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Animals in Fashion: Portrayal of Animal Biodiversity on Children's Clothing

Michiel Jan Dirk Hooykaas | ORCID: 0000-0001-8586-3849

Naturalis Biodiversity Center, Leiden, The Netherlands and
Science Communication and Society, Leiden University,
Leiden, The Netherlands

Corresponding author

m.j.d.hooykaas@biology.leidenuniv.nl

Antonia Katharina Aalders

Science Communication and Society, Leiden University,
Leiden, The Netherlands

toni.aalders@gmail.com

Menno Schilthuizen | ORCID: 0000-0001-6229-0347

Science Communication and Society, Leiden University,
Leiden, The Netherlands and Naturalis Biodiversity Center,
Leiden, The Netherlands

menno.schilthuizen@naturalis.nl

Ionica Smeets | ORCID: 0000-0003-1743-9493

Science Communication and Society, Leiden University,
Leiden, The Netherlands

i.smeets@biology.leidenuniv.nl

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Abstract

While cultural products such as clothes are usually not designed with an educational goal in mind, they may still raise biodiversity awareness. This study explored the portrayal of animal biodiversity on children's clothing marketed by three major clothing retailers in the Netherlands. Findings showed that although nonhuman animals were

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a common theme, diversity was quite low. The portrayal was centered on mammals, in particular exotic and domestic species, and a gender binary was uncovered, restricting animals such as dinosaurs to boys' clothes and butterflies to girls' clothes. Moreover, portrayals were often highly simplified and anthropomorphic, which reduced recognizability. The results show that children's clothes currently do not offer the balanced and iconic depiction of animal biodiversity needed for broadening people's perceptions. To achieve a more extensive representation that can help connect people with biodiversity, a shift in ideas will be required of what animals are suitable to portray.

Keywords

biodiversity – cultural representations – animals in fashion – vertebrate bias – gender binary

While the human population grows and the world becomes increasingly urbanized, many nonhuman animal populations are rapidly declining (Ceballos et al., 2017; Dirzo et al., 2014). To halt the decline, it is vital that the public is aware of animal diversity. However, previous studies have concluded that laypeople's perceptions of biodiversity are limited. For instance, many children are only aware of a small number of domestic and exotic species that they also show affinities towards, and experience difficulty with identifying native animals (Ballouard et al., 2011; Celis-Diez et al., 2017; Genovart et al., 2013; Hooykaas et al., 2019; Lindemann-Matthies, 2005). This limited and biased perception may prevent children from building lasting connections to biodiversity (Cox & Gaston, 2015), and could negatively affect future support for conservation (Kim et al., 2014; Wilson & Tisdell, 2005).

Previous studies have linked the low levels of awareness about biodiversity to a decline in direct exposure. This "extinction of experience" may inhibit people from learning about animal biodiversity (Kai et al., 2014; Pilgrim et al., 2007, 2008), and could lead to an increasing emotional separation of people from nature (Miller, 2005; Soga & Gaston, 2016). However, people learn about animals not only through direct encounters with real animals, but also through exposure to cultural representations of animals. Representations of animals are found in society in many shapes and forms – in the media, architecture, art, and in cultural products that range from toys to clothes. Together, these cultural sources reflect how society relates to animals, but more importantly in this context, they also make biodiversity accessible to the general public in new ways (Kellert, 2002). For instance, people are far more likely to encounter

vulnerable, reclusive, or exotic species vicariously than in real life (Courchamp et al., 2018).

Especially in highly urbanized countries, cultural representations play an increasing part in shaping people's perceptions of biodiversity (Prévot-Julliard et al., 2015; Soga et al., 2016). By offering indirect ways of experiencing animal diversity, these portrayals may compensate for a reduction in direct experiences. This links to cultivation theory, which highlights the impact of vicarious experience on people's perceptions (Gerbner, 1969; Potter, 2014). Indeed, there are indications that exposure to animal portrayals in cultural sources such as the media triggers interest and engagement (Fernández-Bellon & Kane, 2019; Fukano et al., 2020; Soga et al., 2016), fosters species literacy (Alves et al., 2014; Ballouard et al., 2011; Dixon et al., 2005; Hooykaas et al., 2019), and may help build positive attitudes towards animals (Barbas et al., 2009; Barney et al., 2005; Fukano et al., 2020; Kalof et al., 2015). In line with this, the International Union for Conservation of Nature partnered up with fashion brand Lacoste in 2018 for a campaign in which the usual crocodile emblem on Lacoste polos was replaced with ten endangered animal species to increase awareness of and support for these species.

While some cultural products are purposefully designed to educate people about animals, most of them are not. However, simply by portraying animals, the latter do influence people's connections with biodiversity, as it is known that subtle and repeated exposure can induce positive changes in attitudes and preferences (Bornstein & D'Agostino, 1992; Kaikati & Kaikati, 2004; Kalof et al., 2015; Roy & Chattopadhyay, 2010; Zajonc, 1968). Interest in cultural representations of animals has increased in recent decades, although some cultural products have received more attention than others. Most studies have explored the portrayal of animal diversity on the internet (Ballouard et al., 2011; Berland, 2019; Correia et al., 2016; Roberge, 2014; Roll et al., 2016; Schuetz et al., 2015) and in print media (Celis-Diez et al., 2016; Clucas et al., 2008; Genovart et al., 2013; Marriott, 2002; Sousa et al., 2017). One cultural product that has received little attention in studies on animal representations is clothing.

The Role of the Fashion Industry

There has been no extensive study on how the fashion industry portrays and appropriates biodiversity. However, clothes do portray animals, especially those marketed towards young children, who are at a suitable age to learn about animals and whose knowledge of and affinities towards animals have been shown to affect future perceptions and pro-conservation behaviors (Hinds & Sparks, 2008; Kahn Jr., 2002; Kellert, 1985, 2002; Pilgrim et al., 2007). Moreover,

although they are usually not designed to raise awareness about biodiversity, clothes are used in daily life and therefore constitute a frequent public display (Feinberg et al., 1992). As such, children's fashion offers subtle and repeated exposure (Bornstein & D'Agostino, 1992; Roy & Chattopadhyay, 2010), which we regard as a potential route to raise awareness about biodiversity.

However, several factors may compromise opportunities to raise biodiversity awareness through clothes. First, biases in the portrayal could expose people to animals that they are already familiar with. It has been reported that in other cultural products vertebrates outnumber invertebrates, and that birds, and mammals in particular, predominate over fish, amphibians, and reptiles (Fernández-Bellón & Kane, 2019; Nemésio et al., 2013; Sousa et al., 2017). Exotic and domestic species also seem to be featured relatively often as compared to their native, and wild counterparts (Ballouard et al., 2011; Celis-Diez et al., 2016; Huxham et al., 2006). Such biases are expected in children's fashion too and may stem from deliberate choices by designers based on what animals they expect to appeal to consumers, or from limited and biased perceptions of biodiversity that they hold themselves. The tight link between the fashion, media, and entertainment industry is also likely to influence what animals are portrayed, as cartoon characters are expected to be popular choices to portray. Rather than expand, skewed representations would reinforce biases in people's perceptions of biodiversity.

Secondly, clothing designers use artistic freedom in their designs, which may result in low specificity of portrayals. Whereas realistic or iconic depictions allow for precise identification ("a blackbird"), an animal that is depicted in an artistic or abstract way is likely to be identified at a higher taxonomic level ("a bird"). Designers may even purposefully transform animals into cute and marketable commodities to appeal to consumers (Cole & Stewart, 2016). For instance, anthropomorphism is a widely used stylistic device when portraying animals in cultural products, that may make animals relatable for people (Chan, 2012; Geerdts, 2016; Root-Bernstein et al., 2013), yet may also reduce recognizability by misrepresenting the true character of a species (Ganea et al., 2014; Geerdts et al., 2016a; Marriott, 2002). Moreover, a preference for anthropomorphic animals may create a biased inclusion of animals – particularly mammals – who are more easily anthropomorphized (Huxham et al., 2006).

Aims of Our Study

We studied the portrayal of animal biodiversity in childrenswear offered by fashion retailers in the Netherlands, a highly urbanized country in Western Europe, where vicarious sources are expected to play a relatively large part

in shaping people's perceptions of biodiversity (Prévot-Julliard et al., 2015), and where biodiversity awareness was found to be low, especially in children (Hooykaas et al., 2019). By exploring the range of animals featured on children's clothing we aim to shed light on the species that children encounter in their daily lives, and to determine both the current learning potential and room for improvement.

We determined which taxonomic groups and types of animals were portrayed, to what level the animals were specified, and whether the animals were anthropomorphized. As some animals seem to be culturally associated with either the male or female gender (Lash & Polyson, 1988), and clothes can be an expression of gender identity (Dodd et al., 2000; Goodman et al., 2007), we also investigated possible differences in portrayal between clothes marketed towards different genders. We formulated the following research questions:

1. Which taxa and types of animals (exotic or native, and domestic or non-domestic) are portrayed?
2. To what taxonomic rank are the portrayed animals specified?
3. What proportion of the portrayed animals are anthropomorphized?
4. How does the portrayal of animal biodiversity differ between clothes marketed towards different genders?

Methods

We conducted a quantitative content analysis of the animals portrayed on clothes marketed online towards children aged 2–10 by three major clothing retailers in the Netherlands: Zalando, H&M, and C&A. By including these three retailers, we accounted for variation in pricing and target groups, and provided a robust sample of the clothing supply for children offered to Dutch customers.

Data Collection

Data were collected on three consecutive days at the beginning of November 2019. Clothes were sampled digitally: For each of the three online stores, we scanned the first 500 newest clothing items offered on their respective websites for both boys and girls aged 2–10 (sizes 92–140), for a total of 3000 items. Web cookies were deleted between rounds of data collection to increase reliability. We excluded shoes, bags, jewelry, badges, undergarments, and night-wear from the selection. Pictures of clothing items that portrayed animal biodiversity were downloaded for further processing. Clothing item duplicates marketed both towards boys and girls were regarded as “unisex” and included only once.

Coding the Animals

A codebook was designed to code the animals depicted on the clothes (Appendix A). Each garment was scanned horizontally from the top left to the bottom right, and a maximum of five animal species were coded per item. Depictions of both extant and extinct animals were included; fantasy creatures (e.g., unicorns) and biodiversity elements such as feathers, footprints, and skin patterns were excluded.

First, each animal was identified at the lowest possible taxonomic level, drawing from the literature and professional experience. Subsequently, the taxonomic affiliation was noted using the English Wikipedia (species, family, order, class, and whether the animal was an invertebrate or vertebrate). We treated dinosaurs as a taxonomic class to separate them from other reptiles and birds. In addition, we coded the type of animal (native or exotic, and domestic or non-domestic), using lists of animal species native to the Netherlands and a list of domestic animals (Appendix B).

To explore the level of distortion in the portrayal and recognizability, we finally noted for each animal the lowest taxonomic rank at which it could be identified, and its depiction state (anthropomorphized or not). Animals were coded as anthropomorphic when they showed one or more of the following characteristics: wearing clothes or accessories, human behavior (including human posture), and human facial features (Figure 1).

Intercoder Reliability

Coding was performed by two researchers, including the lead author, who checked all data entries. For anthropomorphism, intercoder reliability was calculated by comparing the independent coding of a randomly chosen quarter of the animals. Intercoder reliability was high (agreement = 95.2%, Cohen's Kappa = 0.90), indicating a strong level of agreement between the two coders (McHugh, 2012). The cases where there was disagreement between the two coders were resolved through discussion.

Data Analysis

A descriptive and statistical analysis of the data was performed in SPSS Statistics 25 (IBM Corp, 2017). First, we made frequency tables for the taxonomic groups, specificity of the identification, and anthropomorphism, and subsequently used two-tailed chi-square tests of independence with a significance level of $p \leq .05$ to analyze relationships between the categorical variables. To determine differences in portrayal of taxonomic groups per gender, we compared the five most frequently featured classes, and the twelve most frequently featured orders, families, and species. To account for multiple testing, a strict Bonferroni adjustment was applied when making multiple comparisons.



FIGURE 1 Different forms of anthropomorphism. Wearing clothing: a dog wearing a winter hat (a); human behavior: a skiing polar bear (b); human facial expressions: happy dinosaurs (c). These examples from C&A (a and b) and Zalando (c) were not part of the final dataset, yet feature portrayals similar to those coded during the project.

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Results

Of the 3000 clothing items that were sampled, 18.3% portrayed one or more animals. The clothes constituted mostly sweaters, t-shirts, and trousers, and due to the season hats and mittens were regularly encountered as well. The final dataset (Appendix C) comprised 549 clothing items (H&M: 201, C&A: 217, and Zalando: 131) depicting 827 animals in total (H&M: 341, C&A: 316, and Zalando: 170). Clothes marketed towards boys (331) featured animals more often than clothes marketed towards girls (215); only three clothing items were unisex.











Taxonomic Representation

The vast majority (90.9%) of the animals portrayed on the children's clothing represented vertebrates. Mammals were the most featured class (54.3%), followed by dinosaurs (27.7%), birds (7.5%), insects (7.4%), and arachnids (1.5%). Other classes, whether vertebrate or invertebrate, were present in the dataset only a few times or were lacking altogether, such as amphibians (Table 1).

From the 827 animals, most could be assigned to a taxonomic order (98.3%) and a taxonomic family (84.9%). In total, animals from 34 orders and 74 families were found. Many orders and families were featured only once or twice, yet a few were highly prevalent – see Tables 2 and 3.













Carnivores were the most common order, representing in particular canids, felids, and bears. Other mammalian orders that were portrayed often included

TABLE 1 Frequency of nonhuman animals portrayed on clothes marketed towards boys, girls, and total (including unisex), per taxonomic class

		Class	Boys	Girls	Total	
1		Mammals	250	194	449	54.3%
2		Dinosaurs	229	0	229	27.7%
3		Birds	23	39	62	7.5%
4		Insects	0	61	61	7.4%
5		Arachnids	12	0	12	1.5%
6		Bony fish	5	1	6	0.7%
7		Reptiles	4	1	5	0.6%
8-10		Cartilaginous fish	1	0	1	0.1%
8-10		Crustaceans	1	0	1	0.1%
8-10		Snails and slugs	1	0	1	0.1%













Note: The total number of animals was 827 (526 for boys and 296 for girls). The unisex clothing items portrayed five mammals.

TABLE 2 The 12 most featured nonhuman animal orders portrayed on clothes marketed towards boys, girls, and total (including unisex), and their frequency of occurrence

		Order	Boys	Girls	Total	
1		Carnivores	155	65	224	27.1%
2		Saurischian dinosaurs	135	0	135	16.3%
3		Even-toed ungulates and cetaceans	51	43	95	11.5%
4		Rodents	28	50	78	9.4%
5		Ornithischian dinosaurs	73	0	73	8.8%
6		Butterflies and moths	0	59	59	7.1%
7		Rabbits, hares, and pikas	1	19	20	2.4%
8		Songbirds	3	16	19	2.3%
9		Pterosaurs	15	0	15	1.8%
10		Odd-toed ungulates	6	8	14	1.7%
11		Anseriforms (waterfowl)	6	7	13	1.6%
12		Spiders	12	0	12	1.5%

Note: The total number of animals was 827 (526 for boys and 296 for girls). The unisex clothing items portrayed one deer (Cetartiodactyla), two bears (Carnivora), and two foxes (Carnivora).

TABLE 3 The 12 most featured families of nonhuman animals on clothes marketed towards boys, girls, and total (including unisex), and their frequency of occurrence

		Family	Boys	Girls	Total	
1		Canids	67	12	81	9.8%
2		Felids	36	40	76	9.2%
3		Deer	41	33	75	9.1%
4		Mice	23	46	69	8.3%
5		Tyrannosaurids	56	0	56	6.8%
6		Bears	38	9	49	5.9%
7		Ceratopsids	29	0	29	3.5%
8		Stegosaurids	28	0	28	3.4%
9		Rabbits and hares	1	19	20	2.4%
10		Brush-footed butterflies	0	18	18	2.2%
11		Pteranodontids	15	0	15	1.8%
12		Ducks, geese, and swans	6	7	13	1.6%

Note: The total number of animals was 827 (526 for boys and 296 for girls). The unisex clothing items portrayed one deer (Cervidae), two bears (Ursidae), and two foxes (Canidae).

cetaceans, even-toed ungulates (mainly due to a high number of deer), and rodents (due to the prevalence of mice).

Saurischian dinosaurs (e.g., tyrannosaurids) and Ornithischian dinosaurs (mainly ceratopsids and stegosaurids) were portrayed often too, as were butterflies, of which a considerable number concerned brush-footed butterflies. Considering birds, songbirds and “waterfowl” (anseriforms, represented by ducks and swans), were most prevalent.

Only 51.1% of the animals could be identified at the species level. In total, 71 different animal species were encountered, yet only a few, particularly domestic and exotic mammals, were portrayed frequently (Table 4).

Type of Animals













Most animals (72.3%) who were portrayed were extant, while the remainder were dinosaurs and thus (under our definition of this group) extinct. Of the extant animals for whom the origin could be determined (341), two-thirds (67.4%) were exotic (e.g., bear, tiger) and one-third (32.6%) were native (e.g., house mouse, red fox). Furthermore, 30.6% of the extant animals were domestic species (e.g., house mouse, dog, cat, horse, duck, llama). Many represented cartoon characters, e.g., characters from PAW Patrol, Minnie and Mickey Mouse, and Hello Kitty. For a small number of animals (2.8%), it could not be determined whether they were domestic or not (e.g., it was unclear for some rabbits whether they represented a domestic rabbit or a different species).

Portrayals

Often, animals were the focal point of the clothing item, although there also were subtle depictions (e.g., brand logos such as Puma and Abercrombie & Fitch). Most animals were portrayed in unrealistic ways; depictions were simplified or abstracted to a varying extent. This influenced recognizability (Figure 2) and only 51.1% could be identified at the species level. Furthermore, 13.4% of the animals were identified at the genus level, 20.3% at the family level, and 13.4% at the order level. The remaining 1.7% could only be assigned to a taxonomic class (e.g., “bird”). Mammals were specified at lower taxonomic ranks than animals from other taxonomic classes. Whereas 79.3% of mammals were identified as species, only 17.7% of non-mammalian classes could be assigned to the species rank ($\chi^2(1, N = 827) = 311.282, p < 0.001$, Cramér's $V = 0.614$). About half of the mammals identified at the species level (48.9%) represented domestic animals.

About half of the clothing items (52.5%) depicted animals anthropomorphically. Clothes regularly featured anthropomorphized cartoon characters, and other animals with clothing or accessories, human behavior, and/or

TABLE 4 The 12 most featured nonhuman animal species on clothes marketed towards boys, girls, and total, and their frequency of occurrence

		Species	Boys	Girls	Total	
1		House mouse	23	46	69	8.3%
2		Dog	54	6	60	7.3%
3		Brown bear	23	1	24	2.9%
4-5		Cougar	13	10	23	2.8%
4-5		Moose	15	8	23	2.8%
6		Domestic cat	3	18	21	2.5%
7		Reindeer	13	6	19	2.3%
8		Tiger	16	1	17	2.1%
9		<i>T. rex</i>	14	0	14	1.7%
10-11		Raccoon	10	2	12	1.5%
10-11		Red fox	7	5	12	1.5%
12		Horse	4	5	9	1.1%

Note: The total number of animals was 827 (526 for boys and 296 for girls). Only 51.1% of the animals were identified as a distinct species. The unisex clothing items did not portray animals specified at the species level.



FIGURE 2 Portrayals ranged from (photo)realistic (a and b) to (highly) abstracted (c and d), influencing the level at which nonhuman animals could be identified; e.g., whereas (b) unmistakably portrays a tiger, (c) depicts penguins, yet which species they represent is unclear. Using contextual information, famous cartoon characters such as Mickey Mouse in (d) were identified at the species level, despite large dissimilarities with the species from which they have been derived. These examples from Zalando (a, b, and c) and H&M (d) were not part of the final dataset, yet feature portrayals similar to those coded during the project.

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human facial features. In total, 44.8% of the animals were anthropomorphic, yet the proportion varied between different taxonomic classes ($\chi^2(9, N = 821) = 186.100, p < 0.001$, Cramér's $V = 0.476$). Over half of the portrayed mammals (63.5%) and birds (58.1%) showed human characteristics, whereas only 21.9% of dinosaurs and no invertebrates (e.g., insects, arachnids) were depicted in an anthropomorphic way.

Difference in Portrayal between Genders

The portrayal of biodiversity differed between clothes marketed towards boys and girls, at the class, order, family, and species level (see Tables 1–4, Appendix D). Clothing items marketed towards boys featured more animals (526) than those marketed towards girls (296). This difference seemed to be driven mainly by dinosaurs, which were only featured on boys' clothes. Without dinosaurs, the number of animals in the dataset would be equal for boys and girls (297 and 296, respectively). The other large difference between genders was that butterflies were restricted to girls' clothes.

Proportionally, both mammals and birds were more common on girls' clothing. Songbirds, rodents (in particular, mice – represented mostly by the cartoon character Minnie Mouse), and rabbits and hares were depicted more often on girls' clothes. Additionally, felids, notably house cats, were also found more frequently on girls' clothes. In contrast, canids, in particular dogs, and brown bears were portrayed more frequently on boys' clothing.

Furthermore, animals portrayed on girls' clothes were anthropomorphized more often (52.2%) than on those marketed as boys' clothing (40.9%) ($\chi^2(1, N =$

816) = 9.754, $p = 0.002$, Cramér's $V = 0.109$). This may be explained by the frequent occurrence of “cute-ified” and feminized animals on girls' clothing (e.g., animals with feminine eyelashes, blushing cheeks, or a ribbon bow; Figure 3).

Discussion

Cultural products not only reflect but also impact people's perceptions, often through subtle and repeated exposure (Bornstein & D'Agostino, 1992; Gerbner, 1969; Potter, 2014; Zajonc, 1968), and in a rapidly urbanizing world, cultural representations of animals will play an increasing part in shaping people's perceptions of biodiversity (Fernández-Bellon & Kane, 2019; Fukano et al., 2020; Kalof et al., 2015; Prévot-Julliard et al., 2015; Soga et al., 2016; Soga & Gaston, 2016). However, the potential to expand biodiversity awareness through such indirect exposure has been questioned. In this study, we explored children's clothing as a cultural source of information about animals and looked for possible biases and distortions in the portrayal of animal biodiversity.

Biases in the Portrayal

Although animals were a common theme in our sample of children's clothes, diversity was low and did not represent global biodiversity. Most animals we encountered were vertebrates – particularly mammals – in line with previous findings in cultural products such as postal stamps (Nemésio et al., 2013), covers of nature magazines (Clucas et al., 2008), and picture books (Sousa et al., 2017). Besides mammals, dinosaurs were also featured often, and birds placed third. In particular, domestic and exotic animals were portrayed frequently, a pattern that has been found in other cultural sources as well (Burton & Collins, 2015; Celis-Diez et al., 2016; Sousa et al., 2017).

The skewed portrayal is likely to stem from deliberate choices by clothing designers based on what they expect to be popular animals in their target group. For instance, a general disregard of invertebrates by the lay public is well-known, and thought to be derived from the fact that invertebrates are phylogenetically, behaviorally, and physically very different from humans (Batt, 2009; Kellert, 1993; Plous, 1993). Furthermore, animals like spiders, mosquitos, and flies are known to provoke feelings of anxiety, antipathy, or disgust (Davey et al., 1998; Kellert, 1993; Prokop et al., 2011), so designers may conclude that invertebrates will not appeal to consumers. In contrast, butterflies are generally loved by the public (Schlegel et al., 2016; Schlegel & Rupf, 2010; Shipley & Bixler, 2017), and were featured quite regularly on girls' clothes.

The strong bias towards mammals and dinosaurs also appears to be a strategy of connecting to customers' prior knowledge and interest. Mammals are



FIGURE 3 Nonhuman animals portrayed on girls' clothes were regularly 'cute-ified' and 'feminized', e.g. by adding blushing cheeks and feminine eyelashes (a). These characteristics were not found on boys' clothes (b). These examples from C&A were not part of the final dataset, yet feature portrayals similar to those coded during the project.

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generally well-known (Genovart et al., 2013; Hooykaas et al., 2019; Huxham et al., 2006) and their fur and large, forward-facing eyes appeal to people (Smith et al., 2012), while large dinosaurs also are highly popular among children, who are often in awe of these extinct giants. In contrast, reptiles and amphibians often have a bad reputation (Alves et al., 2014; Nates Jimenez & Lindemann-Matthies, 2015; Prokop et al., 2016), which may explain their scarcity in children's fashion.

Below the class level, diversity was low, even for mammals and dinosaurs. It seems that designers strategically focus on a very small selection of highly charismatic animals (Albert et al., 2018), although the limited portrayal probably also reflects a bias in their own perceptions towards generally well-known species. The prevalence of cartoon characters in the dataset further shows how the bias towards certain animals is partly driven by the entertainment industry, which is tightly linked to the fashion industry and benefits from extending brand characters to various products (Hosany et al., 2013). For instance, the frequent occurrence of domestic species can partly be explained by the

habit of portraying popular characters such as Mickey Mouse and PAW Patrol. However, domestic species, as well as exotic species, may also be a strategic choice when targeting an international market, as these animals are loved globally (Berland, 2019).

From a conservation perspective, the strong biases in the portrayal are unfortunate, as they may trigger misconceptions about species richness and abundance (Courchamp et al., 2018). Furthermore, many species from seldomly represented groups are threatened with extinction and would have much more to gain by being portrayed than dinosaurs and domestic species, whose survival does not depend on broad-based support for conservation. Although domestic animals can help foster connections between children and animals, it is not clear to what extent these connections extend to wild animals (DeMello, 2012).

The lack of native species on children's clothes may unintentionally suggest that interesting animals can only be found abroad. This aligns with Lindemann-Matthies (2005), who reported that when asked about their favorite species, Swiss children mainly mentioned exotic animals and rarely expressed their appreciation for native flora and fauna. By portraying predominantly exotic species that can be regarded as charismatic due to their aesthetic appeal, people may also incorrectly assume that animals in exotic places generally have these characteristics, even though many exotic species look very similar to native species.

Specificity and Anthropomorphism

Animals were mainly depicted in simplified and unrealistic ways, which compromised recognizability. Only half of the animals, mostly mammals, could be identified at the species level, and many animals were anthropomorphized. We assume that designers humanize animals for comic effects, e.g., by portraying a bear on a bike, but also to create an emotional bond between the viewer and the depicted animal (Chan, 2012; Marriott, 2002; Root-Bernstein et al., 2013). Given this, it is important to note that while mammals and birds were regularly anthropomorphized, no human characteristics were assigned to invertebrates. This may give the impression that they are less worthy of affection and conservation (Root-Bernstein et al., 2013), suggesting that invertebrates might in fact benefit from subtle anthropomorphism.

However, extreme forms of anthropomorphizing may lead to misconceptions and reduced recognizability. It is unlikely that lay consumers associate cartoon characters like Mickey Mouse with the species that they have been derived from. Cartoon characters based on animals may thus become associated more with humans than with their real-life relatives, so that the emotional connection established through anthropomorphism no longer connects to the actual animal (Anderson & Henderson, 2005; Geerdts, Van de Walle,

et al., 2016). Similarly, “cute-ified” depictions may trigger affection that does not extend to real animals (Cole & Stewart, 2016), compromising the potential to raise affinities towards animals.

Gender Binary

The portrayal of animal biodiversity on children’s clothing differed between genders. Not only did clothes marketed towards boys feature animals more frequently, but certain animals were also associated with either boys’ or girls’ clothes. This corresponds with Lash & Polyson (1988), who reported that people perceive many animals as either feminine or masculine, and to Cole & Stewart (2016), who noted that animal portrayals may act as gendering symbols. While dinosaurs were restricted to the boys’ sections of the online shops, butterflies were only found on girls’ clothes. Moreover, dogs and brown bears were found predominantly on boys’ clothes, while mice, rabbits, domestic cats, and songbirds were featured more often on girls’ clothes. It seems that clothing designers select animals deemed to be masculine (large, tough, and impressive) for boys’ clothes, while they choose animals believed to be feminine (small, soft, and pretty) for clothes marketed towards girls. Furthermore, we noticed frequent occurrences of gendering, even in animals not typically associated with femininity. For instance, while deer appeared frequently on both boys’ and girls’ clothes, they were often and only feminized on the latter.

The gender binary in the portrayal may not directly limit opportunities for children to encounter biodiversity, as boys and girls may still see animals featured on clothes of the opposite gender. Moreover, clothes marketed for either boys or girls can be worn by both. However, these products send the message to children that some parts of biodiversity belong to girls and some to boys. The distinct separation could contribute to differential attitudes towards animals, which links to studies that have suggested that preferences for, emotional affection for, and fear of different types of animals differ by gender (Alves et al., 2014; Kellert & Berry, 1987; Lindemann-Matthies, 2005). This could ultimately impact conservation, as people might become more responsive to campaigns for animals associated with their gender.

The distinction is further questionable because the portrayals reflect traditional gender roles and may reinforce gender stereotypes (Cole & Stewart, 2016). Research has demonstrated that children internalize traditional gender roles at a young age, through interactions with the physical and symbolic environments around them (Aubrey & Harrison, 2004; Auster & Mansbach, 2012; Blakemore, 2003; Murnen et al., 2016; Solbes-Canales et al., 2020). These constructs can limit children’s opportunities when they grow up. From an equality and a conservation standpoint, it would be better if biodiversity is seen as

something shared by everyone, regardless of gender, and without implicit messages that certain animals are appropriate only for some. We argue that when anthropomorphizing is used as a strategy to make animals relatable, gendering is not the best approach.

Limitations and Future Research

We note that portrayals do not automatically translate to what people learn from them and how people's attitudes will be affected. In our study, the animals were identified by experts, based on specific traits that laypeople may not be aware of. It is questionable whether laypeople would reach the same specificity and accuracy in their identification of the animals. People may even misidentify exotic species or generic depictions of animals (e.g., "a deer") as native species that they know. This implies that laypeople may form positive affinities towards native species when they look similar to generic depictions on clothes, yet from the perspective of species literacy (Hooykaas et al., 2019), the potential for people to get to know native species through prototypes is very limited. Future research could explore to what extent children are aware of the depicted animals on their clothes and how the way in which animals are portrayed (e.g., realistic, abstracted, or cute-ified) impacts affinities towards animals.

Furthermore, we gathered our data within a short timeframe, whereas today's fast fashion industry constantly produces new hypes and clothing collections change continuously (Bhardwaj & Fairhurst, 2010). Although the main patterns and biases found in our study are expected to be fairly constant, some animals are associated with holidays or seasons, e.g., we found a considerable number of reindeer. Longitudinal studies could explore how the frequencies of different taxa vary through time, e.g., per season.

Conclusion

Clothes are usually not designed as educational tools, yet like other cultural products that portray animals, they may still raise biodiversity awareness. However, in our study we found two patterns that currently limit this potential. First, the portrayal of animal biodiversity was highly skewed, and differentiated between boys' and girls' clothing. Secondly, many portrayals were abstracted and anthropomorphized, obscuring the connection with the real animals from which they were derived.

Children's clothes currently seem to be dominated by a small subset of animals, many of which regularly appear elsewhere in society too, e.g., in other

cultural products, in zoos, or around people's homes as companion animals. This will do little to help children with grasping the rich diversity of the animal kingdom. Although the choice for popular animals is understandable, there are many animals that could inspire innovative designs that spark the interest of consumers. Considering portrayals, it would be inappropriate to criticize clothing designers for depicting animals in a non-realistic way, for instead of being purely referential, portrayals are designed as artistic symbols and metaphors. In fact, subtle anthropomorphizing may actually be a strategic choice for taxa that tend to provoke negative emotions in people. Still, it is questionable whether extreme alterations are needed to make animals appealing to customers.

Overall, we argue that the huge variety of animals worldwide offers much more than the animals currently portrayed on children's clothes. To tap into this potential, a shift in ideas is required of what animals are suitable to portray. As clothes exist between the poles of supply and demand, clothing designers and retailers will need to be convinced that a more diverse portrayal of biodiversity will appeal to customers. Recognizing the increasing agency of the child consumer (Cook, 2004; Crewe & Collins, 2006), future research could explore children's views on animal portrayals and thereby determine opportunities to diversify. Additionally, while it is important to avoid greenwashing (Bechlivanis, 2019; Delmas & Burbano, 2011; Niinimäki et al., 2020), partnerships between designers and conservationists could help achieve a more extensive representation of animal biodiversity in children's fashion, that would enrich children's perceptions and may ultimately contribute to biodiversity conservation.

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Conflicts of Interest

The authors declare no conflict of interest.

References

- Albert, C., Luque, G. M., & Courchamp, F. (2018). The twenty most charismatic species. *PLoS ONE*, 13(7), e0199149. <https://doi.org/10.1371/journal.pone.0199149>.
- Alves, R. R. N., Silva, V. N., Trovão, D. M., Oliveira, J. V., Mourão, J. S., Dias, T. L., Alves, Â. G., Lucena, R. F., Barboza, R. R., Montenegro, P. F., Vieira, W. L., & Souto, W. M. (2014). Students' attitudes toward and knowledge about snakes in the semiarid region of Northeastern Brazil. *Journal of Ethnobiology and Ethnomedicine*, 10(30). <https://doi.org/10.1186/1746-4269-10-30>.
- Anderson, M. V., & Henderson, A. J. Z. (2005). Pernicious portrayals: The impact of children's attachment to animals of fiction on animals of fact. *Society and Animals*, 13(4), 297–314. <https://doi.org/10.1163/156853005774653645>.
- Aubrey, J. S., & Harrison, K. (2004). The gender-role content of children's favorite television programs and its links to their gender-related perceptions. *Media Psychology*, 6(2), 111–146. https://doi.org/10.1207/s1532785xmep0602_1.
- Auster, C. J., & Mansbach, C. S. (2012). The gender marketing of toys: An analysis of color and type of toy on the Disney Store website. *Sex Roles*, 67(7–8), 375–388. <https://doi.org/10.1007/s11199-012-0177-8>.
- Ballouard, J. M., Brischoux, F., & Bonnet, X. (2011). Children prioritize virtual exotic biodiversity over local biodiversity. *PLoS ONE*, 6(8), e23152. <https://doi.org/10.1371/journal.pone.0023152>.
- Barbas, T. A., Paraskevopoulos, S., & Stamou, A. G. (2009). The effect of nature documentaries on students' environmental sensitivity: A case study. *Learning, Media and Technology*, 34(1), 61–69. <https://doi.org/10.1080/17439880902759943>.
- Barney, E. C., Mintzes, J. J., & Yen, C.-F. (2005). Assessing knowledge, attitudes, and behavior toward charismatic megafauna: The case of dolphins. *The Journal of Environmental Education*, 36(2), 41–55. <https://doi.org/10.3200/JOEE.36.2.41-55>.
- Batt, S. (2009). Human attitudes towards animals in relation to species similarity to humans: A multivariate approach. *Bioscience Horizons*, 2(2), 180–190. <https://doi.org/10.1093/biohorizons/hzp021>.
- Bechlivanis, T. (2019). *Are the new Lacoste logos just recycled greenwashing?* Medium. <https://medium.com/@theodore.bechlivanis/are-the-new-lacoste-logos-just-recycled-greenwashing-1038ced91ec3>.
- Berland, J. (2019). *Virtual menageries: Animals as mediators in network cultures* (R. F. Malina & S. Cubitt (eds.)). MIT Press.
- Bhardwaj, V., & Fairhurst, A. (2010). Fast fashion: Response to changes in the fashion industry. *The International Review of Retail, Distribution and Consumer Research*, 20(1), 165–173. <https://doi.org/10.1080/09593960903498300>.
- Blakemore, J. E. O. (2003). Children's beliefs about violating gender norms: Boys shouldn't look like girls, and girls shouldn't act like boys. *Sex Roles*, 48(9–10), 411–419. <https://doi.org/10.1023/A:1023574427720>.

- Bornstein, R. F., & D'Agostino, P. R. (1992). Stimulus recognition and the mere exposure effect. *Journal of Personality and Social Psychology*, 63(4), 545–552. <https://doi.org/10.1037/0022-3514.63.4.545>.
- Burton, L., & Collins, F. L. (2015). Mediated animal geographies: Symbolism, manipulation and the imaginary in advertising imaginary in advertising. *Social & Cultural Geography*, 16(3), 276–298. <https://doi.org/10.1080/14649365.2014.979863>.
- Ceballos, G., Ehrlich, P. R., & Dirzo, R. (2017). Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines. *Proceedings of the National Academy of Sciences*, 114(30), E6089–E6096. <https://doi.org/10.1073/pnas.1704949114>.
- Celis-Diez, J. L., Díaz-Forestier, J., Márquez-García, M., Lazzarino, S., Rozzi, R., & Armesto, J. J. (2016). Biodiversity knowledge loss in children's books and textbooks. *Frontiers in Ecology and the Environment*, 14(8), 408–410. <https://doi.org/10.1002/fee.1324>.
- Celis-Diez, J. L., Muñoz, C. E., Abades, S., Marquet, P. A., & Armesto, J. J. (2017). Biocultural homogenization in urban settings: Public knowledge of birds in city parks of Santiago, Chile. *Sustainability*, 9(4), 485. <https://doi.org/10.3390/su9040485>.
- Chan, A. A. Y.-H. (2012). Anthropomorphism as a conservation tool. *Biodiversity and Conservation*, 21(7), 1889–1892. <https://doi.org/10.1007/s10531-012-0274-6>.
- Clucas, B., McHugh, K., & Caro, T. (2008). Flagship species on covers of US conservation and nature magazines. *Biodiversity and Conservation*, 17(6), 1517–1528. <https://doi.org/10.1007/s10531-008-9361-0>.
- Cole, M., & Stewart, K. (2016). *Our children and other animals: The cultural construction of human-animal relations in childhood*. Routledge. <https://doi.org/10.1080/08927936.2016.1173371>.
- Cook, D. T. (2004). *The commodification of childhood: The children's clothing industry and the rise of the child consumer*. Duke University Press. <https://doi.org/10.1515/9780822385431>.
- Correia, R. A., Jepson, P. R., Malhado, A. C. M., & Ladle, R. J. (2016). Familiarity breeds content: Assessing bird species popularity with culturomics. *PeerJ*, 4, e1728. <https://doi.org/10.7717/peerj.1728>.
- Courchamp, F., Jaric, I., Albert, C., Yves, M., Ripple, W. J., & Chapron, G. (2018). The paradoxical extinction of the most charismatic animals. *PLOS Biology*, 16(4), e2003997. <https://doi.org/10.1371/journal.pbio.2003997>.
- Cox, D. T. C., & Gaston, K. J. (2015). Likeability of garden birds: Importance of species knowledge & richness in connecting people to nature. *PLoS ONE*, 10(11). <https://doi.org/10.1371/journal.pone.0141505>.
- Crewe, L., & Collins, P. (2006). Commodifying children: Fashion, space, and the production of the profitable child. *Environment and Planning A*, 38(1), 7–24. <https://doi.org/10.1068/a35252>.

- Davey, G. C. L., McDonald, A. S., Hirisave, U., Prabhu, G. G., Iwawaki, S., Jim, C. I., Merckelbach, H., De Jong, P. J., Leung, P. W. L., & C. Reimann, B. (1998). A cross-cultural study of animal fears. *Behaviour Research and Therapy*, 36(7–8), 735–750. [https://doi.org/10.1016/S0005-7967\(98\)00059-X](https://doi.org/10.1016/S0005-7967(98)00059-X).
- Delmas, M. A., & Burbano, V. C. (2011). The drivers of greenwashing. *California Management Review*, 54(1), 64–87. <https://doi.org/10.1525/cmr.2011.54.1.64>.
- DeMello, M. (2012). *Animals and society: An introduction to human-animal studies*. Columbia University Press.
- Dirzo, R., Young, H. S., Galetti, M., Ceballos, G., Isaac, N. J. B., & Collen, B. (2014). Defaunation in the Anthropocene. *Science*, 345(6195), 401–406. <https://doi.org/10.1126/science.1251817>.
- Dixon, S. P., Birchenough, A., Evans, S. M., & Quigley, M. P. (2005). Children's knowledge of birds: How can it be improved and can it be used to conserve wildlife? *Transactions of the Natural History Society of Northumbria*, 64, 121–134.
- Dodd, C. A., Clarke, I., Baron, S., & Houston, V. (2000). "Looking the part": Identity, meaning and culture in clothing purchasing – Theoretical considerations. *Journal of Fashion Marketing and Management*, 4(1), 41–48. <https://doi.org/10.1108/eb022578>.
- Feinberg, R. A., Mataro, L., & Burroughs, W. J. (1992). Clothing and social identity. *Clothing and Textiles Research Journal*, 1(1), 18–23. <https://doi.org/10.1177/0887302X9201100103>.
- Fernández-Bellon, D., & Kane, A. (2019). Natural history films raise species awareness – A big data approach. *Conservation Letters*, 13(1), e12678. <https://doi.org/10.1111/conl.12678>.
- Fukano, Y., Tanaka, Y., & Soga, M. (2020). Zoos and animated animals increase public interest in and support for threatened animals. *Science of the Total Environment*, 704. <https://doi.org/10.1016/j.scitotenv.2019.135352>.
- Ganea, P. A., Canfield, C. F., Simons-Ghafari, K., & Chou, T. (2014). Do cavies talk? The effect of anthropomorphic picture books on children's knowledge about animals. *Frontiers in Psychology*, 5, 1–9. <https://doi.org/10.3389/fpsyg.2014.00283>.
- Geerds, M. S. (2016). (Un)Real animals: Anthropomorphism and early learning about animals. *Child Development Perspectives*, 10(1), 10–14. <https://doi.org/10.1111/cdep.12153>.
- Geerds, M. S., Van de Walle, G. A., & LoBue, V. (2016a). Learning about real animals from anthropomorphic media. *Imagination, Cognition and Personality: Consciousness in Theory, Research, and Clinical Practice*, 36(1), 5–26. <https://doi.org/10.1177/0276236615611798>.
- Geerds, M. S., Van De Walle, G., & LoBue, V. (2016b). Using animals to teach children biology: Exploring the use of biological explanations in children's anthropomorphic storybooks. *Early Education and Development*, 27(8), 1237–1249. <https://doi.org/10.1080/10409289.2016.1174052>.

- Genovart, M., Tavecchia, G., Enseñat, J. J., & Laiolo, P. (2013). Holding up a mirror to the society: Children recognize exotic species much more than local ones. *Biological Conservation*, 159, 484–489. <https://doi.org/10.1016/j.biocon.2012.10.028>.
- Gerbner, G. (1969). Toward “cultural indicators”: The analysis of mass mediated public message systems. *Audio-Visual Communication Review*, 17(2), 137–148. <https://doi.org/10.1007/BF02769102>.
- Goodman, J., Knotts, G., & Jackson, J. (2007). Doing dress and the construction of women’s gender identity. *Journal of Occupational Science*, 14(2), 100–107. <https://doi.org/10.1080/14427591.2007.9686590>.
- Hinds, J., & Sparks, P. (2008). Engaging with the natural environment: The role of affective connection and identity. *Journal of Environmental Psychology*, 28(2), 109–120. <https://doi.org/10.1016/j.jenvp.2007.11.001>.
- Hooykaas, M. J. D., Schilthuizen, M., Aten, C., Hemelaar, E. M., Albers, C. J., & Smeets, I. (2019). Identification skills in biodiversity professionals and laypeople: A gap in species literacy. *Biological Conservation*, 238. <https://doi.org/10.1016/j.biocon.2019.108202>.
- Hosany, S., Prayag, G., Martin, D., & Lee, W. Y. (2013). Theory and strategies of anthropomorphic brand characters from Peter Rabbit, Mickey Mouse, and Ronald McDonald, to Hello Kitty. *Journal of Marketing Management*, 29(1–2), 48–68. <https://doi.org/10.1080/0267257X.2013.764346>.
- Huxham, M., Welsh, A., Berry, A., & Templeton, S. (2006). Factors influencing primary school children’s knowledge of wildlife. *Journal of Biological Education*, 41(1), 9–12. <https://doi.org/10.1080/00219266.2006.9656050>.
- Kahn Jr., P. H. (2002). Children’s affiliations with nature: Structure, development, and the problem of environmental generational amnesia. In P. H. Kahn Jr. & S. R. Kellert (Eds.), *Children and nature: Psychological, sociocultural, and evolutionary investigations* (pp. 93–116). MIT Press.
- Kai, Z., Woan, T. S., Jie, L., Goodale, E., Kitajima, K., Bagchi, R., & Harrison, R. D. (2014). Shifting baselines on a tropical forest frontier: Extirpations drive declines in local ecological knowledge. *PLoS ONE*, 9(1), e86598. <https://doi.org/10.1371/journal.pone.0086598>.
- Kaikati, A. M., & Kaikati, J. G. (2004). Stealth marketing: How to reach consumers surreptitiously. *California Management Review*, 46(4), 6–22. <https://doi.org/10.2307/41166272>.
- Kalof, L., Zammit-Lucia, J., Bell, J., & Granter, G. (2015). Fostering kinship with animals: Animal portraiture in humane education. *Environmental Education Research*, 22(2), 203–228. <https://doi.org/10.1080/13504622.2014.999226>.
- Kellert, S. R. (1985). Attitudes toward animals: Age-related development among children. *The Journal of Environmental Education*, 16(3), 29–39. <https://doi.org/10.1080/00958964.1985.9942709>.

- Kellert, S. R. (1993). Values and perceptions of invertebrates. *Conservation Biology*, 7(4), 845–855. <https://doi.org/10.1046/j.1523-1739.1993.740845.x>.
- Kellert, S. R. (2002). Experiencing nature: Affective, cognitive, and evaluative development in children. In P. H. Kahn Jr. & S. R. Kellert (Eds.), *Children and nature: Psychological, Sociocultural, and Evolutionary Investigations* (pp. 117–151). MIT Press.
- Kellert, S. R., & Berry, J. K. (1987). Attitudes, knowledge, and behaviors toward wildlife as affected by gender. *Wildlife Society Bulletin*, 15(3), 363–371. <https://doi.org/10.2307/3782542>.
- Kim, J. Y., Do, Y., Im, R.-Y., Kim, G.-Y., & Joo, G.-J. (2014). Use of large web-based data to identify public interest and trends related to endangered species. *Biodiversity Conservation*, 23, 2961–2984. <https://doi.org/10.1007/s10531-014-0757-8>.
- Lash, S. J., & Polyson, J. A. (1988). Reassessment of gender perception in projected animal content. *Perceptual and Motor Skills*, 67(2), 547–553. <https://doi.org/10.2466/pms.1988.67.2.547>.
- Lindemann-Matthies, P. (2005). ‘Loveable’ mammals and ‘lifeless’ plants: How children’s interest in common local organisms can be enhanced through observation of nature. *International Journal of Science Education*, 27(6), 655–677. <https://doi.org/10.1080/09500690500038116>.
- Marriott, S. (2002). Red in tooth and claw? Images of nature in modern picture books. *Children’s Literature in Education*, 33(3), 175–183. <https://doi.org/10.1023/A:1019677931406>.
- McHugh, M. L. (2012). Interrater reliability: The kappa statistic. *Biochemia Medica*, 22(3), 276–282.
- Miller, J. R. (2005). Biodiversity conservation and the extinction of experience. *Trends in Ecology and Evolution*, 20(8), 430–434. <https://doi.org/10.1016/j.tree.2005.05.013>.
- Murnen, S. K., Greenfield, C., Younger, A., & Boyd, H. (2016). Boys act and girls appear: A content analysis of gender stereotypes associated with characters in children’s popular culture. *Sex Roles*, 74(1–2), 78–91. <https://doi.org/10.1007/s11199-015-0558-x>.
- Nates Jimenez, J., & Lindemann-Matthies, P. (2015). Public knowledge of, and attitudes to, frogs in Colombia. *Anthrozoös*, 28(2), 319–332. <https://doi.org/10.1080/08927936.2015.11435405>.
- Nemésio, A., Seixas, D. P., & Vasconcelos, H. L. (2013). The public perception of animal diversity: What do postage stamps tell us? *Frontiers in Ecology and the Environment*, 11(1), 9–10. <https://doi.org/10.1890/13.WB.001>.
- Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T., & Gwilt, A. (2020). The environmental price of fast fashion. *Nature Reviews Earth & Environment*, 1(4), 189–200. <https://doi.org/10.1038/s43017-020-0039-9>.
- Pilgrim, S. E., Cullen, L. C., Smith, D. J., & Pretty, J. (2008). Ecological knowledge is lost in wealthier communities and countries. *Environmental Science and Technology*, 42(4), 1004–1009. <https://doi.org/10.1021/es070837v>.

- Pilgrim, S. E., Smith, D. J., & Pretty, J. (2007). A cross-regional assessment of the factors affecting ecoliteracy: Implications for policy and practice. *Ecological Applications*, 17(6), 1742–1751. <https://doi.org/10.1890/06-1358.1>.
- Plous, S. (1993). Psychological mechanisms in the human use of animals. *Journal of Social Issues*, 49(1), 11–52. <https://doi.org/10.1111/j.1540-4560.1993.tb00907.x>.
- Potter, W. J. (2014). A critical analysis of cultivation theory. *Journal of Communication*, 64(6), 1015–1036. <https://doi.org/10.1111/jcom.12128>.
- Prévot-Julliard, A. C., Julliard, R., & Clayton, S. (2015). Historical evidence for nature disconnection in a 70-year time series of Disney animated films. *Public Understanding of Science*, 24(6), 672–680. <https://doi.org/10.1177/0963662513519042>.
- Prokop, P., Medina-Jerez, W., Coleman, J., Fancovicová, J., Özel, M., & Fedor, P. (2016). Tolerance of frogs among high school students: Influences of disgust and culture. *Eurasia Journal of Mathematics, Science and Technology Education*, 12(6), 1499–1505. <https://doi.org/10.12973/eurasia.2016.1241a>.
- Prokop, P., Usak, M., Erdogan, M., Fancovicova, J., & Bahar, M. (2011). Slovakian and Turkish students' fear, disgust and perceived danger of invertebrates. *Hacettepe University The Journal of Education*, 40, 344–352.
- Roberge, J. M. (2014). Using data from online social networks in conservation science: Which species engage people the most on Twitter? *Biodiversity and Conservation*, 23(3), 715–726. <https://doi.org/10.1007/s10531-014-0629-2>.
- Roll, U., Mittermeier, J. C., Diaz, G. I., Novosolov, M., Feldman, A., Itescu, Y., Meiri, S., & Grenyer, R. (2016). Using Wikipedia page views to explore the cultural importance of global reptiles. *Biological Conservation*, 204, 42–50. <https://doi.org/10.1016/j.biocon.2016.03.037>.
- Root-Bernstein, M., Douglas, L., Smith, A., & Veríssimo, D. (2013). Anthropomorphized species as tools for conservation: Utility beyond prosocial, intelligent and suffering species. *Biodiversity and Conservation*, 22, 1577–1589. <https://doi.org/10.1007/s10531-013-0494-4>.
- Roy, A., & Chattopadhyay, S. P. (2010). Stealth marketing as a strategy. *Business Horizons*, 53(1), 69–79. <https://doi.org/10.1016/j.bushor.2009.09.004>.
- Schlegel, J., Breuer, G., & Rupf, R. (2016). Local insects as flagship species to promote nature conservation? A survey among primary school children on their attitudes toward invertebrates. *Anthrozoös*, 28(2), 229–245. <https://doi.org/10.1080/08927936.2015.11435399>.
- Schlegel, J., & Rupf, R. (2010). Attitudes towards potential animal flagship species in nature conservation: A survey among students of different educational institutions. *Journal for Nature Conservation*, 18(4), 278–290. <https://doi.org/10.1016/j.jnc.2009.12.002>.
- Schuetz, J., Soykan, C. U., Distler, T., & Langham, G. (2015). Searching for backyard birds in virtual worlds: Internet queries mirror real species distributions. *Biodiversity and Conservation*, 24, 1147–1154. <https://doi.org/10.1007/s10531-014-0847-7>.

- ShIPLEY, N. J., & Bixler, R. D. (2017). Beautiful bugs, bothersome bugs, and FUN bugs: Examining human interactions with insects and other arthropods. *Anthrozoös*, 30(3), 357–372. <https://doi.org/10.1080/08927936.2017.1335083>.
- Smith, R. J., Veríssimo, D., Isaac, N. J. B., & Jones, K. E. (2012). Identifying Cinderella species: Uncovering mammals with conservation flagship appeal. *Conservation Letters*, 5(3), 205–212. <https://doi.org/10.1111/j.1755-263X.2012.00229.x>.
- Soga, M., & Gaston, K. J. (2016). Extinction of experience: The loss of human-nature interactions. *Frontiers in Ecology and the Environment*, 14(2), 94–101. <https://doi.org/10.1002/fee.1225>.
- Soga, M., Gaston, K. J., Yamaura, Y., Kurisu, K., & Hanaki, K. (2016). Both direct and vicarious experiences of nature affect children's willingness to conserve biodiversity. *International Journal of Environmental Research and Public Health*, 13(6), 529. <https://doi.org/10.3390/ijerph13060529>.
- Solbes-Canales, I., Valverde-Montesino, S., & Herranz-Hernández, P. (2020). Socialization of gender stereotypes related to attributes and professions among young Spanish school-aged children. *Frontiers in Psychology*, 11, 609. <https://doi.org/10.3389/fpsyg.2020.00609>.
- Sousa, E., Quintino, V., Teixeira, J., & Rodrigues, A. M. (2017). A portrait of biodiversity in children's trade books. *Society & Animals*, 25(3), 257–279. <https://doi.org/10.1163/15685306-12341447>.
- Wilson, C., & Tisdell, C. (2005). Knowledge of birds and willingness to support their conservation: An Australian case study. *Bird Conservation International*, 15(3), 225–235. <https://doi.org/10.1017/S0959270905000419>.
- Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology*, 9(2), 1–27. <https://doi.org/10.1037/h0025848>.