomorphism can vary in objectivity and form, with some of the more common forms being anatomical and behavioral. Anthropomorphisms, in either form, can often stem from simple comparisons between non-humans and humans (Root-Bernstein et al., 2013).

Anatomical anthropomorphism consists of referring to animal features as their human analogues. Sometimes such anthropomorphism is acceptable, sometimes not. For instance, "feet" is generally acceptable when discussing most bipedal and quadrupedal animals, even when "paws" or "hooves" may be more accurate. However, it would be less acceptable to refer to a racoon's paws as hands. While raccoon paws are highly dexterous, they lack opposable thumbs and are not necessarily true hands. This form of anthropomorphization is one of the most basic and is often deemed more acceptable because of its inherent objectivity, or non-bias. This perceived non-bias can be attributed to the intent and assumptions of the writer. The intent of anatomical anthropomorphizing is often for descriptive purposes with the assumption that the audience knows the

difference. However, it can still influence audiences depending on their levels of understanding, knowledge, and cultural/social experience (Batt, 2009). A young adult, teenager, or child with relatively less education or experience may take anatomical anthropomorphisms as facts without question.

Behavioral anthropomorphism consists of attributing human behaviors and reasons for behaviors to non-human entities. The more an animal is compared to humans and deemed to have human-like features, the more people, regardless of knowledge, will tend to ascribe unobserved human characteristics to that animal (Manfredo et al., 2020). One example is assuming a homosexual preference when a male dog attempts to mount another male dog. While the action is observed, the preference cannot be verified which leads to an inaccurate conclusion.

A more unobjective, or biased, form of anthropomorphism consists of attributing human emotions to non-human entities when little evidence supports the attribution. An example is the tendency of people to see emotions in the facial expressions of their pets even though behaviors like wagging tails and ear position might be better indicators of some pet emotions. Pet fish often swim faster and closer to the tank glass and water surface as people approach in a display that may seem like excitement. It is more likely the fish learned that when a person approaches, food may come soon after.

Anthropomorphizing pets could bias which animals receive more support in nature conservation. Manfredo et al. (2020) have contend that "studies consistently find a link between attachment to pets and empathy towards animals … As empathy towards these close companions rose, so did compassion towards similar animals." For example,

people that have domesticated house cats could exhibit greater empathy toward wild large cats.

The immensely popular documentary *Blackfish* illustrates this tendency to ascribe human emotions and even social connections to animals to elicit extremely strong emotional responses from the audience (Rowley & Johnson, 2016). In this film, a lot of commentary is about the emotional wellbeing of the central character, an orca named Tilikum. The commentary describes some of the orcas' vocalizations as mournful or sad when they are separated from each other, which may or may not be the case. It also describes the orcas as lonely or depressed by their living conditions. While these emotions may be viable speculations, considering orcas' social structures, they are still based on human emotions. Other possible interpretations of the vocalizations could include the orcas' use of echolocation to sense their surroundings or the orcas communicating with each other, even across tanks.

Another form anthropomorphism can take is the creation of narratives around animal characters. Disney has created an empire out of creating such characters, and the anthropomorphism is not limited to their animated productions. Even in some of the Disney nature documentaries, individuals and specific families of animals are followed throughout episodes and sometimes even given human names so that the audience can more fully connect with the "animal stars" (Berenbaum, 2009; Pierson, 2005).

Anthropomorphism has also been shown to affect how non-human animals are depicted in animated or live action films (Porter, 2006). For example, in the movie *Jurassic Park* (a live action movie including CG animation) some of the animals are

depicted more as individuals, like the T-Rex and velociraptors, by framing and reference than others that are seen mostly in herds or groups. It was also quickly pointed out after the movie's release that liberties were taken in depicting the size and look of velociraptors. Velociraptors in the film were made much larger (closer to large human heights) than any known fossils and without their feather coats.

In another example, people assigned human sexual orientations to a pair of penguins in a Canadian zoo. The penguins were described by the media as "gay" because of their apparently close relationship in captivity. They were part of an endangered species of penguin and needed to be separated to mate and help conservation efforts to continue the species. This led to local debates on the fate of the two penguins and the species. Public expressions of homophobia and other emotional anthropomorphisms perpetuated by the media could have hindered the breeding program. After the penguins were separated, neither penguin exhibited any signs of depression or negative effects, and both were successfully bred (Schneider, 2012).

1.3. Hypothesis and Study Objective

Much study has addressed the controversy of anthropomorphism and its possible benefits and harms. A few studies have shown one of those benefits to be higher possibility of supporting conservation efforts when subjects are anthropomorphized (Boissat et al., 2021; Manfredo et al., 2020). History has also shown that certain social, political, and corporate movements can greatly benefit from popularity. For instance, the late 1970s bans on chlorofluorocarbon (CFC) gases in aerosol cans to protect the ozone

layer or the 2011 Egyptian revolution that heavily benefited from social media platforms, like Facebook and Twitter, both gained a lot of support from widespread information. Therefore, this study attempted to find a connection between anthropomorphism and popularity. If such a connection exists, could it be leveraged to garner support for conservation efforts.

The hypothesis was that in natural history documentaries, an association exists between anthropomorphism and popularity. Specifically, I hypothesized that increased anthropomorphism would be associated with increased popularity.

The objective was to evaluate the potential role anthropomorphism plays in documentary videos on YouTube. More specifically, I determined the amounts of anthropomorphism in natural history documentaries on YouTube and then, to assess popularity, analyzed the numbers of views and likes.

2. METHODS

I analyzed videos using content analysis from three major documentary producers (Discovery, National Geographic, and PBS: Nature series) with content on youtube.com. While YouTube does not always have full or feature-length episodes, it does cast a wide net for collections of documentary videos produced by many different companies. Even when large companies like Netflix and BBC produce and self-distribute documentaries, clips and full episodes eventually end up on YouTube, where they can generate views in addition to those already attained on their own platforms. YouTube provides freely available data on each video like video length, number of views, number of likes, and who posted the video.

By sampling from YouTube, I intended to make inferences to the larger population of documentaries produced by large production companies that publish on multiple platforms. Videos from smaller independent production companies were not studied, because less content was available and in many cases I could not verify original content (the person or company posting a video on YouTube might not be the original producer of said video).

Because anthropomorphism was the primary variable of interest, documentaries that contained little or no on-screen human interactions were preferred to limit any ambiguous interpretations during content analysis. If a person not affiliated with the documentary production company is shown on camera, they may make anthropomorphic references unscripted by the film crew. In essence, this person becomes one of the

subjects of the documentary and the question of including this reference as a counted instance becomes more difficult. A logical argument can also be made that more human interference or interaction could increase the likelihood of more anthropomorphic instances. For this study, videos that featured more than two people on screen for most of the video were excluded. Nature and wildlife documentaries set in wild habitats away from human settlements fit this criterion best.

For each video, I recorded common popularity indicators (likes, views, and like/view ratio) with other factors like video length and producer considered later in the analyses of anthropomorphism and popularity. Anthropomorphism per minute of video length was tested for association with popularity and producers were compared using analysis of variance (ANOVA). The Likes per Views ratio (L/V) has become a common metric for estimating success or popularity of videos on YouTube and other social media video sharing services(Robertson, 2014; Vedula et al., 2017). Data was recorded in Microsoft Excel, and analysis was conducted using StataBE 17 (64-bit) (StataCopr LLC).

2.1. Reference Population

The reference population for this study was nature and wildlife documentaries produced in the English language by large documentary production companies. In other words, well-known documentary producers that distribute content worldwide and have large catalogs of films and series across multiple platforms (TV, films, and streaming services). The study population was documentaries of this same genre and type found on

YouTube.com. Results from the study population were then used to make inferences about the reference population.

2.2. Sample Selection

Videos to analyze were selected from nature, wildlife, or environmental videos posted by the three major production companies. Only original content was included. Content was limited to that from these three companies because initial exploration indicated that the original sources of other such videos in YouTube often were difficult or impossible to determine or verify. Promotional trailers, previews, and advertisements were excluded.

Equal numbers of videos were selected from the three production companies: Discovery, National Geographic, and PBS Nature. These companies were chosen not only for their long history of producing a wide variety of documentaries, but also because they all distribute their products on multiple platforms, including YouTube, making inferences from study results more plausible. Companies such as Netflix and BBC, while initially considered, were excluded because less information was available, less relevant video content existed, or both.

The sampling frame was any videos of at least 2 minutes that were identified by searching YouTube for terms like nature, wildlife, natural history, or other related subjects in documentary videos across the three producer channels. Each channel's video catalog was individually searched during Fall of 2020, and results were listed in reverse chronological order. Initial results were too numerous to count. The list was then

narrowed by excluding any videos that the titles or descriptions indicated were previews, trailers, or advertisements.

Videos also were excluded if they featured significant human interactions with wildlife. Such interactions were defined as instances in which either humans were shown directly interacting with wildlife, human presence changed natural behaviors, or humans were more central characters than wildlife. An example would be an instance in which a seal uses a film crew's boat for safety from a predatory event.

After initial cuts, results were still too numerous to analyze in a reasonable amount of time. The next step was to select the most recent 120 videos from each production company for further consideration. This sampling pool size was determined based on the total amount of videos available from each company that fit the initial criteria. As no previous studies were found to base standard deviation or means on, power calculations for sample pool size would have been conjecture. These videos dated back to 2018 for Discovery, 2019 for National Geographic, and 2019 for PBS Nature. These videos were then watched without sound to screen for human interactions not found previously. Because most anthropomorphic references happen in the audio commentary, watching without sound for exclusionary purposes provided additional protection against potential selection bias later during final selection. Second cuts eliminated 13 more videos from the Discovery channel set, 16 from the National Geographic channel set, and 8 from the PBS Nature channel set. This left 107 Discovery videos, 104 National Geographic videos, and 112 PBS Nature videos. Then 30 videos from each company (90 total) were selected via random number generation (RNG) from

Random.org for inclusion in the study (Haahr). Due to the lack of previous studies of this type as previously stated, sample size was determined based on the number of videos that could be analyzed in a reasonable amount of time. If upon viewing for content analysis a video needed to be excluded, it was replaced from that channel's remaining set via RNG.

Videos that featured or focused on "untouched" natural habitats and wildlife and had little or no on-screen human presence, such as the Discovery series *Serengeti*, were the main types of videos included. On-screen human presence was considered on a qualitative case-by-case basis depending on how much the documentary focused on human interactions. For instance, a narrator like Sir David Attenborough standing in front of the camera as opposed to behind it did not necessarily disqualify a video from consideration for this study if the narrator did not overly interfere with the natural environment or its inhabitants. The presence of a narrator in front of the camera adds another human to the environment which can affect how wildlife behave (Collard, 2016). However, only videos with humans in key roles, like wildlife veterinarian shows or *The Deadliest Catch*, which regards crab fishers in the Bering Sea, were excluded. Eliminating such videos made clearer whether anthropomorphism was present and eliminated potentially unscripted persons from adding more anthropomorphic references unintentionally. Instances like this leave too many questions about the senders and intended receivers of such messages, adding further uncertainty to their potential effects on popularity as well.

2.3. Variables of Interest and Coding

Many variables can affect a video's popularity, but the variable of interest for this study was the amount of anthropomorphism present. For each video, I determined how many instances of anthropomorphism, if any, were present and then recorded the finding in Microsoft Excel. Also recorded in Excel were time since upload, views, likes, dislikes, video length, and number of comments. The numbers of instances of anthropomorphism (A#) were compared with the popularity indicator variable, Likes per Views ratio (L/V).

Coding was conducted by a single coder (myself) only for oral or written instances of anthropomorphism to avoid ambiguity. Non-verbal aspects like emotionally charged background sounds or music were not coded, as they could be variably interpreted. For example, if imagery of a shark biting at a camera or bait line is accompanied by menacing or suspenseful background music, such music could evoke fear in viewers or project human antagonistic motivations onto the shark. Background music could also be paired with the mating dance of birds of paradise even though they do not necessarily dance to or for music like humans do.

Coding for each video was completed by watching each video and using the transcript if available. Instances were coded positive for A# when subjects were directly anthropomorphized by the narration. Anthropomorphizations included giving proper names to subjects, using human anatomy terms to describe analogous anatomy of subjects, ascribing human emotions or motivations to subjects, or ascribing human-type social connections to subjects without evidence of such connections. If multiple

instances occurred close together, each was counted positively only if it referred to a different entity. If a narrator used two anthropomorphisms to describe the same thing twice close together, this was coded as a single instance.

Analogous anatomy was coded positive only when the anatomy described had distinctively different names. Using words like “legs,” “nose,” and “mouth” were not coded positive when the same words are used for most animals. However, if, for example, the word “arm” was used for a limb of a quadruped, the instance was coded positive for anthropomorphism. Direct comparisons of animal or plant anatomy to human anatomy using “like” or “as” in attempts to explain or educate were not coded positive if they were simply used to illustrate for the audience. For example, if a narrator said a bat’s wings were like human hands with relatively elongated bones joined together by webbed skin, this was not coded positive.

Emotions, motivations, and social connections can greatly depend on the perspective of the producers, the audience, and the subjects being described. Therefore, anthropomorphisms in this regard were the most difficult to code. For example, animal behavior studies have shown evidence of social connections that resemble those in humans, for instance in marine mammal populations (Díaz López, 2020). Recent research also has shown social connections in other animals, even some that were previously thought to be less social, like sharks (Mourier & Planes, 2021; Vila Pouca et al., 2020). A documentary could mention the “playful” antics of dolphins or even lion cubs but also explain how this social behavior is a life training mechanism as well.

Commonly observed behaviors like these, which are well established as similar to human behaviors, were not coded positive for A#.

Evidence of emotions and motivations in animals is more difficult to research with current technology and scientific methods. Instances of this nature were coded positive for A# if little or no evidence was present for such emotions, motivations, or social connections. For example, instances were coded positive if commentary referred to a situation of wildlife interspecies adoption being motivated by love or caring emotions instead of some other more plausible instinctual motivation. Such is the case when another species of bird raises the offspring of a cuckoo after it lays its eggs in its nest and the documentary refers to a motherly love of the adopting parent.

To determine whether amount of anthropomorphism and popularity were associated for the videos analyzed, comparisons were done between A# and L/V ratios across all samples and within each production company. Analyses of variance (ANOVA) were also run between companies for A# and L/V to highlight any significant differences between each company's use of anthropomorphism and their popularity. Testing also was done to determine whether amount of anthropomorphism was associated with other factors such as video length and time since upload.

Measures considered as indicators of popularity were total number of views per video, total likes, like-to-dislike ratio (L/D), and like-to-view ratio (L/V). Like-to-view ratio was the primary outcome of interest, with other factors considered secondarily. A common indicator that a YouTube video is popular is a like-to-view ratio of at least 4%, meaning popular videos have at least 4 likes per 100 views (Robertson, 2014). Like-to-

dislike ratio indicates whether videos garner mainly positive or negative attention but cannot be used to gauge popularity on its own. For most YouTube videos, the numbers of likes and dislikes pale in comparison to the number of views. Using view count alone is also problematic because without internal data access, it is impossible to see how many of the viewers watched most, or all, of the video.

Other variables such as time since upload, video length, channel/producer, and narrator/spokesperson were also considered with available data from YouTube. While this study did not attempt to define associations for these outcomes, it did attempt to stratify results in these regards to help identify and limit confounders. Narrator or spokesperson identification was not possible for every video in the dataset and even when known, their contribution to the videos' popularity was too difficult to quantify. The variables of interest were analyzed as a whole and with time since upload, video length, and channel/producer considered as cofactors.

2.4. Statistical Analysis

The unit of analysis for this study was the individual video. For statistical analysis, the amount of association between anthropomorphism and popularity was measured with linear regression. Linear regressions were run with A# as the independent variable and L/V as the dependent variable.

The regressions were also run with additional factors like video length and time since upload considered. Comparisons were made between anthropomorphism and popularity indices across all samples and within each production company. The ANOVA

run between the production companies also showed which company used anthropomorphism more or less than the others and their relative popularities.

3. RESULTS

3.1. Raw Results and Descriptive Statistics (Tables 1-2)

Out of the 90 videos in the study, 54 had at least one instance of anthropomorphism (A#), leaving 36 videos with no instances. The max number of A# in any one video was 12, and the minimum was 0. Twenty videos had only one instance of anthropomorphism. The total number of A# from all videos was 169. The mean A#, excluding videos with 0, was 3.13; including videos with 0, it was 1.88. The median, excluding videos with 0, was 2; including videos with 0, it was 1. Standard deviation (StD) for A# across all 90 videos was 2.43. The difference in standard deviation when including versus excluding videos with 0 A# was negligible. Time online ranged from 4 to 794 days at the time of initial data collection. Video length ranged from 2.05 to 21.33 minutes. Longer videos did tend to have more instances of A# than shorter ones and in videos with more than one A#, the instances tended to occur somewhat closely together. Total A# per total minutes of video amounted to 0.35 A# per minute or about one instance every three minutes of video time.

The generally accepted value of 4 likes for every 100 views, or a 0.04 Like per View (L/V) ratio, is the benchmark videos should attain to be considered successful or popular. Of the 90 videos in this study, only one did not attain that benchmark. The L/V ratio for all videos ranged from 0.035 (min) to 0.161 (max), with a mean of 0.092 (StD = 0.027) and a median of 0.089. Average Like per View ratios and total figures are compiled in Table 1.

Table 1: Average Likes per Views ratios and total counts for all videos with and without anthropomorphism.

	Average L/V	L/V Std. Dev.	Total views	Total likes	Total dislikes
With Anth	0.095	0.016	3,943,965	317,362	2,484
Without Anth	0.087	0.015	3,687,902	273,159	1,987
All	0.092	0.027	7,631,867	590,521	4,471

Correlation coefficients for videos with anthropomorphism and total videos, by producer, are provided in Table 2. The coefficients for both categories across all three producers showed very low or no associations.

Table 2: Correlation between Likes per Views ratios and Anthropomorphism.

	Discovery	NatGeo	PBS Nature	All
Correlation Coefficient	-0.0573	0.0078	0.2697	0.1542
Correlation Coefficient (A# > 0)	0.1758	-0.1742	0.3501	0.1103

3.2. Results by Producer (Tables 3-5)

3.2.1. Discovery Channel

Discovery Channel had the fewest videos with at least one instance of anthropomorphism: 11 out of 30. It also had the fewest videos with five or more instances, at zero. The mean A#, excluding A# = 0 videos, was 1.73 and including A# = 0 videos was $0.63\overline{3}$. The median, excluding A# = 0 videos, was 1 and including A# = 0

videos was 0. The StD for A# > 0 videos was 0.96 and was 1.02 when including A# = 0 videos. Time online ranged from 42 to 794 days, and video length ranged from 2.08 minutes to 7.60 minutes. Average L/V and total figures are compiled in Table 3.

Table 3: Average Likes per Views ratios and total counts for Discovery videos with and without anthropomorphism.

	Average L/V	L/V Std. Dev.	Total views	Total likes	Total dislikes
With Anth	0.073	0.026	1,888,291	124,114	1,053
Without Anth	0.081	0.024	2,606,073	181,617	1,329
All	0.078	0.025	4,494,364	305,731	2,382

3.2.2. National Geographic

National Geographic had the second most videos with at least one instance of anthropomorphism (21 out of 30) and the second most with more than five or more instances (5). The mean A#, excluding A# = 0 videos, was 2.86 and including A# = 0 videos was 2. The median, excluding A# = 0 videos, was 2 and including A# = 0 videos was 1. The StD for A# > 0 videos was 2.21 and was 2.27 when including A# = 0 videos. Time online ranged from 22 to 235 days and video length ranged from 2.7$\bar{3}$ minutes to 16.75 minutes. Average L/V and total figures are compiled in Table 4.

Table 4: Average Likes per Views ratios and total counts for National Geographic videos with and without anthropomorphism.

	Average L/V	L/V Std. Dev.	Total views	Total likes	Total dislikes
With Anth	0.11	0.022	1,091,278	126,100	857
Without Anth	0.10	0.027	780,509	64,007	343
All	0.109	0.024	1,871,787	190,107	1,200

3.2.3. PBS Nature

PBS Nature had 22 out of 30 videos with at least one instance of anthropomorphism, 9 of which had 5 or more. The mean A#, excluding A# = 0 videos, was 4.09 and including A# = 0 videos was 3. The median, excluding A# = 0 videos, was 3.5 and including A# = 0 videos was 2.5. The StD for A# > 0 videos was 2.71 and was 2.94 when including A# = 0 videos. Time online ranged from 4 to 392 days and video length ranged from 2.05 minutes to 21.33̄ minutes. Average L/V and total figures are compiled in Table 5.

Table 5: Average Likes per Views ratios and total counts for PBS Nature videos with and without anthropomorphism.

	Average L/V	L/V Std. Dev.	Total views	Total likes	Total dislikes
With Anth	0.089	0.020	964,396	67,148	574
Without Anth	0.086	0.020	301,320	27,535	315
All	0.088	0.020	1,265,716	94,683	889

3.2.4. Production company ANOVA (Tables 6-9)

The ANOVA for both L/V and A# showed highly significant differences between producers. The most significant differences in L/V occurred between National Geographic and Discovery and between PBS Nature and National Geographic. Only PBS Nature and Discovery showed a significant variation in A#. The breakdown of variation for each ANOVA is shown in Tables 6-9. If there is a significant difference *between groups*, it is expected that the corresponding mean squares (MS) will be greater than the MS of *within groups*. The F column is the ratio of MS values (within groups/between groups). The higher this ratio number is the greater the difference, as is seen in both Table 6 and Table 8. Significance is based on a 0.05 p-value.

Table 6: ANOVA of Likes per Views ratios by producer.

Source	SS	DF	MS	F	Prob > F (p-value)
Between groups	0.015349008	2	0.007674504	13.85	0.0000
Within groups	0.048200851	87	0.000554033		

Table 7: Comparison of Likes per Views ratios by producer: Bonferroni table.

	Discovery	NatGeo
NatGeo	0.031299 0.000 (p-value)	
PBS Nature	0.009928 0.318 (p-value)	-0.021371 0.002 (p-value)

The Bonferroni tables shown in Tables 7 and 9 display where the significant variations lie between the three groups. All the groups' means vary from each other but only some of those variations are large enough differences to be significant.

Table 8: ANOVA of Anthropomorphism by producer.

Source	SS	DF	MS	F	Prob > F (p-value)
Between groups	84.6888889	2	42.3444444	8.28	0.0005
Within groups	444.966667	87	5.11455939		

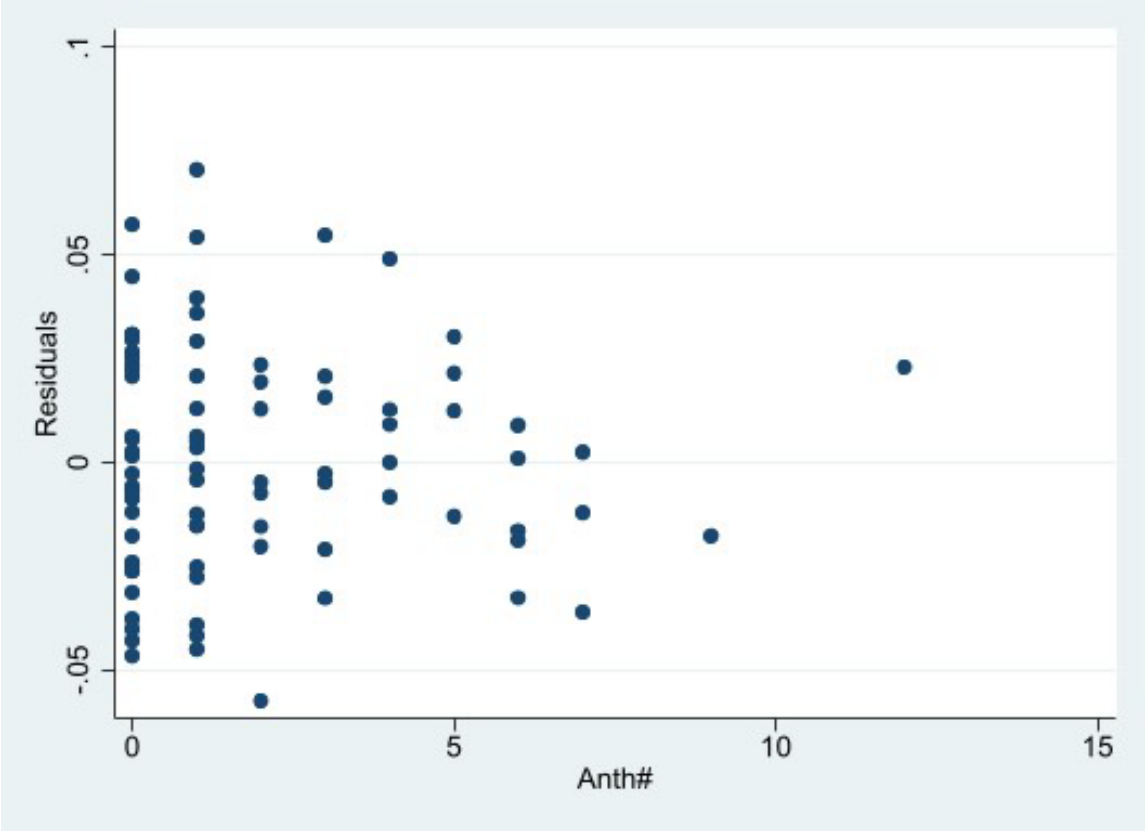
Table 9: Comparison of Anthropomorphism by producer: Bonferroni table.

	Discovery	NatGeo
NatGeo	1.36667 0.065 (p-value)	
PBS Nature	2.36667 0.000 (p-value)	1 0.0271 (p-value)

3.3. Regression Analysis Results

Linear regression of L/V (dependent) and A# (independent) for all videos in the set of 90 was highly insignificant at a p-value of 0.147 (p-value < 0.05 considered significant) and a R-squared value of 0.0238. When videos with A# = 0 were excluded, the p-value rose to 0.427 and the R-squared value dropped to 0.0122. When video length was also considered (A#/min), the p-value rose higher to 0.772, with a R-squared value of 0.0427 for all videos. The difference in regression p-value and R-squared value when excluding A# = 0 was negligible when considering video length. Correlation between L/V and A#/min was also very low at -0.1273. The scatterplot graph in Figure 1 shows a decreasing trend in L/V as A# increases.

Figure 1: Linear Regression of Likes per Views ratios and Anthropomorphism.



4. DISCUSSION AND CONCLUSIONS

The hypothesis that increased anthropomorphism was associated with increased popularity in natural history documentaries on YouTube was not supported by the results of this study. Linear regressions showed no significant relationships between anthropomorphism and the Likes per Views ratio (L/V). Factors contributing to these results could include the low total number of anthropomorphisms present in videos and the small sample set. Results from running a linear regression on only videos containing anthropomorphism were even less significant, most likely due to even smaller sample size.

While 60% of videos had at least one instance of anthropomorphism, this does not necessarily indicate prevalent usage. The total amount of anthropomorphism per total minutes of video in the study set shows otherwise. The 169 instances across 488.9 minutes of video would amount to only 0.35 instances of anthropomorphism per minute, or about one instance every three minutes. Furthermore, most anthropomorphic instances were not evenly distributed throughout the videos but occurred in sporadic bursts when more than one instance was in a single video.

With 54 videos containing anthropomorphism and 36 without, a direct comparison between the two groups would not be accurate because the statistical power would be tied to the lower of the two groups. However, this study set did show a higher average L/V (0.13) for the videos with only one or zero instances of anthropomorphism than the videos with more than one instance. There were 20 videos with just one

instance. The largest contributors to this higher average L/V are Discovery and National Geographic. Possible reasons for the slightly higher L/V of lessor or non-anthropomorphized content could include video quality, target audience age ranges, or even possible audience preconceived notions about the producers.

A larger sample size could have improved significance levels but does not guarantee that any association found in a larger sample set would support the hypothesis. Correlation coefficients for all videos and by producer were very low as well. The trend in L/V residuals starts out broad then narrows and decreases as anthropomorphism increases. The scatter plot of the linear regression shows a trending curve that could point to a significant association between anthropomorphism and decreased popularity with a larger sample size. Like-to-view ratio also dips as anthropomorphism increases when results are divided by production company.

The ANOVA (analysis of variants) results for L/V and A# (instances of anthropomorphism) between production companies show not only significant variation between companies for both, but also where most of that variation lies between each company. L/V varied more widely between companies than A# did. This finding is not surprising considering the low amount of anthropomorphism present overall.

4.1. Discussion

Anthropomorphism is a tool that humans have used for centuries to understand the world around them. As for any tool, whether the results turn out helpful or harmful depends on its usage. Over the last two centuries, the scientific community has criticized

use of anthropomorphism (Jarrett, 2020; Wynne, 2006). However, entertainment media have long embraced this tool (Murray & Heumann, 2013).

Science documentaries, which are in part an educational medium, are a bridge between scientific literature and public entertainment media. This study analyzed science documentaries to determine whether associations exist between anthropomorphism and popularity.

The low amount of anthropomorphism in this study set was somewhat surprising, considering its prevalent use in other popular entertainment media such as many Disney products. Even the currently highest grossing franchise of all time, Marvel, has an anthropomorphized racoon as a major character. It might be that the use of anthropomorphism in science and nature documentaries has always been limited, or that its usage has declined in recent years. With very little previous studies on the amount of anthropomorphism in documentaries, it is difficult to determine whether there has been a decline.

The low usage found in this study could be due to one of the intended purposes of documentaries, to educate. If a documentary wanted as much academic authority as possible, it may adhere to some pressures of the academic community on the use of anthropomorphism in its product. Another potential factor that could influence the amount of anthropomorphism a documentary uses is its intended audience. A film aimed at a younger demographic may prioritize entertainment over education and could potentially contain more anthropomorphic references. The educational backgrounds of

those making the documentaries could also affect anthropomorphism levels. Production decisions like this could also ultimately play a role in a film's popularity.

Popularity is highly difficult to quantify. Marketing firms and entertainment media devote considerable resources to finding what is popular or not and why. Lacking those resources, I chose the best available metrics to gauge popularity in the sample set, likes and views. Views alone do not suffice because those numbers can be inflated by those who are accessing the documentary but not watching or engaging with the material. Likes alone only show a positive. Combining the two, the like-to-view ratio (L/V) is widely considered a better method for determining viewer engagement and video success (Vedula et al., 2017).

Although documentaries are far from the most popular videos on YouTube, only one video in the sample did not achieve an L/V ratio of at least 0.04, which is considered a benchmark for popularity (Robertson, 2014). Even that video only narrowly missed this mark. While this study had few videos containing anthropomorphism, it was interesting to find that the least anthropomorphized videos had a higher average L/V ratio. However, to determine whether a difference truly exists, a larger sample would be needed. If additional videos were added or taken away from either side to make the two even, averages could change but overall power could increase.

The inability of this study to find a significant association between anthropomorphism and popularity shows that it may not affect popularity as predicted. Furthermore, the observed trends suggest that popularity indicators decline as

anthropomorphism increased. A larger study, with more statistical power, may be able to determine whether a negative relationship indeed exists.

Given this study's results, it can be suggested that anthropomorphism lacks enough power by itself to influence the popularity of wildlife and natural history documentaries. Many other factors can affect popularity, and not all can be controlled for or quantified. Anthropomorphism may still be a popular device for entertainment media, but it might hinder science and nature documentaries, especially if those producing them seek substantial levels of scientific authority in their films.

Recent studies of science communication on various social media have also found a negative relationship between anthropomorphism and audience engagement (Su et al., 2022; Yeo et al., 2020). They found the use of anthropomorphism consistently referred to as "juvenile" or viewed as childish. Considering that a lot of anthropomorphism in entertainment media is also targeted at children, for example in the movies *Finding Nemo* and *The Lion King*, this reaction is not surprising.

4.2. Limitations and Bias

This study had four main limitations. First, the study focused only on documentaries available on YouTube. While selections on YouTube represent a vast array of different documentary videos, series, and films, it is not the only medium that these films are viewed on, and thus the results might not apply to other media. Second, and especially important, the size of the study limited its power to detect associations. Much more time, resources, and access to more detailed viewership data would be

required to mitigate these limits. Additionally, because the study was a content analysis rather than an experiment, causality cannot be inferred. Finally, the use of a single coder for the content analysis also limited this study. Additional coders would further protect against bias and possibly allow for a larger sample set to be coded in a more reasonable timeframe.

A potential confounding factor is the overall popularity of documentary narrators or celebrities associated with some videos and how their personal popularity could affect the popularity of the videos by association. If such celebrities promoted the documentary through their own large social media followings it would likely inflate both views and likes on related videos. Another unpredictable factor is "virality" (how quickly a video's view count rises from sudden and massive sharing). Virality cannot be calculated without access to more detailed YouTube data. Some videos can accumulate most of their views within the first weeks after upload, but this study could not determine when view counts rose. More importantly, the reason some videos go viral would not necessarily be tied to this study's variable of interest (anthropomorphism).

4.3. Conclusions

In summary, recent natural history documentary videos available on YouTube from Discovery, National Geographic, and PBS Nature did not include much anthropomorphism. Furthermore, the presence of anthropomorphism did not seem to be associated with increased popularity. These findings, which were contrary to

expectation, suggest compliance with scientists' recommendations to limit the use of anthropomorphism in such cases.

If a significant negative association could be found, some areas for further research could include what impact such a negative relationship could have on conservation efforts. Another possible area of interest could be if any association exists between anthropomorphism and misinformation, or the communication of inaccurate or false scientific information to the public.

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