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The portrayal of animal interactions in nature documentaries by David Attenborough and Bernhard Grzimek

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Abstract

Millions of people across the world have been exposed to the wildlife documentaries of David Attenborough and Bernhard Grzimek, who have thus greatly influenced the public's views on nature and biodiversity. We investigated the way organisms' biology is portrayed in these documentaries, quantifying different types of animal interactions shown. We evaluated 1498 (Attenborough) and 391 (Grzimek) interactions within- and between-species from documentaries covering a wide range of environments and animal taxa, first aired between 1956 and 2019. We tested whether the relative frequencies of different interactions were influenced by temporal trends as well as by the presenters and their production teams who likely reflect the given Zeitgeist in the UK compared to the European mainland. For our categorisation of animal interactions, we contrasted interspecific versus intraspecific interactions and antagonistic versus cooperative behaviour. While Grzimek's documentaries put a stronger emphasis on cooperation and Attenborough's on antagonistic behaviour, the trends were not statistically significant. Furthermore, these patterns show no significant change over time, contrasting with the changing view among biologists that cooperation is more predominant than considered in the traditional understanding of nature as 'red in tooth and claw'.

Keywords: Antagonism, Cooperation, Attenborough, Grzimek, Communication

Introduction

Nature documentaries are a main gateway to information about biodiversity for millions of people, contributing to the public's general understanding and feeling of connection with nature (Arendt and Matthes 2; Jones et al. 19; Hynes et al. 18). Moreover, they potentially mirror the Zeitgeist of the time, presumably reflecting the views of scientific advisors and producers. The way in which information is portrayed in mainstream media can affect the attitudes of its viewers, as has been demonstrated in the public perception of sharks (Le Busque and Litchfield 21).

We studied the portrayal of nature in documentaries by two of Europe's most notable presenters, David Attenborough (b. 1926) and Bernhard Grzimek (1909–1987). One of Britain's most recognisable voices, Attenborough was educated in the Natural Sciences at Cambridge in the 1940s and received his first documentary credit as a producer on *The Coelacanth* (Gouyon 15) in 1952. He has continued working as a presenter since then, with his 2019 Netflix series *Our Planet* reaching over 100 million people by March 2021 (Stewart 27). The portrayal and subsequent perception of environmental issues associated with Attenborough's documentaries have been discussed extensively (Mahmood 23; Keller and Wyles 20).

Best known for his work as director of Frankfurt Zoo, his Oscar-winning documentary *Serengeti will not die*, and his *Animal Life Encyclopaedia*, Grzimek was educated in veterinary medicine in Germany in the 1920s.

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Grzimek portrayed himself as an animal lover and was known for his activism in conservation (Grzimek 17). His primetime series *Ein Platz für Tiere* was broadcasted live across a span of 31 years and 175 episodes, during which time it contributed greatly to Grzimek collecting donations of over 30million Deutsche Mark to aid conservation efforts (Reufsteck and Niggemeier 25). Grzimek's nonfiction books, documentary films, and autobiography have been claimed to reflect a particular Euro-centric ideology of global conservation (Lekan 2016). Surely different aspects of the work and influence of this communicator are worth further investigation.

Here we quantify how Attenborough and Grzimek portray animal interactions, categorised depending on their antagonistic or cooperative nature, a fundamental dichotomy to characterise behaviour. We tested possible data trends in relation to the presenter and to time that could reflect, respectively, the presenter's scientific background and changing scientific understanding over the past 75 years.

Given his upbringing and education in the Natural Sciences at Cambridge, we hypothesised that Attenborough would be influenced by a more traditional Darwinian view of evolution, in which struggle for existence is paramount (Darwin 9). Darwin (9) followed the ideas of Thomas Malthus at the time of the Industrial Revolution in England, emphasising the importance of famine and disease controlling population size (Desmond 11; Ruse 26). In contrast, we expected Grzimek's documentaries to portray interactions less centred on competition, aggression, and the 'struggle for existence', instead displaying more examples of cooperation (Gould 14). Furthermore, we discuss whether there are changes in the almost seven

decades covered in the study that would reflect how the general understanding of evolutionary biology has changed over this time (Zimmer and Emlen 32; Diogo 12).

Methods

Variables and quantification

In total, all inter- and intraspecific interactions between two or more animals from 70 episodes presented by Attenborough (Table 1) and 18 episodes by Grzimek (including two standalone documentaries) (Table 2) were documented, a total of 75 film hours. The 70 episodes by Attenborough make up eight series across the timespan of his wildlife documentary career thus far, while the 18 episodes from Grzimek represent all the documentary material that was available for purchase at the time of this study for which we could find out the original release date. These documentaries may have been years in the making for minutes of footage, such as the cases of the 300 h of filming to capture the mating dance of a bird of paradise in *Planet Earth* (Boboltz 5) and the 3500 filming days for the eight episodes of *Our Planet* (WWF 30) or could have been produced week on week and narrated on the spot, as in the case of Grzimek's *Ein Platz für Tiere*.

We noted down the following: species involved, description of the interaction observed, antagonistic vs cooperative interaction, and inter- vs intraspecific interaction. We focused on the latter two variables for visualisation and statistical analyses, while recording the species allowed us to generate a table of the percentage of interactions involving a number of different taxa. Antagonistic interactions were defined as those involving a fitness benefit to one animal to the detriment of another.

Table 1 An overview of the interactions recorded from each series of Attenborough documentaries

Series (Year)	Interspecific		Intraspecific		Total
	Antagonistic & predation	Cooperation	Antagonistic	Cooperation & parental care	
Life on Earth (1979)	73 (39.9)	3 (1.6)	15 (8.2)	101 (55.2)	183
The Living Planet (1984)	145 (63.0)	9 (3.9)	18 (7.8)	72 (31.3)	230
The Trials of Life (1990)	128 (33.7)	27 (7.1)	85 (22.3)	191 (50.3)	380
The Blue Planet (2001)	134 (66.0)	12 (5.9)	12 (5.9)	60 (29.6)	203
Planet Earth (2006)	116 (51.6)	7 (3.1)	19 (8.4)	119 (52.9)	225
Planet Earth II (2016)	66 (52.8)	9 (7.2)	22 (17.6)	51 (40.8)	125
Our Planet (2019)	79 (52.0)	13 (8.6)	16 (10.5)	73 (48.0)	152

Raw values are above with percentage values italicised in brackets below

Table 2 An overview of the interactions recorded from each series of Grzimek documentaries

Series/Episode (Year)	Interspecific		Intraspecific		Total
	Antagonistic & Predation	Cooperation	Antagonistic	Cooperation & parental care	
No Place for Wild Animals (1956)	8 (28.6)	3 (10.7)	4 (14.3)	15 (53.6)	28
Serengeti (1959)	16 (47.1)	2 (5.9)	2 (5.9)	16 (47.1)	34
Die Serengeti ist Nicht Gestorben (1972)	6 (33.3)	0 (0.0)	2 (11.1)	11 (61.1)	18
Gorilla Massa wird operiert/Lebensraum Baobab (1972)	15 (60.0)	2 (8.0)	3 (12.0)	14 (56.0)	25
Im Heißluftballon über dem Kilimanjaro (1975)	1 (25.0)	1 (25.0)	0 (0.0)	2 (50.0)	4
Riesige Ameisenheere (1975)	5 (25.0)	1 (5.0)	1 (5.0)	16 (80.0)	20
Wilde Elefanten in Manyara (1975)	8 (27.6)	0 (0.0)	4 (13.8)	20 (69.0)	29
Berggorillas in Zaire (1976)	5 (41.7)	2 (16.7)	0 (0.0)	6 (50.0)	12
Geparden in der Serengeti (1977)	15 (55.6)	0 (0.0)	2 (7.4)	15 (55.6)	27
Gnuwanderung in der Serengeti (1978)	15 (45.5)	1 (3.0)	6 (18.2)	13 (39.4)	33
Drei kleine Europäer (1979)	15 (60.0)	0 (0.0)	5 (20.0)	7 (28.0)	25
Schmetterlinge, Baumfrösche und Harpyien (1979)	10 (55.6)	0 (0.0)	0 (0.0)	12 (66.7)	18
Unter den Wildtieren Alaskas (1981)	3 (15.8)	1 (5.3)	2 (10.5)	14 (73.7)	19
Rätseltiere im eigenen Garten (1986)	16 (57.1)	0 (0.0)	5 (17.9)	8 (28.6)	28
Reineke Fuchs und Adebar (1986)	14 (48.3)	0 (0.0)	1 (3.4)	18 (62.1)	29
Ausrottung von Bisons und Indianern (N/A)	4 (23.5)	3 (17.6)	4 (23.5)	7 (41.2)	17
Naturpark Bayerischer Wald (N/A)	6 (33.3)	1 (5.6)	2 (11.1)	10 (55.6)	18
Wale und künstliche Urwälder im Meer (N/A)	3 (42.9)	2 (28.6)	1 (14.3)	1 (14.3)	7

Dates for the final three episodes were not included in the source material nor available through external sources, thus were recorded N/A. Raw values are above with percentage values italicised in brackets below

Cooperation interactions were those that involved a mutual fitness benefit to two or more animals, for example cleaning services, or those that involved a fitness benefit to one individual without detriment to the other, for example when large mammals permit small birds to sit on top of them. The combination of both dichotomies resulted in 4 categories. Furthermore, the category “interspecific antagonistic behaviour” was extended to “interspecific antagonistic behaviour and predation”, which still follows our previous definition of antagonistic behaviour in general. Likewise, the category “intraspecific cooperative behaviour” was broadened to “intraspecific

cooperative behaviour and parental care”. Table 3 provides a full summary of the types of interactions included within these categories.

All interactions between two or more animals that appeared on screen were recorded, including those that were not commented on by the narrator. Each interaction was recorded as only cooperation and parental care, only antagonistic behaviour and predation or with elements of both; and as containing only interspecific interactions, only intraspecific interactions, or elements of both. In either case, a value of ‘both’ was recorded in the corresponding column, with this then contributing to the total

Table 3 A summary of the types of interactions included within the terms ‘antagonistic’ and ‘cooperative’

Antagonistic	Cooperative
Predator–prey interactions	Parental care (both mother- and father-offspring)
Competition for mates	Colony, flocking, herding and shoaling behaviour
Parasitism	Vocal or visual communication, such as warning calls
Territorial competition	Courtship displays and mating behaviour
Scavenging	Cleaning services and grooming
Food competition	Cooperative/group hunting
Dominance/hierarchy interactions	Play behaviour
Farming	Protective behaviour/inter-species cooperative living

This list is not intended to be exhaustive, and there may be some context-dependent crossover between the categories

number of each type of interaction involved (a comprehensive spreadsheet of all data recorded from the documentaries is available in Additional files 1, 2 and 4. This is why the summed percentage value of the four types of interaction for each series is greater than 100%.

Statistical analyses

We examined if the types of interactions were influenced by the presenter (Attenborough vs. Grzimek) and/or by the time (decade) in which the documentary was produced by conducting multinomial logistic regressions with ‘Interaction’ as the categorical response variable. As a baseline, we ran a null-model only including the intercept. As a next step, we ran two models in which we included one of the two categorical predictors (presenter and time) respectively. The time variable was categorised into six decades (1950–2020) spanning the documentaries broadcast between 1956 and 2019, with the first two decades merged into one joint category (1950–1969) to avoid bias due to the lack of data for the years 1960–1969.

Finally, we conducted a model containing both variables as predictors. Statistical models were compared using the AIC criteria. To assess the quality of fit of our best model, we calculated the Nagelkerke $PseudoR^2$ value since standard R^2 values cannot be calculated for logistic regressions. All statistical analyses were conducted in the R environment (v. 2021.09.1; Additional file 3). For multinomial logistic regression models, we used the package `nnet` (Venables and Ripley 28). After we used the `multinom` function for calculation of test values and standard errors, we calculated p -values by applying the two-tailed z -test. For calculation of the Nagelkerke criteria, we used the package `DescTools` (Andri et al. 1).

To visualise our data, a number of bar graphs were produced in Microsoft Excel. Percentage values were used in all comparisons to account for the variable number of episodes in each series and, hence, the variable number of interactions observed.

Results

In documentaries presented by Attenborough, we found two categories to dominate the interactions across all episodes (Fig. 1a; Table 1): (1) interspecific antagonistic behaviour and predation and (2) intraspecific cooperative behaviour and parental care.

Interspecific antagonistic behaviour and predation peaks at 66.0% in *The Blue Planet* and intraspecific cooperation and parental care peaks at 55.2% in *Life on Earth*. Interspecific cooperation is least represented and only reaches a maximum value of 8.6% in *Our Planet*. Intraspecific antagonistic behaviour is generally higher than interspecific cooperation, but only reaches double figures three times, and only exceeds 20% once—when it reaches 22.4% in *The Trials of Life*.

In Grzimek’s documentaries *No Place for Wild Animals* and *Ein Platz für Tiere* (Fig. 1b; Table 2), intraspecific cooperation and parental care predominates, with 53.6% (vs 28.6%) and 52.9% (vs 42.9%) respectively. In both series intraspecific antagonistic behaviour is much greater than interspecific cooperation, with values peaking in *No Place for Wild Animals* at 14.3% and 10.7% respectively. However, in *Serengeti* these values are equal at 47.1%, while the values of interspecific cooperation and intraspecific antagonistic behaviour are also equal at 5.9%.

To investigate whether ‘presenter’ and ‘time’ had an effect on the biological interactions portrayed, we examined four models. The null model (M0) with only the intercept included showed the highest AIC value of 3193.669, which renders it the weakest of our models. Out of the two models containing one of the predictors each, model M1b (predictor ‘time’) was preferred (AIC: 3139.336) over model M1a (predictor ‘presenter’; AIC: 3193.599). Adding ‘presenter’ as a second factor to model M1b (M2) did not improve the information criterion (AIC: 3142.749). We used the best model (M1b) to calculate p -values, which are shown in Table 4. As illustrated in Fig. 1a and b, there is no significant trend against time

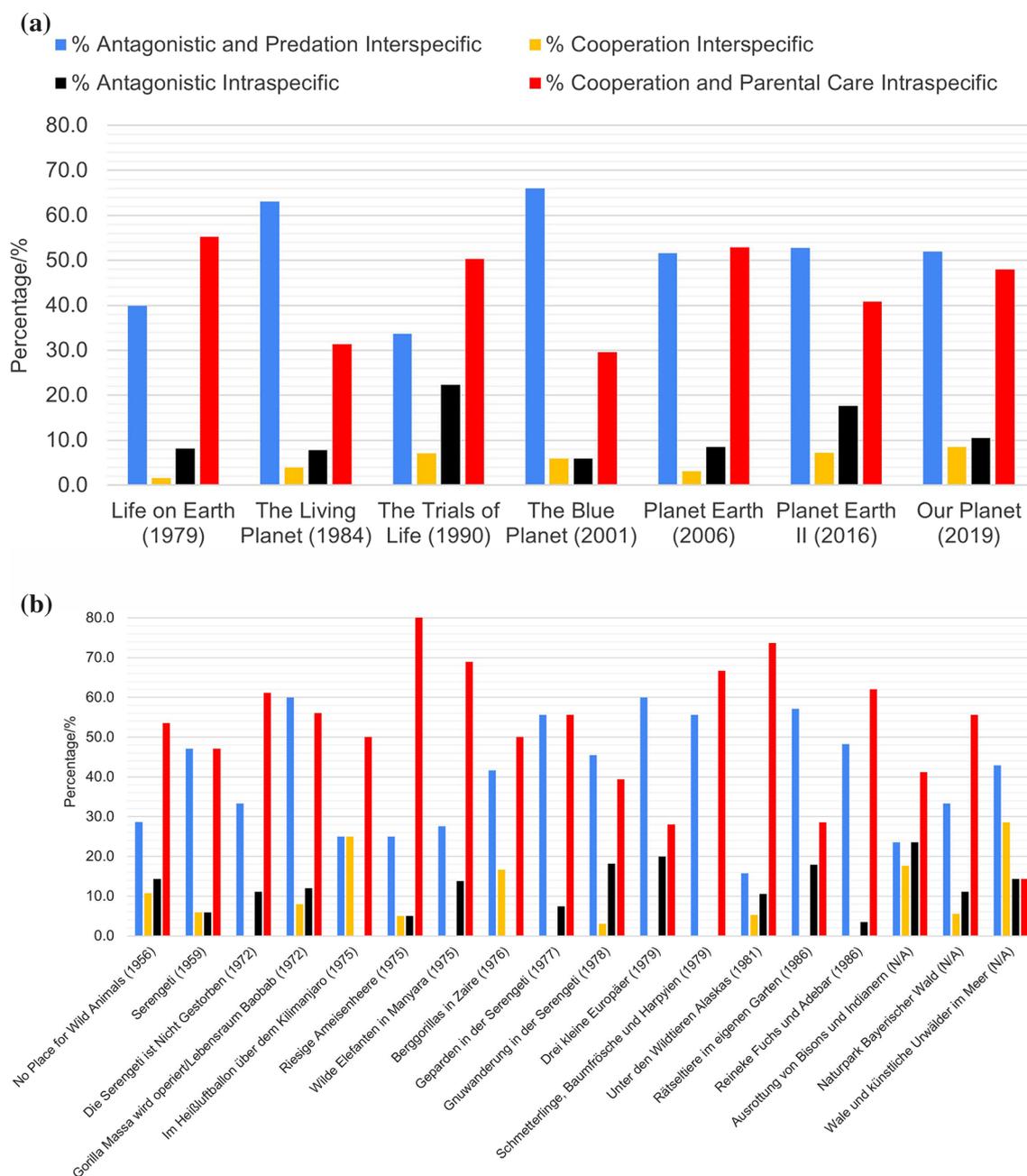


Fig. 1 The relative frequencies of the different types of animal interaction over time in nature documentaries by (a) above—Attenborough and (b) below—Grzimek

for any interaction. When interspecific antagonistic behaviour and predation increases, intraspecific cooperation and parental care decreases and vice versa, but this occurs in an oscillating pattern between series rather than demonstrating any particular trend with regards to time. Model M1b had a PseudoR² (“Nagelkerke”) value of 0.07, which is rather low and reflects that ‘time’ is not

a good predictor of the type of biological interaction shown in the studied nature documentaries. A careful evaluation of the model results is suggested given a low underlying PseudoR² value. However, visual and statistical evaluations support each other, enhancing reliability of the results.

Both presenters show similar percentage values of interspecific cooperation (5.3% vs 4.9%) and intraspecific antagonistic behaviour (12.5% vs 11.3%). Documentaries by Attenborough show a higher percentage of interspecific antagonistic behaviour and predation than Grzimek (49.5% vs 42.2%), while Grzimek documentaries show a higher percentage value for intraspecific cooperation and parental care (44.5% vs 52.4%) (Additional file 2; Table 5). However, this difference was not picked up as significant by our model (M1a, results not shown). Results for the percentage of interactions involving a number of different taxa are included in Table 6.

Discussion

We found a common pattern in both presenters, in which approximately 94% of portrayed biological interactions either showed interspecific antagonistic behaviour and predation or intraspecific cooperation and parental care. The most relevant aspect however is not the overall

ratio of the four interaction types, but that this pattern has not significantly changed over the 63 years between the first and last studied documentary’s first broadcast. Both presenters were not only the voice of the productions studied here but, given their biological background and fervent interest in nature, had major influence on the final productions, sometimes even as official (co)-producers (Attenborough 3; Grzimek 17). Nevertheless, other members of the production teams provided a range of expertise to influence the content of the documentaries studied, representing a strong diversity in background, gender-identity and ethnicity. While we fully appreciate the roles of these other team members, we believe that their contributions do not interfere with our assumption that the factor ‘presenter’ reflects the given Zeitgeist in these different societies. We initially hypothesised that Grzimek’s documentaries would focus more on the social, cooperative nature of animals, while the focus of Attenborough’s documentaries was hypothesised to be

Table 4 Results of the multinomial logistic regression with the best model fit (Model 1b)

Interaction category	Intercept	Decade 2 (1970–1979)	Decade 3 (1980–1989)	Decade 4 (1990–1999)	Decade 5 (2000–2009)	Decade 6 (2010–2019)
Interspecific cooperation	<i>− 1.609</i> 0.005	<i>− 0.876</i> 0.211	<i>− 1.289</i> 0.069	<i>− 0.163</i> 0.867	<i>− 1.053</i> 0.112	<i>− 0.115</i> 0.927
Intraspecific antagonistic	<i>− 1.386</i> 0.008	<i>− 0.118</i> 0.909	<i>− 0.893</i> 0.149	<i>0.940</i> 0.091	<i>− 0.717</i> 0.230	<i>0.103</i> 0.928
Intraspecific cooperation & parental care	<i>− 0.049</i> 0.955	<i>0.320</i> 0.400	<i>− 0.576</i> 0.116	<i>0.244</i> 0.536	<i>− 0.417</i> 0.251	<i>− 0.245</i> 0.543

Test coefficients (in italics) and corresponding *p*-values (below). None of the 6 levels of the categorical variable ‘time’ has a statistically significant effect on the response variable ‘Interaction’

Table 5 Overall absolute (*a*) and percentage (*p*) values for both types of antagonistic and cooperation interactions across all series for Attenborough (above) and Grzimek (below)

Presenter	Interspecific		Intraspecific		Total
	Antagonistic & Predation	Cooperation	Antagonistic	Cooperation & parental care	
Attenborough a	741	80	187	667	1498
Attenborough p	49.5	5.3	12.5	44.5	111.8
Grzimek a	165	19	44	205	391
Grzimek p	42.0	4.9	11.3	52.4	110.6

Table 6 The percentages of interactions that feature each described taxon

Presenter	Mammal	Bird	Reptile	Amphibian	Fish	Arthropod	Other invertebrate
Attenborough	45.4	28.3	5.8	3.3	18.3	23.8	6.9
Grzimek	63.7	31.2	2.8	2.0	2.3	16.1	3.6
Combined	49.2	28.9	5.2	3.0	15.0	22.2	6.2

shifted more towards antagonistic interactions. However, the slight differences we found in these directions were not statistically significant and were even hard to detect in the visualisation of the data. This indicates that the socio-economic situation or ideological background of the country of production might have had only a minimal effect on what was depicted in nature documentaries. It would not be unreasonable to assume that Grzimek's various documentaries may have influenced Attenborough's work, which might have caused a more homogeneous picture across documentaries of both presenters. Evidence for this can be found in Attenborough's 2020 documentary *A Life on our Planet* in which he shows footage of *Serengeti* by Grzimek, with Attenborough describing him as a 'visionary scientist'.

Another core assumption of our study was that the studied documentaries reflected scientific knowledge at their time of production, updating with new discoveries. However, although it seems that changes related to technological advances influence documentary production, we found no evidence for content change over time, at least in the interaction categories we examined. This remarkable constancy invites an evaluation of what the most influential natural documentaries from Europe have been portraying and if there are geographic or temporal differences in the scientific understanding of the subjects.

Especially in the Anglo-Saxon scientific discourse, the first decades of the documentaries studied were characterised by an emphasis on the struggle for existence and competition, leading to 'selfish' behaviour (Dawkins 10). In contrast, behavioural biology studies in the most recent decades showed the importance and ubiquity of cooperative behaviour (Bshary 6; Diogo 12). Although this change in understanding is arguably quite clearly shared across biology (Clutton-Brock 8; West et al. 29), we lack a quantitative record of the frequency in the wild of the interactions we studied, so it is impossible to know the extent to which documentaries reflect reality. It is telling that the patterns remain the same over decades, and that cooperation has not become more ubiquitous in Attenborough documentaries since, for example, the year 2000. The pattern of the kinds of interactions presented in the first documentaries has been kept despite time and financial constraints that likely limited Grzimek's work and the earlier Attenborough series but were probably only of minor influence in Attenborough's more recent projects, since these were filmed over several years with massive budgets (Boboltz 5; WWF 30). As such, current documentaries may be suffering from a cultural lag, not having been updated on at least some aspects of the portrayed biology. Technological advances in filmmaking have been put to good use with the documentation of animals in places and situations that are rare if not

impossible to see (e.g. 'the first intimate images of snow leopard ever filmed in the wild'—*Planet Earth*). However, these advances have not fundamentally affected the biology portrayed.

The diversity portrayed in Attenborough and Grzimek documentaries (Table 6) does not correspond to diversity in number of species (Zimmer and Emlen 32), nor to their biomass (for example, if diversity portrayed were to be accurate in terms of global biomass, chickens, which only appeared in three interactions across all the episodes studied, should have actually been shown in around $\frac{1}{4}$ of the interactions (Bennett et al. 4)—across the documentaries Grzimek focuses more on birds and mammals while Attenborough has a broader approach; this could be due to either differences in the interests of the presenters and their teams, or in the availability of resources to be able to film certain taxa. However, the goal of a documentary is not to be correct with respect to actual numbers of global biomass. Instead, the intention of documentaries is to entertain while educating (Attenborough 3), with documentaries themselves being one potential factor driving an increased public interest in the megafauna shown on screen (Mazzoldi et al. 24). Most organismal interactions in nature—the world of bacteria and viruses (Zimmer 31)—are not visible to the camera film and occur even within humans (Gilbert et al. 13). The broad categorisation of interactions of our analysis may not reflect differences in the documentaries' narratives, which may reveal changes over time, although we hypothesise that these have not been significant either.

It was not surprising to find interspecific cooperation in last place of the four categories. This reflects well that mutualisms between different species are less common than the other interactions considered (Clutton-Brock 8). The second to last category, intraspecific antagonistic behaviour, scored very low in frequency (around 11–12%) in documentaries of both presenters. It has often been argued that the struggle for existence reaches a maximum within populations since all individuals occupy the same niche, i.e. compete for the same resources (Zimmer and Emlen 32). Why is this crucial assumption not better reflected by some of the most influential nature documentaries? We tentatively argue that while some intraspecific antagonistic behaviours such as intrasexual competition for mating partners can be easily observed in some systems, for example, in rutting red deer (Carranza et al. 7), other forms of intraspecific antagonistic behaviours might be of a more passive nature (Grabowska et al. 16). For instance, it is not easy to clearly detect the underlying reason for an individual to be starving. Although intraspecific antagonistic behaviour could have led to the poor state of this individual, this process would be difficult to present on camera. What we would more

probably see in a nature documentary is the more spectacular likely fate of that individual ending up as predator's vulnerable prey, which, in turn, further contributes to the high score of interspecific (and not intraspecific) antagonistic behaviour and predation. The constantly high value of interspecific antagonistic behaviour and predation might satisfy the expectations of most people watching nature documentaries. It renders the focus on nature, driven by the merciless circle of life of wild animals, to be 'red in tooth and claw' (Tennyson 22).

Conclusions

There is no trend of change in the relative percentages of different types of interactions portrayed in Attenborough and Grzimek wildlife documentaries with time. For documentaries to reflect new discoveries in biology, a greater portrayal of cooperative interactions should be shown in the newer productions compared to the first ones investigated in this study. Perhaps nature being portrayed as 'red in tooth and claw' has dominated mainstream representations of animal interactions for too long. Significantly, documentaries serve to pose questions to biologists, asking, for example, how a realistic portrayal of interactions should be presented. Here naturalistic observations are paramount, with so many inspired by the teams of Attenborough and Grzimek over the past several decades. Another line of enquiry concerning these documentaries could be the influence, if any, of the assemblage of film production teams behind the nature documentaries discussed here, to move away from the heroification of the presenters.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12052-022-00171-5>.

Additional file 1. Spreadsheet with all the interactions in documentaries by Attenborough and Grzimek.

Additional file 2. Summary graph of the interactions in documentaries by Attenborough and Grzimek.

Additional file 3. Statistical analyses in R environment.

Additional file 4. Spreadsheet with summary of movie, name, interaction, presenter, and time in documentaries by Attenborough and Grzimek.

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Author contributions

MSV conceived the study. CJM performed documentary data collection, produced the figures and was responsible for initial write-up. CST performed all statistical analyses and produced the tables. All authors were responsible for redrafting and writing the final paper. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets supporting the conclusions of this article are included within the article (and its additional files). R code is available according to guidelines. Documentary source material is available through the BBC, Netflix and DVD purchase.

Declarations

Competing interests

The authors declare no competing interests.

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