



What's your favourite Pokémon? Pocket monster popularity reflects interest in real-world Biology

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Tell me what Pokémon you like, and I will tell you who you are.

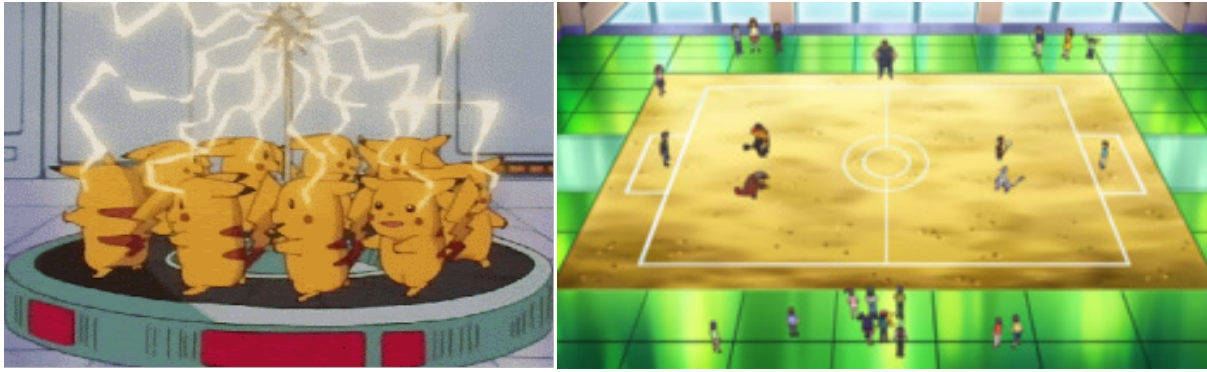
Each person is different and has different tastes, and within all the diversity of *Pokémon*, everyone, independent of gender, age and degree of involvement with the games, can find one Pokémon that is the best fit for them. Everyone has a favourite Pokémon, and every Pokémon is someone's favourite. But our choices can be influenced by the real world and can tell a lot about the human society and culture.

Everyone who plays or watch Pokémon have dreamt about having its own pocket monster, as a pet, a friend, or a partner in crime. It says a lot about the ways humans see animals and biodiversity in general (Ethnozoology). Depending on culture, animals can be venerated or respected, or, on the contrary, exploited, not considered as living beings, and exterminated. This attitude varies not only between cultures but also within the same culture through time (Tapper, 1988). Many cultures' myths or folklore have a close relation with animals, having developed over time by interaction with the local fauna.

However, on a larger scale, cultural point of views can affect conservation and even the evolution of some species. In popular opinion, the animals who most "deserve to be saved" are the cutest, more beautiful or more famous ones ('willingness-to-pay'; Colléony et al., 2016); charismatic species

that serve as symbols and rallying points to stimulate conservation awareness and action (also known as umbrella species or flagship species). It has been shown that perception and affinity ratings for animal species primarily depend on the criteria 'appearance', 'usefulness/harmfulness', and 'rareness'. For instance, pets have been artificially selected to be cute for our own personal luxury, despite the high risks for their health and survival (Serpell, 2003). Still, human perception of animals has several impacts on biodiversity and the environment in general. The international, legal and illegal, trade of wildlife (for domestic purpose, entertainment, exploitation for food, or alleged medicinal purposes) is a major business, critically affecting the preservation of some species (Broad et al., 2014). With a value between \$7 billion and \$23 billion each year, illegal wildlife trafficking is the fourth most lucrative global crime after drugs, human trafficking, and weapons (AWF, 2015).

Humans have always attempted to understand animals, to enslave them, and to capture their strength and power (Holley, 2009). In the *Pokémon* world, the same problematics are approached. On the one hand, Pokémon can be captured in the wild to be used as weapons in combat for power, glory, and money, or just for the sake of collecting them. On the other hand, they can be real friends and companions, and may even be part of society by working on medical services or security. The relationship



In the *Pokémon* world, Pokémon can be used for their special powers in everyday life or during combat. The entire society is built around them and the economy is based on their exploitation.

between humans and Pokémon is, naturally, very similar to that between humans and animals. In the games, the place of Pokémon and the responsibility of humans to them are also questioned by the villainous teams (typically presented as large organizations) that are the antagonists in the *Pokémon* world. Those can be understood as images of real-world mafia, poachers, and even ecoterrorism groups. As every element from pop culture, Pokémon can teach us about our own civilization and how our society, in turn, influences pop culture and its related industries.

Most Pokémon are based on real animals or mythical creatures (mainly from Japan); some were based on plants, fungi, minerals, objects, or have weird origins (scientific experiments, aliens, or macabre materialization). But the general tastes of people when choosing their favourite Pokémon might follow a common pattern, and one that can teach us about our culture. We can suppose that favourites are also chosen according to their popularity outside the *Pokémon* games/anime and to their similarity with something already familiar. For example, choice can be biased due to their resemblance to an already popular animal in our world (cats and dogs) or our imaginations (monsters, dinosaurs and dragons). Pokémon can also inspire feelings of power or protection, which affect their popularity in their fictional world; supposing that

Pokémon fans would like to have a Pokémon with them, the favourite is chosen because of their strength or reassuring appearance (cute and fluffy). On the contrary, less popular Pokémon would be the ones that inspire weakness and disinterest for people. Of course, we also have to take into account the emotional bias in preferences that the original impact of the *Pokémon* franchise had on people, meaning that we expect to find more favourites from the first generation (Gen I). Finally, we expect to have an anthropomorphic bias in choice: Pokémon who look more human-like (bipedal, use objects or “clothes”, have more empathic faces, etc.) might be more often selected as favourites.

METHODS

Data

The data used here are the results of an online survey asking people which was their favourite Pokémon to test the hypothesis “Every Pokémon is someone’s favourite”. 809 Pokémon from Generations I through VII were included (alternate forms are not listed separately). The survey¹ was anonymous to avoid bias of selection and limited to one response per participant. People were asked to pick one or several favourite Pokémon out of a list of 20 Pokémon, re-

¹ By Butterfree/Dragonfree/antialiasis, 2018. Still available at <https://www.dragonflycave.com/favorite.html>

peating this process for several rounds until only a few monsters remained, from which the overall favourite could be elected.

After 52,725 responses (average 65 votes per Pokémon), the results² were analysed and some patterns could be distinguished. We have to take into account that the survey was conducted without control for gender, age or cultural background of respondents. It was divulged online through a specialised website in English, which excludes non-English speakers (country bias) and some non-aficionado people (possible age and gender ratio bias). These can bring a lot a bias in the results and confound interpretation. However, the number of responses was very high overall, enough to assume powerful statistical tests. Even if interpretations have to be taken with prudence, we can at least make several useful assumptions and raise questions about the perception of Pokémon biodiversity.

Classification

All the Pokémon have been classified according to the “species” that inspired it. Most information come from Bulbapedia (<https://bulbapedia.bulbagarden.net/>), according to the English or Japanese name or interpretation of the community who manages the website. Because some Pokémon have abstract inspirations, are mythological, or a mixture of different species, we tried to be as precise as possible; we acknowledge that many mistakes or misinterpretations are present in the dataset. The Pokémon were then classified in the following categories according to their inspirations: Humanoid, Object, Ghost, Mineral, general Biology, Vegetal, Fungi, and Animal. The latter was divided into general clades of animals: Amphibian, Arthropod, Bird, Dinosaur, Fish, Invertebrate, Reptile, and

Mammal. “Invertebrate” is not a natural clade, but was used to represent cnidarians (jellyfish, corals), echinoderms (starfishes, sea cucumbers) and molluscs. Crocodylians were included in Reptile, even if phylogenetically they are closer to dinosaurs and birds. Finally, Dragon is considered as an extra distinct clade within Animals, because of their mythological origin and prevalence in *Pokémon*. We did not consider the Type of each Pokémon (Fire, Ground, Psychic, Bug, etc.) in the analysis.

RESULTS AND DISCUSSION

Generation bias

As expected, we have a bias of votes for Pokémon from the first generations. The distribution of votes decreases with generations (Table 1, Fig. 1). Because there are not the same number of Pokémon in each generation, we have to use the average number of votes per generation and use an ANOVA (Kruskall-Wallis test³) to compare the effect of generation on the number of votes. The test indicates that there are significant differences between groups of generations (Kruskal-Wallis chi-squared = 146.76, df = 6, p-value < 2.2e-16). To investigate further the differences among groups, we used a pairwise Wilcoxon⁴ test between generations (only the test with Gen I is shown in Table 1). The differences among groups indicate that for further analyses, the generation range can influence the results.

The number of votes is higher for Gen I and decreases after it. In Figure 1, we can also see that the highest number of votes is shared between the first generations. This bias can be explained because the first generations have the benefit of coming first, having the creativity initiative and receiv-

² The final results can be found at https://www.reddit.com/r/Pokémon/comments/c0w4s0/favourite_pok%C3%A9mon_survey_results/.

³ A non-parametric-test (the data do not follow a normal/Gaussian distribution) to analyse the difference of variance (ANOVA) among groups.

⁴ A non-parametric-test to assess whether the mean of two groups differ.

ing most of the popularity from the start. Because the survey is anonymous, we do not know the age of respondents to figure out if they are “Gen I kids”, but we can suppose that in most cases, people discovered *Pokémon* during the first generations and stopped being involved with the franchise with time, missing out the last generations.

Table 1. Number of votes per generation and average of votes per Pokémon in that generation (\pm standard deviation from the mean). The p-value indicates the value of the test in comparison to Gen I. Tests are significant when p-value is under the threshold of 0.05 (*: significant; **: highly significant).

Generation	Nr votes	Mean \pm SD	p-value
I	18289	121.12 \pm 184.65	–
II	9115	91.15 \pm 125.20	p=0.70
III	9469	70.14 \pm 119.62	p<0.001 **
IV	7622	70.57 \pm 107.06	p=0.0027 *
V	4300	27.74 \pm 41.74	p<0.001 **
VI	2154	29.92 \pm 46.53	p<0.001 **
VII	1776	20.18 \pm 34.95	p<0.001 **

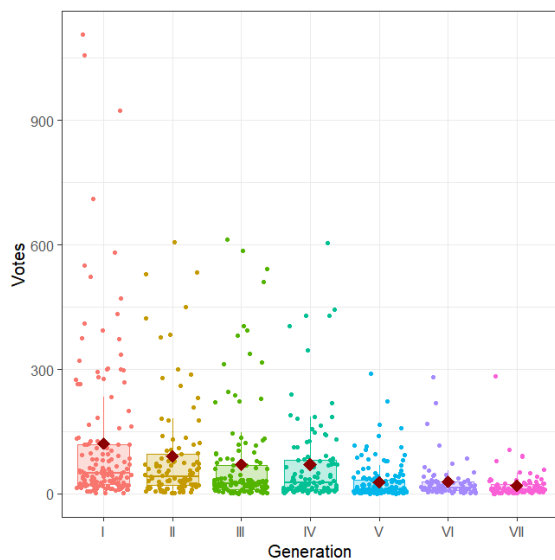


Figure 1. Box plot of the distribution of number of votes (points) of every Pokémon in each generation, and average of votes (red diamond) per generation.

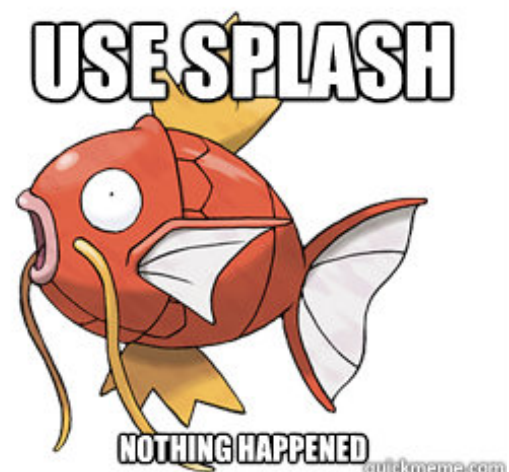
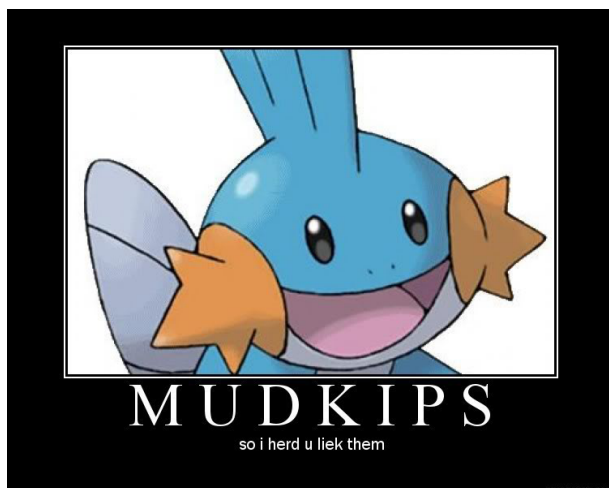
Starter bias

The emotional side is also influencing the vote. Among the first 20 most voted Pokémon, 7 are starters and concentrate the majority of votes (Table 2). The average number of votes for the starters are significantly different from the Pokémon that have “no advantage” (Wilcoxon test, p-value = 7.6e-8). This means that most of the favourite Pokémon are actually the most used monsters in the games, which makes gamers feel closer to them. However, the starters have been purposefully chosen by game developers to be popular due to their resemblance to popular animals, real or mythological. For instance, several starters are reptiles/amphibians with a dinosaurian or a dragon-like design (around 47%); the rest are mammals (39%) and birds (14%). Because this clearly doesn’t represent real animal biodiversity (where well over 90% are invertebrates) and also creates a large bias in the results, the starters were removed from the rest of the analyses.

Table 2 also shows that among the top 20 favourite Pokémon, nine are from Gen I. All the rest are from Gen II to IV, confirming that we have to take into account the generation bias in the analyses. Among the favourite Pokémon, some are also really popular on the Internet for diverse reasons (typically as memes) and overrepresented outside the Pokémon core franchise. This extra popularity has affected randomly the number of votes (Wilcoxon test, p-value = 5.6e-4), but is not directly linked to their species of inspiration or origin. Consequently, these factors will not be taken into account for the interpretation. Another advantage that could cause a boost in popularity is being a legendary or mythical Pokémon, or otherwise rare and unique. However, those Pokémon do not have a significantly different number of votes compared to “normal” monsters; thus, their legendary/mythical status was likewise not taken into account.

Table 2. Top 20 most favourite Pokémon according to total number of votes; also shown is their Generation, clade (the group to which the Pokémon belongs, see text), the “species” to which they can be associated with, their origin, and any feature that might have given them and advantage in being chosen (e.g., being a starter, legendary, etc.).

Rank	Pokémon	Nr votes	Generation	Clade	“Species”	Origin	Advantage
1	Charizard	1107	I	Dragon	Dragon	Fantastic	Starter
2	Gengar	1056	I	Ghost	Ghost	Yōkai	
3	Arcanine	923	I	Mammal	Dog	Pet/Fantastic	
4	Bulbasaur	710	I	Amphibian	Toad		Starter
5	Blaziken	613	III	Bird/Humanoid	Rooster	Domestic	Starter
6	Umbreon	607	II	Mammal	Fennec	Pet	
7	Lucario	604	IV	Humanoid	Canine	Pet	Meme
8	Gardevoir	585	III	Humanoid	Human		Meme
9	Eevee	581	I	Mammal	Fennec	Pet	Meme
10	Dragonite	551	I	Dragon	Dragon	Fantastic	
11	Absol	542	III	Mammal	Feline	Yōkai	
12	Typhlosion	534	II	Mammal	Hedgehog		Starter
13	Ampharos	529	II	Mammal	Sheep/Dragon	Domestic	
14	Squirtle	523	I	Reptile	Turtle		Starter
15	Flygon	510	III	Dragon	Dragon		
16	Ninetales	471	I	Mammal	Fox	Yōkai	
17	Tyranitar	451	II	Dinosaur	T-rex	Kaiju	
18	Infernape	443	IV	Mammal	Ape		Starter
19	Snorlax	433	I	Mammal	Bear		Meme
20	Torterra	430	IV	Reptile	Tortoise	Fantastic	Starter



Two examples of Pokémon memes, based on Mudkip (rank 24) and Magikarp (rank 107).

Favourite Pokémon

Only Pokémon with animal and human inspiration have been include in the analyses. This excludes Pokémon based on objects (8%), plants (6%), or minerals (3%), as well as some ghosts (3%). The popularity of each group of real-world animals (classified as clades) reflects the popularity of Pokémon (Fig. 2).

However, to go further in the interpretation, we have to take into account the generations; as we have seen earlier, they influenced the results. Moreover, not all clades are well represented in all generations, that

is, the proportion of Pokémon by clade vary a lot among generations. To compare popularity of Pokémon according their animal clade, we have to take these factors into account along the number of votes (Fig. 3).

The average of votes per clade was thus corrected according to the generation: by dividing the average votes per clade by the weight of each generation, we obtained a ratio of votes by clade (Table 3, Fig. 3). If we compare the ratio of votes (corrected for generation; Fig. 4, Table 2) with the mean number of votes per clade (Fig. 2, Table 4), we can see that general patterns of favourites are also conserved (Table 3).

Table 3. Number of Pokémon and number of votes, mean votes (\pm SD) and ratio (\pm SD) per clade.

Clade	Nr Pokémon	Nr votes	Mean votes \pm SD	Ratio votes \pm SD
Amphibian	15	750	50.00 \pm 39.44	0.71 \pm 0.37
Arthropod	81	3302	40.77 \pm 77.20	0.75 \pm 0.58
Bird	52	2347	45.13 \pm 61.08	0.56 \pm 0.19
Dinosaur	34	2879	84.68 \pm 124.19	1.22 \pm 0.55
Dragon	27	2927	108.41 \pm 142.87	1.67 \pm 0.73
Fish	34	1103	32.44 \pm 59.4	0.43 \pm 0.14
Humanoid	81	4917	60.70 \pm 111.83	0.92 \pm 0.48
Invertebrate	34	830	24.41 \pm 21.76	0.54 \pm 0.39
Mammal	194	14249	73.45 \pm 126.27	1.01 \pm 0.23
Reptile	17	927	54.53 \pm 59.57	0.84 \pm 0.73

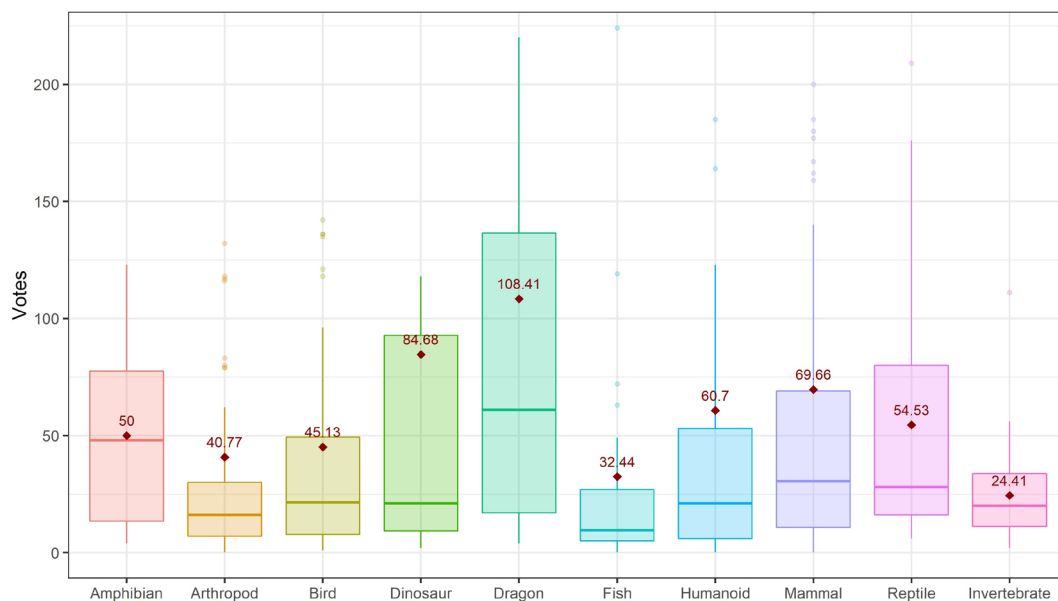


Figure 2. Box-plot of the distribution of the number of votes (points) of every Pokémon and average of votes (red spot) per clades of animal species. The outlier points (>220 votes) are not all represented here. Starters were excluded from this analysis.

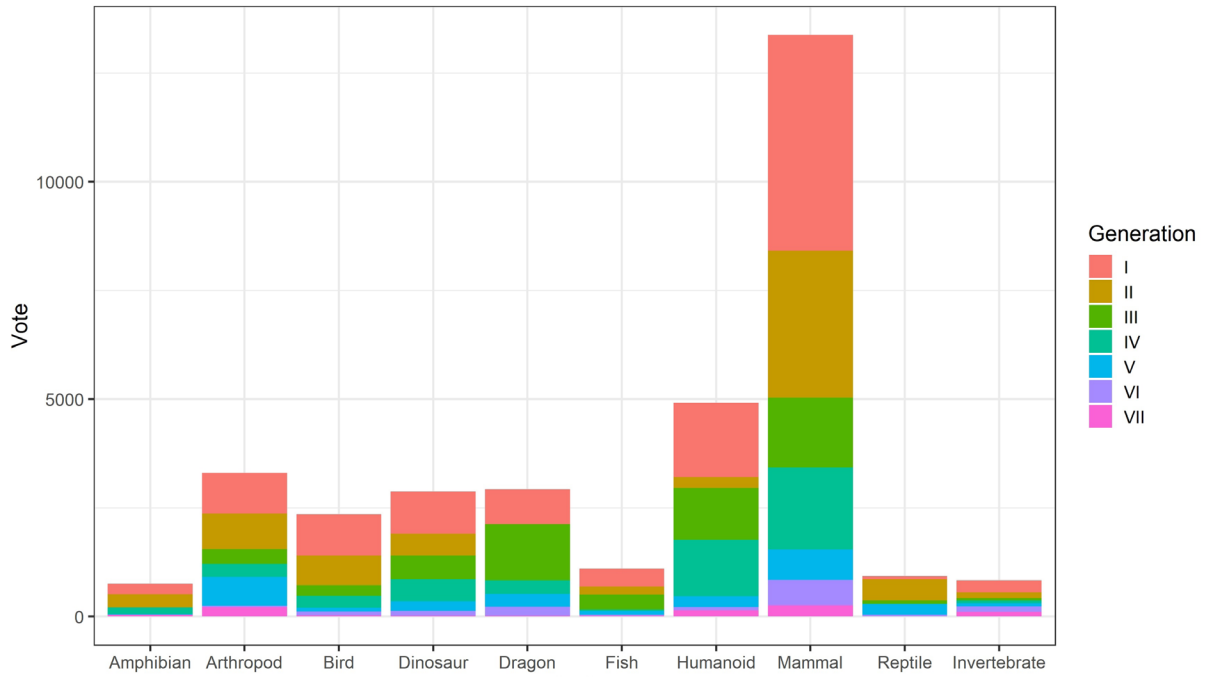


Figure 3. Cumulative histogram of the number of votes per clade according to generation. Starters were excluded from this analysis.

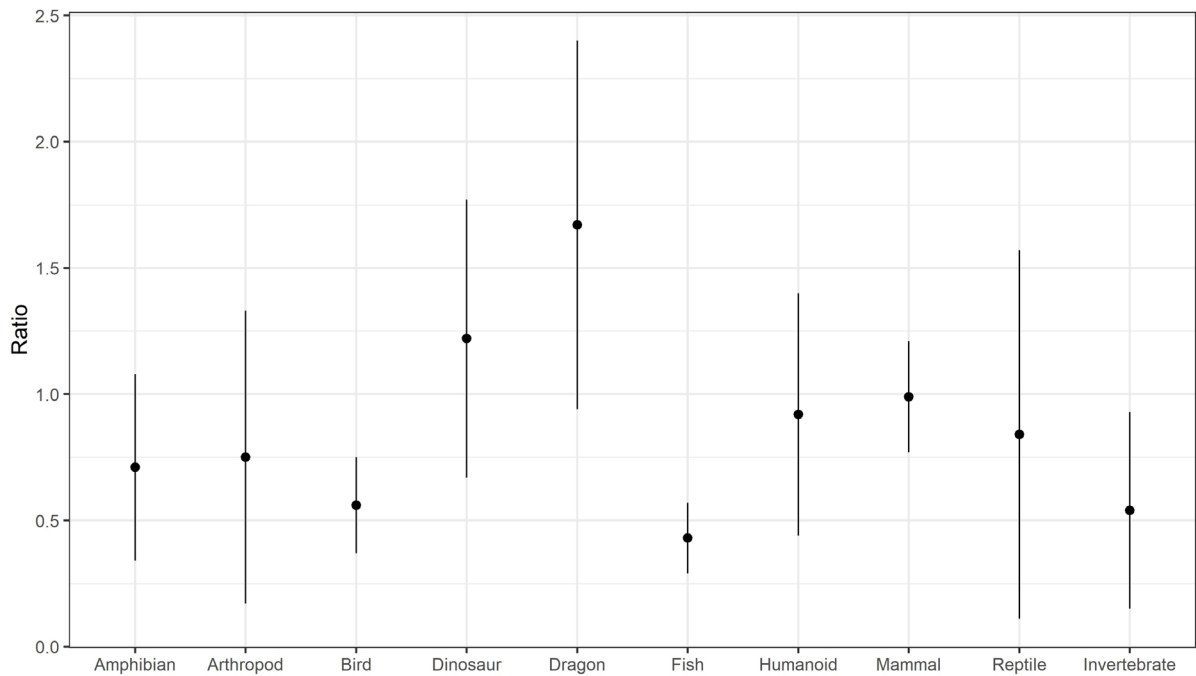


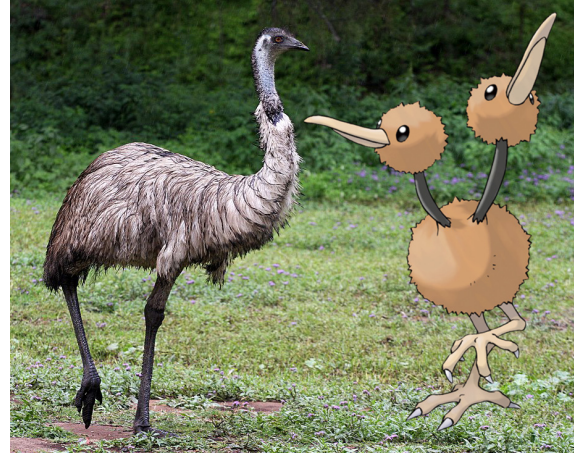
Figure 4. Average votes corrected for the weight of generation (ratio of votes \pm SD) per clade.

Dragon and dinosaurs are the most favourite. This is not very surprising, though, because both are very similar in several aspects, inspiring fear and power, an important criterion in *Pokémon*. Dragons are the favourite category of Pokémon, underlined by THE most popular one, Charizard (Table 2). Dragons are mythical creatures and most dragon Pokémon are legendary or otherwise rare and among the most powerful monsters in the games, which could have influenced the number of votes. Dragon-like creatures are present in many cultures worldwide and are popular motifs (Baker, 2012), and the dragon Pokémon popularity simply follows suit. Dinosaurs have a mysterious aura and stimulate the imagination of children, being widely used in pop culture and as a marketing tool (Thomson, 2005). *Pokémon*, having been created in 1996, followed the world success of the cult dinosaur-movie *Jurassic Park*, so it is not surprising that many monsters have a dinosaurian inspiration.



Three of the most popular Pokémon, Dragonite (rank 10), Charizard (rank 1), and Tyranitar (rank 17), have a design inspired by dragons and dinosaurs.

Following the success of dinosaur-like Pokémon, reptiles and amphibians also obtained a high popularity score, placing before birds. This is quite surprising because birdwatching (or birding) is a popular hobby all around the world (Cordell & Hebert, 2002), whereas interest in herpetology (the study of reptile and amphibians) is less common. Real-world birds are, on average, more appreciated than reptiles and amphibians (Schlegel & Rupf, 2009) and stimulate more curiosity and affinity (Zimihorski et al., 2013).



Despite the appearance, birds are actually dinosaurs. Braviary (rank 317) is based on the bald eagle, while Doduo (rank 637) is a two-head bird inspired by the Australian emu. The common pigeon has his own Pokémon, Pidove (rank 637), whereas Pikipec (rank 746) is inspired by a woodpecker (here a pileated woodpecker).

However, the number of bird Pokémon (52) relative to reptiles (17) and amphibians (15) can influence the design conception and their success. Birds represent a large amount of diversity, from the smallest and cutest birbs to the largest and impressive ones (the latter usually represented as legendary Pokémon). The success of bird Pokémon depends mainly on what particular species they represent and their own perceived reputation, which can unbalance the ratio of votes.

Reptiles are easily identifiable and fascinating for many people; despite the fear and danger they might inspire, they can be appreciated differently depending on cultural background. The notable abilities of reptiles (e.g., longevity, toxicity, movement) make them symbolic animals, often used in myths. The similitude with dragons is thus easily achieved. We also have to take into account that crocodiles are included here in the Reptile category despite their phylogenetic separation, but this did not change significantly the results. Crocodiles are biologically more closely related to dinosaurs, and viewed as an iconic, marketable species and a tourist attraction in many places, despite the fear and danger they might inspire.



Starter Pokémon used iconic reptiles as inspiration: Treecko (rank 95) is a green gecko and Squirtle (rank 14), an aquatic turtle (distinct from the terrestrial tortoises, such as starter Turtwig, rank 67).



Some species are often confused with the reptile group. Totodile (rank 42), as a crocodylian species, is genetically closer to dinosaurs and birds. Salamanders are also often mistaken with lizards, but are actually amphibians; some of the traits are clear, like the long tongue, naked skin and the digit extension in males for copulation present in Lickitung (rank 222).

There are more mixed feelings towards amphibians. Generally, the amphibian group is not the most popular, being mostly associated with negative reactions and representations. However, some iconic species in these groups (like tree frogs and newts) can receive a positive response from the public and thus, reverse the situation. Feelings of appreciation or disgust are difficult to compare between different cultural groups and may explain the large difference of success found between animal categories (Schlegel & Rupf, 2009). Amphibians are very popular in Japan and overall in Asia. Because of their ability to change their form, colonize different habitats, and come back to their birth place, they are an icon for travellers and thus very symbolic in shōnen and JRPGs, including *Pokémon*. That's also the reason why the first Pokémon in the Pokédex and starter in the game⁵ is a toad, Bulbasaur⁶. However, amphibians are the most endangered vertebrates (Hoffman et

⁵ *Pokémon Green*, from 1996, never made to the West, though we got the *LeafGreen* remake of 2004.

⁶ The '-saur' suffix comes from the scientific name of many species, such as *Tyrannosaurus*. It comes from the Greek and means 'lizard' or 'reptile' and has been applied wrongly in both Biology (like most dinosaurs and the whale *Basilosaurus*) and Pokémon.

al., 2010) on our planet and most people are ignorant of this fact; amphibians' pervasive representation overshadows the threats they face (Biega et al., 2017).

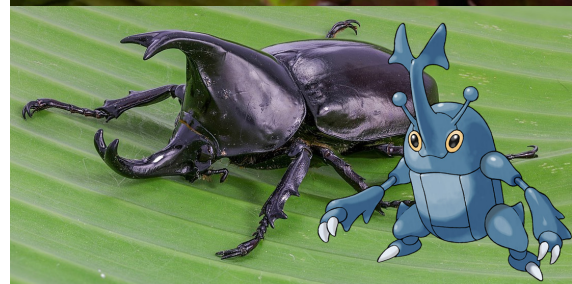


The popular tree frog is represented by Politoed (rank 179), one of the final evolutions of the tadpole Pokémon Poliwhirl (rank 344), which conserved the spiral symbol (the intestine, visible by transparency in some tadpoles). Mudkip (rank 24) and his final form Swampert (rank 29), even if nominally inspired from the amphibious fish goby, got its crest and gill design from newts.

Ambiguous Pokémon

Attitudes to insects, crustaceans and arachnids are ambivalent. Arthropod Pokémon can be popular but at the same time, the most hated (Fig. 4, Table 4). This reflects well what's observed in our world, where there is in general low affinity for insects (Kellert, 1993). The high rate of success of some insect Pokémon is due to some iconic monsters (Scyther, Scizor, Heracross, Volcarona), which explains the difference in the distribution of the votes for this clade (Fig. 2) and the mean ratio of votes. Bug Pokémon are among the first encountered in the games and thus, also generally the weakest and most abundant (Prado & Almeida, 2017; Kittel, 2018), which unbalanced the popularity of other arthropod

Pokémon. Pupae (cocoons) are particularly uninteresting and difficult to empathise with, which can explain the few (or zero) votes of some of them (Table 4).



The most popular insect Pokémon, Scyther (rank 27) and Heracross (rank 50), respectively represent a mantis and the Japanese rhinoceros beetle, famous for their combativeness. On the contrary, Beautifly (rank 770) and Masquerain (rank 397), probably inspired respectively by the tiger swallowtail and the coastal peacock spider, are not so popular despite their coloration and interest of the species in our world.

Table 4. The least favourite Pokémon. Only those with 0 or 1 vote are listed, alongside their respective evolutions and/or pre-evolutions when applicable.

Rank	Pokémon	Nr votes	Generation	Clade	"Species"
242	Eelektross	49	V	Fish	Lamprey
489	Gothitelle	16	V	Humanoid	Gothic lolita
539	Wurmple	12	III	Arthropod	Caterpillar
573	Toucannon	10	VII	Bird	Toucan
660	Tynamo	6	V	Fish	Anchovy
687	Dustox	5	III	Arthropod	Moth
687	Gothorita	5	V	Humanoid	Gothic lolita
722	Gumshoos	4	VII	Mammal	Mongoose
722	Watchog	4	V	Mammal	Meerkat
746	Pikipek	3	VII	Bird	Woodpecker
770	Cascoon	2	III	Arthropod	Cocoon
770	Beautifly	2	III	Arthropod	Butterfly
798	Patrat	1	V	Mammal	Chimpunk
798	Baltoy	1	III	Object	Status
798	Skorupi	1	IV	Arachnid	Scorpion
798	Sewaddle	1	V	Arthropod	Larvae
798	Alomomola	1	V	Fish	Sunfish
798	Trumbeak	1	VII	Bird	Woodpecker
798	Cosmoem	1	VII	Mineral	Cosmos
798	Exeggcute	1	I	Vegetal	Egg
806	Silcoon	0	III	Arthropod	Cocoon
806	Eelektrik	0	V	Fish	Lamprey
806	Gothita	0	V	Humanoid	Gothic lolita
806	Yungoos	0	VII	Mammal	Mongoose

Insects and arachnids (spiders and scorpions), besides not being very popular with the general public, are also a main source of phobias in western societies, and associated with negative stimuli; even while butterflies receive more attention than the rest by aesthetic reasons (Barua et al., 2012). This is manifested by the low value delegated to them by conservation measures, despite thousands of species being endangered and populations drastically declining (Simmons et al., 2019). At the same time, insects have considerable significance for certain cultures, such as the Chinese cricket culture (Jin & Yen, 1998) and the aesthetic appreciation for insects in Japan (Hogue, 1987). It is common to find amateur entomologists and insect collectors around the world; it is a popular hobby in Japan and the creator of

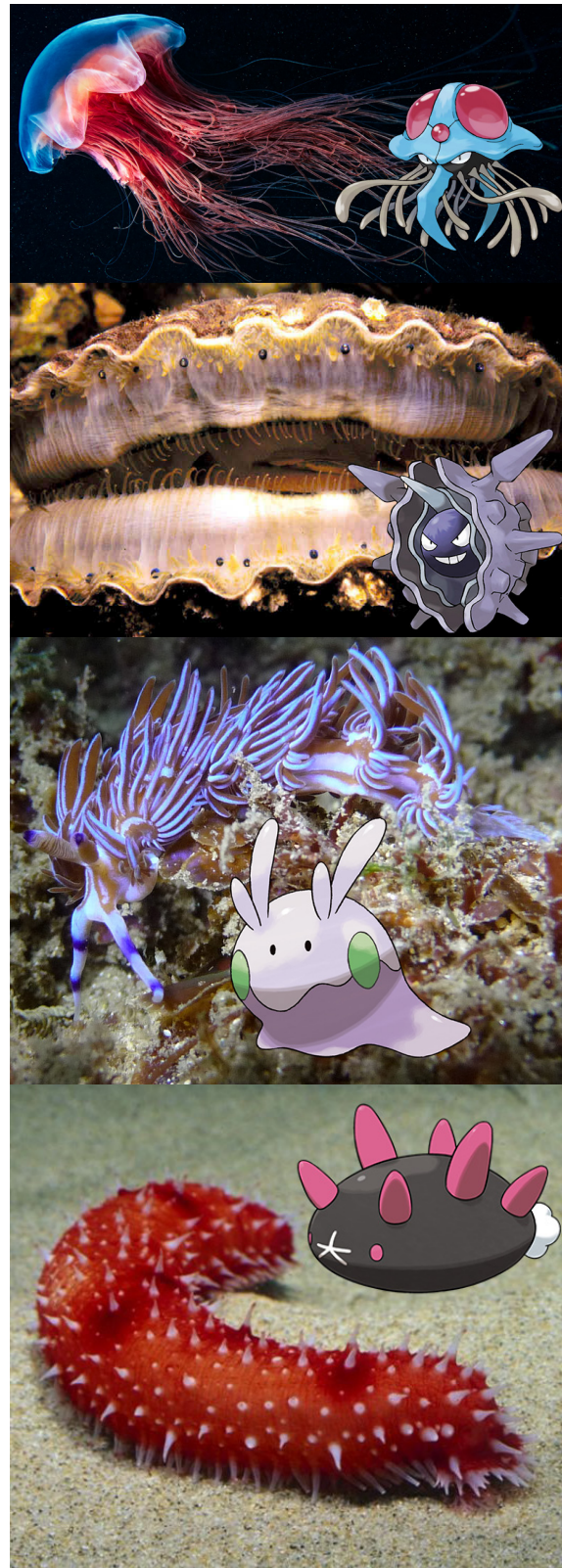
Pokémon himself, Satoshi Tajiri, had the idea for the games due to his own passion for collecting insects.

Fish are an unpopular clade, considered very often as boring animals with limited cognitive abilities, or just plain ugly and disgusting. Except for the colourful tropical fish and seahorses, alongside those animals perceived as dangerous in public imagination (sharks, piranhas), most fishes are just seen as food despite their large biodiversity, which is well reflected in *Pokémon* (Mendes et al., 2017). Among the unpopular *Pokémon* (Table 4), we can find some based on common prey (Tynamo, anchovy) or parasitic (Eelektrik, lamprey) fish, with an off-putting appearance. The difficulty to observe them and the large differences of hab-

ity and morphology between humans and fishes contribute to misunderstand their behaviour and the difficulty to feel empathy for them.



Fish present a large diversity of coloration, form and habitat. Eelektik (rank 806), a lamprey, is the most unpopular fish Pokémon, contrary to Kingdra (rank 182), a dragon seahorse. Luvdisc (rank 595) is inspired from the gourami and Stunfisk (370) by a flounder.



Tentacruel (rank 344) is inspired on jellyfish (not to be confused with a squid, which is a mollusc), whereas the more popular Cloyster (rank 218) is inspired on spiny oysters. Goomy (rank 228) and Pyukumuku (rank 242) are inspired from unsung animal species, respectively a sea slug (as Shellos and Gastrodon) and a sea cucumber.

Invertebrate animals, including here cnidarians, molluscs, and echinoderms, are underrepresented in the Pokémon world, whereas they are extremely diverse in our world, especially in the oceans. Most ranked very low, with only five exceptions above rank 250: Starmie, Cloyster, Goomy, Pyukumuku, Gastrodon. This can be explained because these groups are mostly seen as passive or not very active animals, which is not very attractive for the Pokémon ideology. The majority of these animals have cryptic life styles and/or inhabit unseen environments, as the fish above, so most people do not pay attention to them and do not treat them with the same consideration as vertebrate species (Mather, 2001).

Humanoid and mammal clades

Humanoid and mammalian Pokémon are the most popular after the Dragon and Dinosaur categories. Mammals are a huge success among pokéfans, as expected. Although some (Yungoose, Patrat) are not popular at all (Table 4); which might be re-

lated to the fact they are annoying and over-represented in the games rather than to an aversion to the species that inspired them. There are 195 mammal Pokémon, excluding humanoids, which is equivalent to 24% of all Pokémon. So, these Pokémon were split according to their more specific inspiration (Fig. 5).

Canine Pokémon are the most popular family among mammals; they are the only group with a significantly higher average of votes, whereas all other groups have similar scores. This category includes dogs, of course, which relates to the assimilation of Pokémon as pets. We can however notice that the large success of foxes (which includes Eevee and the eeveelutions) also play a large part in the popularity of canids, because they are represented as cute and joyful, and so easily acceptable as pets. The feline Pokémon, mainly represented by cats, also have a large success. Other pets include the some of the Glires (rodents and lagomorphs), which also have a high popularity score. This latter group includes Pikachu⁷ and Jigglypuff, two of the most recognizable mascot Pokémon.

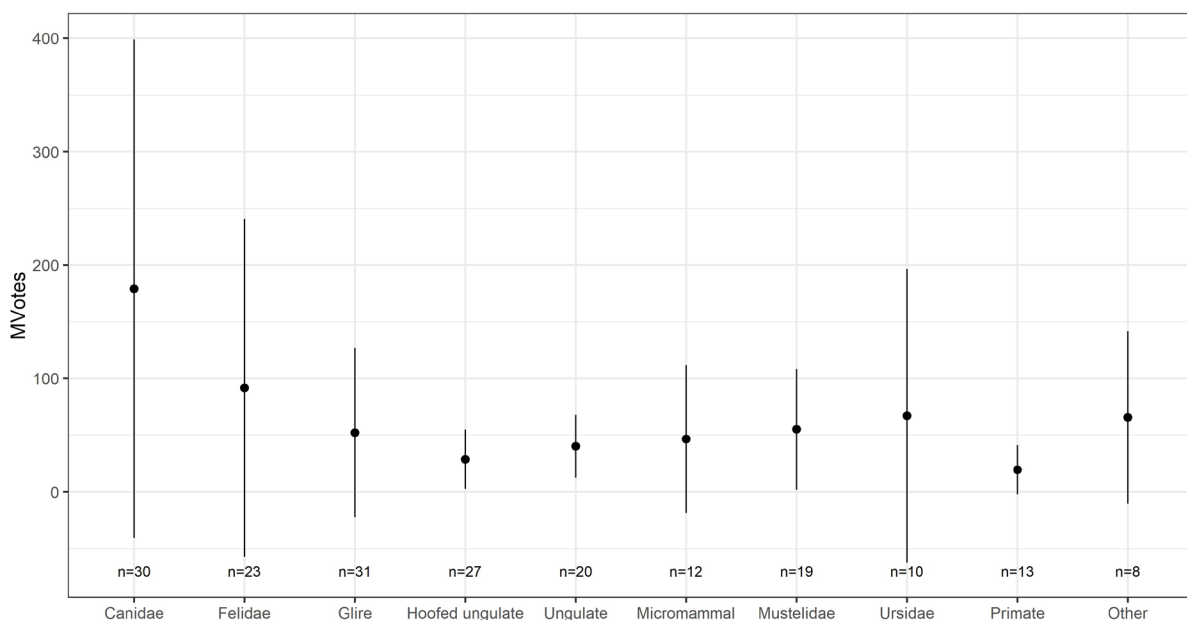
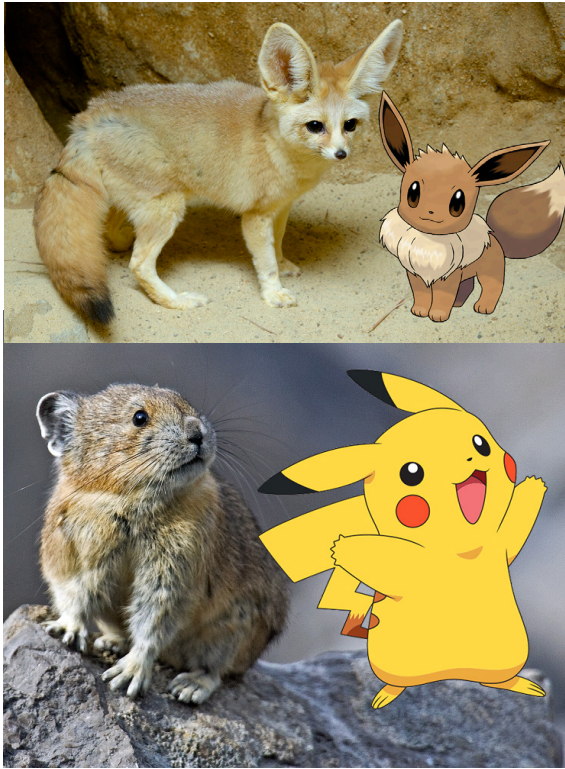


Figure 5. Mean number of votes per large groups of mammals (excluding humanoids and starters). Hoofed (even-toe) ungulates would also include hippos and giraffe, which here instead are included in “Ungulate” instead, to distinguish them from domestic animals. Glires include rodents (mice, rats, squirrels, etc.) and lagomorphs (rabbits, pikas, etc.). Micromammal includes Chiroptera (bats) and Eulipotyphla (moles and hedgehogs). ‘Other’ includes Xenarthra (sloths, pangolins and ant-eaters) and marsupials.

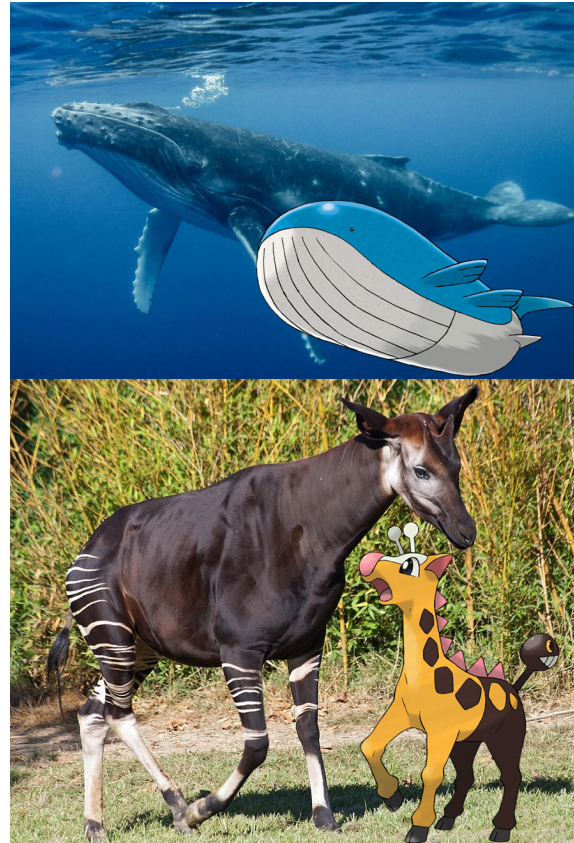
⁷ Just out of curiosity, Pikachu is not very popular considering the incessant marketing surrounding it. It ranks in 44, while Raichu ranks 40 and Pichu ranks 212.



The very popular Eevee (rank 9) and most of its eeveelutions have an appearance similar to a fennec, a desert fox famous for its large ears. The most famous Pokémon of all, Pikachu (rank 44), is often confounded with a mouse, but the pika is related to rabbits and hares (which can explain Pikachu's long ears).

The relationship between humans and their pets became a part of all cultures and domestication of animals was important to our survival. This has made some animals valued members of society and has contributed to the formation of affective links with certain animals. However, and surprisingly, Pokémon representing domestic animals other than pets (that is, horses, pigs, sheep, cows; included here in the Hoofed ungulates), do not have the same amount of success than dogs, cats and rodents/lagomorphs, and even less than most other mammalian groups. The consideration of domestic animals as livestock or transport animals underline the affective separation that humans have between pets and other domestic animals. The affective relation between people and livestock is contradictory and it is a source of main cognitive bias and morality threshold (Holloway, 2001).

⁸ Of course, we are mammals, after all. Weird ones, but still mammals.



The largest Pokémon, Wailord (rank 147), represents the largest living animal of our planet, the blue whale; note that cetaceans are ungulates. Girafarig (rank 307) is a relatively small Pokémon inspired by the cryptic and mysterious okapi and its "cousin", the giraffe, sharing both the horns and the double hoofs, contrary to horses and zebras.

Large carnivorous mammals (Canidae, Felidae, and Ursidae) depend on respondents' assessment of their potential danger and ability to cause damage, while less predatory mammals find wider acceptance (Mustelidae). They are also widely used as flagship animals, like the pandas. Ursidae have a respectable popularity score mainly due to one iconic Pokémon: the ever-hibernating Snorlax. Large carnivorous animals are widely accepted in Pokémon and so in general, despite the human-wildlife conflicts in localised areas.

Mammals are more accepted by humans for their behaviour and resemblance⁸ to us and the easiness to empathise. Non-human primates naturally share a lot of features with us and are thus widely accepted. How-

ever, the primate Pokémon have mixed popularity compared to other mammals. However, we have to take into account that many Pokémon are represented more in the human side of the spectrum. Humanoid Pokémon collected the largest number of votes after mammals and several are among the most loved Pokémon (Table 2); the exception being the unpopular Gothita and its evolutions (Table 4). The gothic lolita representation might be unpleasant to people, whereas her “rival” Gardevoir⁹, which has a mysterious womanly form, is one of the top 10 favourites (Table 2). Several Pokémon are also represented as ghosts, and some are human-like. Humanization of creatures as Pokémon can also underline the ambiguous relation between humans and Pokémon and so with animals.



The legendary Pokémon Suicune (rank 90) represents a snow leopard. Spinda (rank 286) is based on the red panda (a distinct family from the giant panda).



Gothitelle (rank 489) and Gardevoir (rank 8), are the two more woman-like Pokémon

CONCLUSION

With the most favourite Pokémon, we can perceive ecological and social visualisation of animals by humans. Even if further analyses are required to confirm some hypotheses, we can attempt some interpretations of the popularity of Pokémon according to the type of animal they represent.

In this sense, pop culture reflected the same scheme of the construction of a society. The order of popularity of Pokémon reflects that of animals (including imaginary ones) as perceived by humans: dragons, dinosaurs, mammals, and humanoids. Dragons are representative of the mythic and magic in people’s imagination, having strong ties with some cultures, religions and art. The high popularity of pet (mammal) Pokémon also draw from the importance of domestication and the affective relation between pets and humans. In modern societies, the acceptance of pets as family members reflects the elevation of status of specific animals, emotionally and physically. This humanisation of animals is reproduced by the success of human-like Pokémon. If Pokémon should be considered as others living beings, their success show that many consider Pokémon not as a tool in the game, but as real companions, creating a strong relationship. *Pokémon* might illustrate the

⁹ Be careful if you google this Pokéwaifu!

reevaluation of humans as part of the biodiversity and help in the quest to reconsider our relation to other species.

On the contrary, the unpopular Pokémon are considered as “useless”, annoying, or simply not very expressive ones. They also reflect the low consideration people have towards these clades as pests or food, and express little to no empathy towards them. Emotion plays an important role in people’s choices. If the Pokémon, as the animals, inspire disgust or fear (insects, parasites) they will be less popular and won’t be treated with as much consideration as the others.

Pokémon is a contraction of “pocket monster”, and their original appellation underlines the idea of them being monsters, as in several other video games. The success of *Pokémon* may be explained by the differentiation in their representation not only as monsters, but as biodiversity at large, and the relationship people can have towards it. *Pokémon* reconsiders our humanity and responsibility to animals, biological modification, and ecological impact, as seen in the story of Mewtwo and the chimeric Type: Null, as well as in the many stories of the impact of humans on the environment.

From a biological and ecological point of view, the Pokémon franchise is quite accurate and try to respect and represent as much as possible the biodiversity around us, despite some creative freedom, such as their nonsense concept of “evolution”, and the misnaming of some monsters (which seems to be mostly due to poor translation). The franchise does not try to respect the proportion of macroscopic animals in biodiversity (Mendes et al., 2017; Prado & Almeida, 2017; Kittel, 2018; Salvador & Cavallari, 2019), but rather the representation of biodiversity that modern society has. The knowledge of biodiversity and experience with nature affect the involvement and propensity of people in backing conservation actions for species (Martín-López et al., 2007). People are more likely to protect animals they know and cherish.

Favourite Pokémon are also related to the gaming experience of each one and not

all our previous hypotheses can be totally transferred to the real world due to the richness of this gaming culture. Gaming experience is a formidable tool of curiosity: as devoted fans continuously look to improve their knowledge and skills in the game, they end up discovering the complexity and diversity of life around them. Even if the impact of *Pokémon* has been contested at several levels (in most cases by people hostile to Japanese and/or gaming culture), we cannot deny that it creates interest – through generations of gamers – in Biology, which might counteract the decreasing knowledge of younger generations about ecology and systematics. Environmental knowledge and environmental awareness have been repeatedly shown to be important control factors in conservation. *Pokémon* can be for some a first step for respect and conservation of biodiversity and in the end, that’s the most important impact of *Pokémon* in our lives.

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ACKNOWLEDGEMENTS

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