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Cover art: Image from the board game Fly-A-Way, by Playlogue Creations (Singapore). Image is a courtesy of the studio; used with permission.



Fly-A-Way: a board game to save migratory birds

Interview with Simon Vincent

Fly-A-Way is a brand new board game created by the team at Playlogue Creations.¹ In it, players are conservationists helping out birds in their migration across one of the world's largest flyway.² The birds will face many dangers, so the players will have to make sure these critters complete their long journey.

If you are one of our loyal readers, you know we love birds, so we couldn't help but be overly-excited about this game. We reached out to Playlogue Creations and interviewed Simon Vincent, the content strategist of *Fly-A-Way*. We talked about birbs,

nature conservation and, of course, their new game. Take a look below and see what we found out.

How would you briefly describe *Fly-A-Way* and the players' objective in it?

Fly-A-Way is a strategy board game on bird migration. Players compete to save as many migratory birds as possible, while handling natural and man-made dangers. Players save a bird by placing links on the map board to complete migratory routes.





Would you mind sharing a little bit of the story behind *Fly-A-Way*? What inspired you to create a game about birds? Are you all birdwatchers?

After working on a brochure on migratory bird conservation for BirdLife International (Asia) in 2018, we had fallen in love with migratory birds and wanted to share more about their life and trials — but in a new, fun and engaging way.

The board game medium was perfect for this because it allowed us to map out the drama of bird migration in a palpable way. Players are put in the role of conservationists and have to deal with threats faced by migratory birds, as they complete their journeys along the East Asian-Australasian Flyway.

Our creative director Oon Hong is also a bird photographer and we got the first sense of what bird watching is like through her tales of seeing birds on her trips to various parts of the world. The rest of us do not have enough experience to call ourselves birdwatchers, but we have all come to pay more attention to the sounds and sights of birds as we go about our daily lives.

Since developing *Fly-A-Way*, you have launched a new game company called Playlogue Creations. How did this happen?

When we started developing *Fly-A-Way*, all of us from the team were staff at Tuber, a design and editorial consultancy. We spent close to two years on this project, before deciding that our love for game development warranted our own migration — to a new company.

“Playlogue” is a portmanteau of “play” and “dialogue”, and reflects our aim of enriching conversations through games. This conception of ourselves is intimately tied to our experience of developing *Fly-A-Way*, where we collaborated with BirdLife International as our knowledge partner and connected with Kickstarter backers from around the world.

The game’s board shows east/southeast Asia.³ Is the bird fauna present in *Fly-A-Way* all actual species from that region?

Yes, they are. Our game map is based on the East Asian–Australasian Flyway and stretches from Russia in the North to Australia in the South. It features various birds that use this flyway.

Given that the region is so rich in biodiversity – and that you cannot include all the species in the game – how did you decide which species of birds made into *Fly-A-Way*? Are they the team’s favorites or was there a more specific method for choosing them?

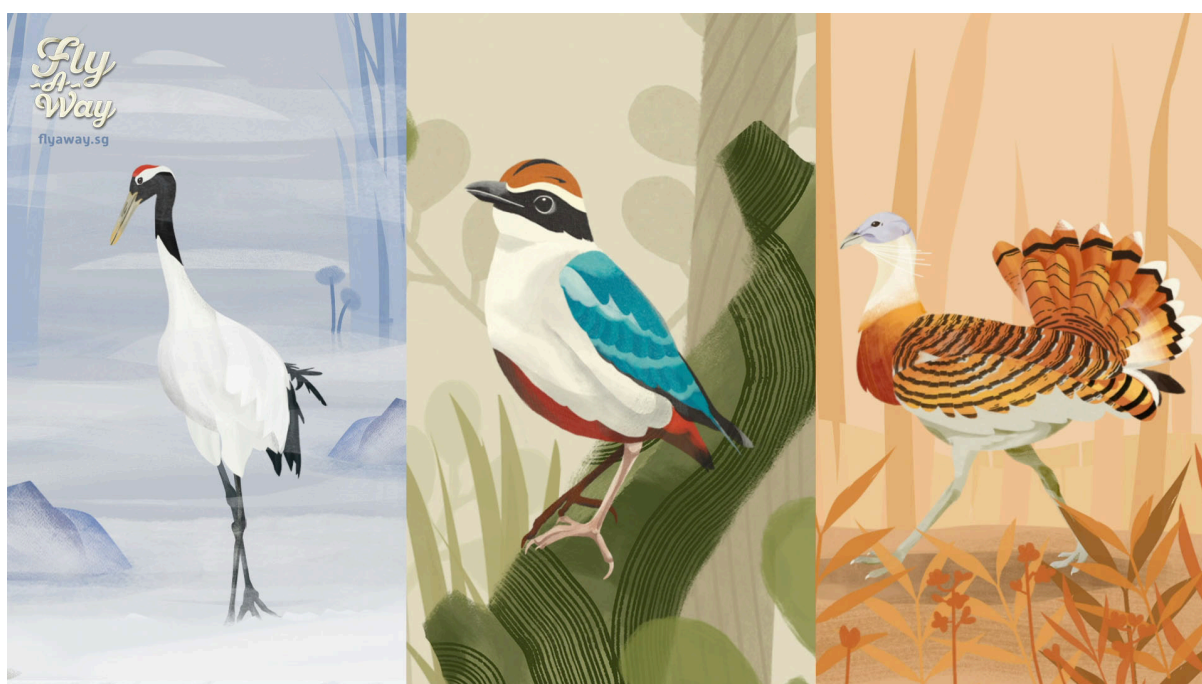
We based our decisions on a few factors. We have birds from three habitats, Forest, Open country and Wetland, and we wanted to represent an equal number of birds from each. To better distribute the migratory routes across the map board, we also picked birds with varied migratory routes. We also wanted to highlight birds of different conservation statuses, including critically endangered birds like the Yellow-breasted Bunting and the Spoon-billed Sandpiper. In picking these, we collaborated closely with Dr. Yong Ding Li, our knowledge partner from BirdLife International (Asia), who told us about the birds we should pay and draw attention to.

Out of curiosity, what are your favorite birds that made into the game?

Our project manager Lynette and content strategist Simon were both happy that the Great Bustard made it into the game. Our creative director Oon Hong loves owls, so she was happy that the Short-eared Owl, Northern Boobook and Snowy Owl feature in *Fly-A-Way*. Our illustrators Iris and Key’s favorite birds, respectively, are the Oriental Dwarf Kingfisher and the Fairy Pitta.

The gameplay revolves around a lot of actual ecological information, especially of migratory routes. How much scientific data have you included in *Fly-A-Way* and what kind of reference material did you use?

We referred to resources like Birds of the World⁴ and the IUCN Red List⁵ in our initial research. We also read various news articles on the different birds we were covering as we went along with game development. Our main point of reference, though, was Dr. Yong because he works in the field and has published numerous articles in the area of migratory bird conservation. So we could always rely on him to provide us with the latest information on migratory birds for our game.





***Fly-A-Way* is clearly well-tuned to current environmental and conservation concerns, such as deforestation and poaching. How do these elements work game-play-wise?**

In trying to save birds, players will have to deal with threats that we have called 'Fowl Play' and 'Bird-tastrophe'. The Fowl Play cards include events like 'Wild Meat Trade' and 'Urbanization', which reflect the real-life dangers faced by migratory birds. Penalties from cards like these include removing links you have placed on the map board and discarding 'Wing It' cards, the cards players can use to aid their efforts to save birds.

To add another layer of drama and urgency, we included catastrophic events, like 'Deforestation', in our Bird-tastrophe cards. These, unlike Fowl Play cards, affect all players. The gameplay experience being, as reflected in real life, that when it comes to the environment, everyone is implicated.

Besides BirdLife International, do you have any joints projects with environmental NGOs?

BirdLife International is the first environmental NGO we've worked with. We've worked with NGOs in other areas, though, like Raleigh Singapore,⁶ which runs the Let's Take a Walk non-profit endurance running event to raise money for various causes, and the T Project,⁷ which runs a shelter in Singapore for transgender people.

Do you hope *Fly-A-Way* can inspire people to appreciate and protect birds? And, supposing it does, what would be the first steps you'd recommend to freshly-minted bird enthusiasts?

It's partly out of this hope that, while highlighting the threats faced by migratory birds, we wanted players to learn about the conservation actions they can take though Wing It cards. These include the 'Funds for Conservation' and 'Birders to the Rescue' cards, which touch on the importance of

public support for conservation and the importance of nature lovers in raising awareness on the threats faced by migratory birds. We want these cards to also evoke the good work done by conservationists on the ground to save migratory birds.

Perhaps some first steps people can take if they are stirred into appreciating and protecting birds would be to reach out to organizations like BirdLife International to volunteer with them or to donate to them. Other than that, perhaps all of us could learn more about birds in our respective countries by going on nature walks and expert-led birdwatching treks.

Do you think *Fly-A-Way* could be used in classrooms and other centers for education, such as zoos and museums?

Yes, definitely. *Fly-A-Way* can be a medium for people, of whatever ages, to learn about migratory birds. Whether *Fly-A-Way* is played in the classroom, a zoo, a museum or simply among friends, we would like people to enjoy themselves even as they

pick up facts on migratory birds and get a better appreciation of their lives.

Do you have any takeaway message you would like the players to get from *Fly-A-Way*?

On one level, we want players to simply learn more about migratory birds from the East Asian-Australasian Flyway, which our game is set in, since these birds might not be familiar to people outside Asia. On another level, we hope everyone gets a better appreciation of the urgency of wildlife conservation, as they encounter the events from the game and try to be the ultimate bird conservationist.

ABOUT THE TEAM

Lynette Lee, Quek Oon Hong, Simon Vincent, Hung Key and Iris Tang are the team behind *Fly-A-Way*. They are from Playlogue Creations, a game company that strives to enrich conversations on different issues through game design, storytelling and collaboration.



¹ Please remember to take a look at their website: <https://flyaway.sg/>

² A flyway is a common path used by many species of birds during their yearly migration.

³ The East Asian-Australasian Flyway, in particular, is one of the world's largest flyways. You can learn more about it at BirdLife International: https://www.birdlife.org/sites/default/files/attachments/8_East_Asia_Australasia_Factsheet.pdf

⁴ <https://birdsoftheworld.org/bow/home>

⁵ The IUCN Red List of Threatened Species: <https://www.iucnredlist.org/>

⁶ <https://www.raleigh.org.sg/>

⁷ <https://www.thetprojectsg.org/>



Floral gigantism in the Pokémon world

Lucas C. Marinho¹ & Liming Cai²

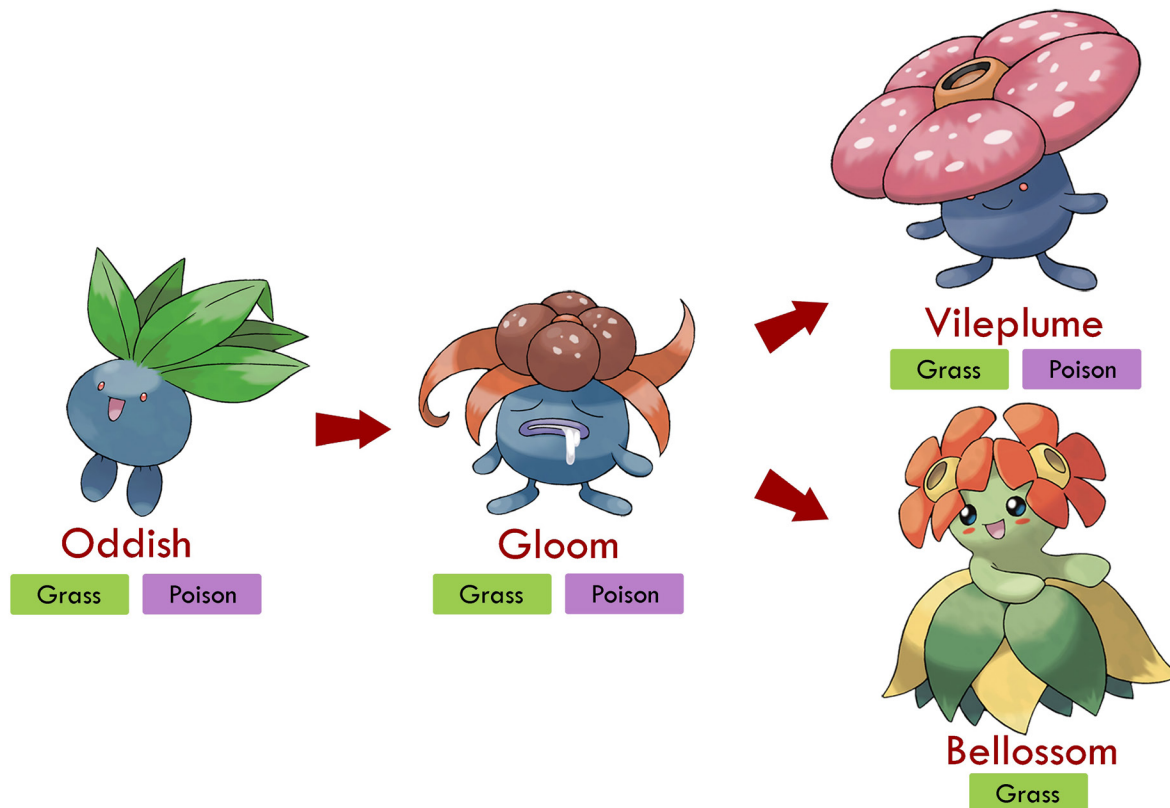
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With more than 260,000 species, flowering plants represent one of the most spectacular radiations on Earth, and provide enormous value to humankind (Stevens, 2017). In the Pokémon universe, however, plant-derived Pokémon, or Grass-type Pokémon, are surprisingly scarce compared to Pokémon resembling vertebrates or arthropods (Le Vaillant, 2020). Representative Grass-type Pokémon feature a number of charismatic flora including the carnivorous

Bellsprout (#069), the drought-adapted Cacnea (#331), and the giant Vileplume (#045). The critters in the latter's evolutionary line, in particular, represent early examples of Grass-type Pokémon that exhibit a suite of distinctive features such as the absence of green pigments in evolved forms and the presence of poisonous chemical compounds (that is, they are also Poison-type).

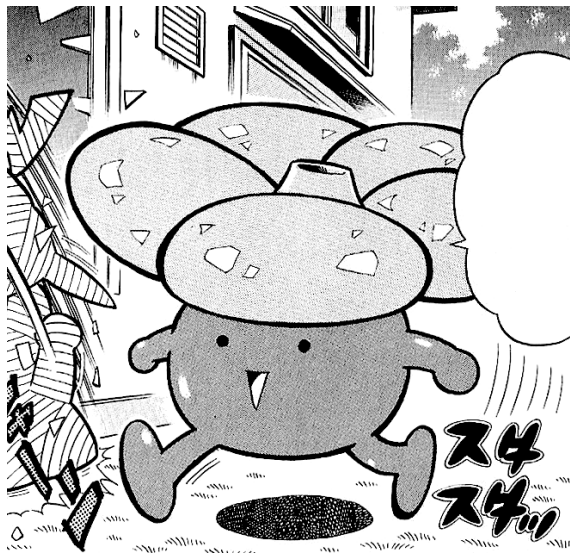
There are four Pokémon in this evolu-



Oddish's evolutionary line (images extracted from Bulbapedia).

tionary line: Oddish (#043), Gloom (#044), Vileplume, and Bellossom (#182), which represent four distinct stages on a chain of gradual metamorphosis (the latter two being mutually exclusive).

These Pokémon are found throughout all regions in the Pokémon world except Alola (Bulbapedia, 2021). Oddish is the juvenile stage, characterized by its blue body and green leaves. It metamorphoses (“evolves” in game terms) into Gloom, which has red leaves and a dull brown perianth with white spots. The change in leaf color suggest the transition to a heterotrophic lifestyle (non-photosynthetic) and the evolution of a perianth may attract pollinators for reproduction. Vileplume and Bellossom, on the other hand, demonstrate two diverse tracks of metamorphosis from Gloom. In Vileplume, the iconic features from Gloom become even more exaggerated: the perianth turns extremely showy and the leaves are lost. Bellossom, in contrast, has green leaves and is morphologically and physiologically more similar to Oddish than to its precursor, Gloom.



Vileplume in *Pocket Monsters* (image extracted from Bulbapedia).

Compared to the limited diversity of Grass-type Pokémon, flowering plants are crucial and significant components of Earth’s ecosystems. They supply food for animals and provide habitable shelters for all living organisms. Among them, the

parasitic plant family Rafflesiaceae exhibit extraordinarily unique characteristics compared to other free-living plants. They do not have identifiable stems, leaves and roots but rely on the tropical grapevine hosts *Tetrastigma* for nutrients and water. The host-derived energy supports the production of the world’s largest flower in the species *Rafflesia arnoldii*. In sum, both Rafflesiaceae and Vileplume have a number of life history traits that are otherwise rare among their relatives. Here, we present a comprehensive analysis of the morphological, physiological and ecological characteristics of the Grass/Poison Pokémon Vileplume and the parasitic plant species *Rafflesia arnoldii*.

Methods

The morphological and behavioral characteristics of Vileplume were collected from the Pokédex (The Pokémon Company, 2021) and Bulbapedia (2021). For the plant family Rafflesiaceae and the species *R. arnoldii*, morphological descriptions were obtained from the scientific literature.

Vileplume



Vileplume (image extracted from Bulbapedia).

Vileplume (Japanese: ラフレシア [Rafureshia]) is a Grass/Poison Pokémon from Generation I. It evolves from Gloom if the player uses a Leaf Stone. Vileplume usually has a purplish body and bears five giant red petals with white spots, which give it its fame of having the largest petals in the Pokémon world (The Pokémon Company,

2021). Color variations are found in isolated populations. For example, the Vileplume on Pinkan Island have a pink body (Bulbapedia, 2021), possibly due to the accumulation of carotenoids from their diet. Populations from Valencia Island are even more unusual, they do not have white spots on red petals, but instead have orange petals with red rings (Bulbapedia, 2021).



Alternately-colored Vileplume specimens from Pinkan Island (above) and Valencia Island (below), both from Orange Archipelago (images from the Pokémon TV series, extracted from Bulbapedia, 2021).

Rafflesiaceae

Rafflesiaceae is a family of leafless, rootless, and non-photosynthetic parasitic plants belonging to the order Malpighiales (Nikolov & Davis, 2017), which also includes cassava, castor bean, flax, poplars, and rubber trees. The family consists of ca. 40 species distributed in three gen-

era: *Rafflesia*, *Rhizanthus* and *Sapria*, all of which are endemic (restricted) to southern China, northeast India, Bhutan, Thailand, Malaysia, and western Indonesia (Meijer, 1997; Barcelona et al., 2009; Bendiksby et al., 2010). These plants are specialized parasites on *Tetrastigma*, which is a group of liana species in the grapevine family (Vitaceae).



Rafflesia sp. (image extracted from Flickr; Martin Sercombe, 2010; CC BY 4.0).

Species of Rafflesiaceae live entirely inside the host and only emerge when they are ready to reproduce. The flower releases a foul odor to recruit carrion flies for pollination (Patiño et al., 2002). Among these two dozen species, the most charismatic is *R. arnoldii*, which produces the largest flower in the world. This species is the national flower of Indonesia and it even appears on the Malaysian Ringgit.

Morphological similarities

Floral gigantism — Both *Vileplume* and *R. arnoldii* are characterized by scarlet petals with white spots. In addition to the overall similarity in the coloration, both *Vileplume* and *R. arnoldii* keep the record of flower size in the Pokémon world and the real world. *Vileplume* can reach up to 1.2 meter high, weighing 18.6 kilograms (Bulbapedia, 2021). *Rafflesia arnoldii*, on the other hand, can grow to a diameter of around one meter, weighing up to 11 kilograms (Cunningham, 2002).



Malaysian banknote of 10 Ringgit (image extracted from <https://www.numiscollection.com/>).

Sexual dimorphism — Both Vileplume and *R. arnoldii* are dioecious, meaning that the male and female blossoms appear on separate plants. Female Vileplume have fewer, but larger white spots on their petals compared to the male (The Pokémon Company, 2021). Flowers of *R. arnoldii* have five sepals (not petals; Nikolov et al., 2013) and a central chamber structure. Male flowers have anthers situated underneath the disk within the central chamber while female flowers have styles instead.



Rafflesia arnoldii (image extracted from Flickr; Sumeet Luktuke, 2017; CC BY 2.0).

Physiological differences

Carnivorous versus parasitic — Though similar in morphology, Vileplume differs fundamentally from *R. arnoldii* in its life history strategy. Vileplume is photosynthetic and carnivorous, while *R. arnoldii* is non-photosynthetic and relies entirely on its host for nutrients. When exposed to bright sunlight, Vileplume can increase its

speed via the Chlorophyll ability. This photosynthetic pigment chlorophyll converts the solar energy to chemical energy. On the contrary, *R. arnoldii* has completely lost the ability to photosynthesize (Nikolov et al., 2014). It is even hypothesized that it has lost its chloroplast (Molina et al., 2014; Cai et al., 2021). However, the unique green color from the photosynthetic pigment chlorophyll is not easily observed in Vileplume.

Only the shiny version has a green body (and orange petals). It is therefore possible that chlorophyll only exists in small quantities in the vast majority of Vileplume populations and other photosynthetic pigments such as carotenoids play a major role in photosynthesis instead. The carnivorous habits of Vileplume may also be an outcome of adaptive evolution in the face of reduced photosynthetic ability.

Vegetative organs – Vileplume, along with many other Grass-type Pokémon, learns the Razor Leaf offensive move, in which leaf blades are launched at high speed and cause damage to opponents. *Rafflesia arnoldii*, however, have lost all identifiable leaves because they are non-photosynthetic. The entire plant grows as a mass of thread-like strands within the host before they flower. Similar to the mycelium of fungi, these structures absorb nutrients directly from the host, hampering the host’s growth.

Weapons for predation versus pollination – One important adaptive feature of Vileplume is its poisonous pollen, which trig-

gers potent allergic reactions in its prey (The Pokémon Company, 2021). In peak seasons, Vileplume can release a tremendous amount of pollen such that it is surrounded by a yellow cloud of pollen. With every step, Vileplume shakes out a tremendous amount of toxic pollen. This noxious pollen is similar to the foul volatiles emitted by *R. arnoldii* to attract pollinators. But unlike Vileplume, *R. arnoldii* uses its decomposition-mimicking volatiles to attract carrion flies for deceptive pollination (Beaman et al., 1988; Bänziger, 1991). Moreover, in Vileplume the propagation of the toxic pollen is achieved by shaking petals, but in *R. arnoldii* it is hypothesized that the emission of the odor is facilitated by raising their temperature above environmental average (Patiño et al., 2000, 2002). Combined with the white and red pattern on the petal and hair-like trichomes that resembles animal fur (Beaman et al., 1988; Nikolov et al., 2014), *R. arnoldii* is highly successful in tricking flies to act as pollinators – these insects even lay eggs within the flowers (Bänziger, 1996).

Table 1. Comparison between Vileplume and *Rafflesia arnoldii*.

Vileplume	<i>Rafflesia arnoldii</i>
Similarities	
Largest flower in the Pokémon world (1.2 m)	Largest flower in the real world (ca. 1 m)
Red and white coloration	Red and white coloration
Dioecious species	Dioecious species
Differences	
Carnivorous and photosynthetic	Parasitic and non-photosynthetic
Five petals	Five sepals
Poisonous	Not poisonous
Razor Leaf offensive ability	Leaf-like organs absent
Toxic pollen	Non-toxic pollen
Acid present	Acid absent
Volatile compounds absent	Foul volatiles emitted to attract pollinators
Pollen released by shaking the petals	Strong odor (volatiles) released by thermogenesis and thermoregulation

CONCLUSION

Here we addressed ecological and morphological aspects of Vileplume in relation to its real-world counterpart, *R. arnoldii*. Both species exhibit similarities in floral morphology, but we also identified several important differences in anatomy, morphology, and physiology between these two species, which were associated with their carnivorous versus parasitic habit. Future research should focus on the ecology and evolution of Vileplume. Is Vileplume pollinated by Cutiefly (#742)? How does the color variation seen on the Pinkan and Valencia Islands contribute to the reproductive barrier in this species? What is the genetic mechanism of the evolution of a five-petaled flower (Vileplume) from a four-petaled one (Gloom)?

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ABOUT THE AUTHORS

Dr. **Lucas C. Marinho** is a professor and botanical taxonomist. He would like to be a Rock/Ground Pokémon trainer, but for now he just trains two dogs.

Dr. **Liming Cai** is a plant systematic biologist. She is also a secret entomologist and a portrait artist. She grew up watching the Pokémon TV series, but hasn't been a big fan of the game.



Short note on recent sightings of Rodan in *Godzilla Singular Point*

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Since the time I wrote a previous *Journal of Geek Studies* article on the giant pterosaur kaiju Rodan (Thomas, 2020), another piece of media featuring the character has aired: the anime series *Godzilla Singular Point* by the studios Bones and Orange (2021). Among the several kaiju that return in the series is a new take on Rodan, which plays a pivotal role in the beginning of the series. Naturally, I shall now comment on the anatomy and biology of this new incarnation of the classic sky monster.

Two forms of Rodan appear in *Godzilla Singular Point* (Fig. 1). The first form appears in the very first episode. Rodan is redesigned here to closely resemble a dsungaripterid pterosaur. *Dsungaripterids* were a clade of pterosaurs with remarkably ro-

bust bodies. *Dsungaripterid* genera include *Dsungaripterus*, *Noripterus*, *Domeykodactylus*, *Ordosipterus*, “Phobetor”,¹ and the questionably valid *Lonchognathosaurus* (Witton, 2013; Ji, 2020). This corroborates my earlier phylogenetic hypothesis on Rodan’s relationships (Thomas, 2020).

The outline of Rodan’s skull closely matches the skull of “Phobetor” in particular (Fig. 2; Bakhurina, 1986). Rodan has a wide skull, with keratinous beaks on both jaws. The interior of the mouth has teeth, similar to dsungaripterids, which were among the few pterosaurs to have both beaks and teeth. Unlike dsungaripterids, however, it appears that Rodan’s entire mouth surface is covered with teeth. This is more reminiscent of temnospondyls, which had palatal



Figure 1: Concept art of Rodan from *Godzilla Singular Point*. Left: first form. Right: second form. Images extracted from Wikizilla (<https://wikizilla.org>).

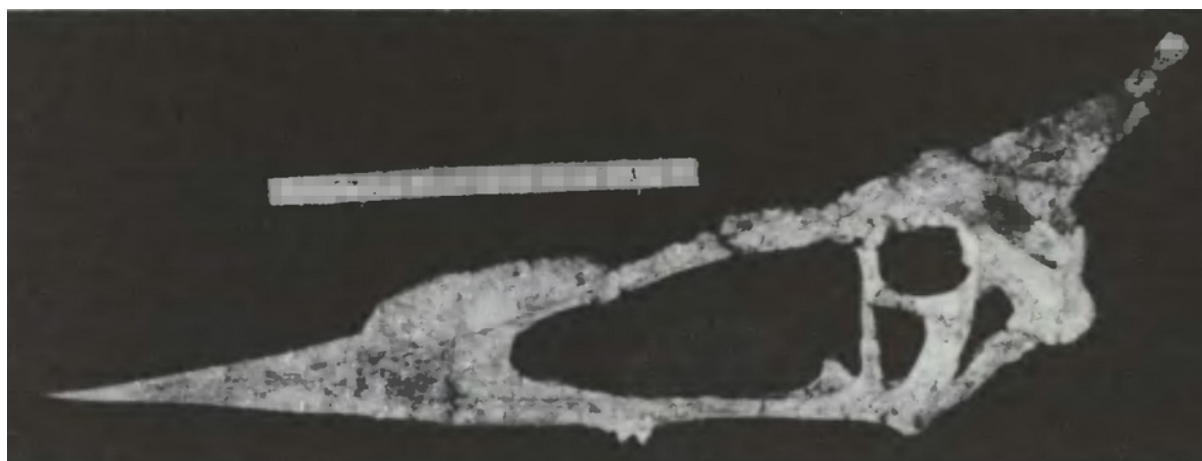


Figure 2: The skull of “Phobetor” *parvus*. Compare to the first form of Rodan (Fig. 1). Image extracted from Bakhurina (1986).

surfaces covered with teeth (*e.g.*, Gee et al., 2017). Real dsungaripterids, in contrast, only had a single toothrow on each jaw. These teeth were short and bulbous, and sometimes covered by outgrowths of the jaw bone. They were limited to the posterior portion of the jaw; the anterior part was occupied by a toothless beak, which was either curved upward, in *Dsungaripterus*, or pointed straight, in other dsungaripterids (Chen et al., 2020). Rodan’s eye is placed high in the skull, similar to *Dsungaripterus* and “Phobetor”. The first form of Rodan has a singular, pointed crest on the back of the head; this resembles the famous crest of *Pteranodon* (not a dsungaripterid), but is also similar to the crest of *Dsungaripterus*.

In a first for the franchise, Rodan is quadrupedal, similar to actual pterosaurs. One individual is even shown launching by leaping quadrupedally, which is the most likely hypothesis for how pterosaurs took off (*e.g.*, Habib, 2008). However, as with many pop culture pterosaurs, the wing folding is incorrect; it appears that the wing finger folds up when on the ground. In real pterosaurs, this would have only been possible by dislocating the wing finger. Instead, the wing finger folded backwards, similar to the human knee joint. The wing membrane correctly attaches at the ankle, as preserved soft tissue demonstrates was the case in pterosaurs (Elgin et al., 2011).

The first form of Rodan has a long tail, longer than recorded in any pterodactyloid.

With the vane on the end, this more closely resembles the tail of earlier pterosaurs such as *Rhamphorhynchus*. Both forms of Rodan also have scutes² on the underside of the torso and on the hands and feet, an inheritance from classic Rodan designs (Thomas, 2020). Interestingly, Rodan is digitigrade in the series, *i.e.*, it walks on its toes. The vast majority of pterosaurs appear to be plantigrade, *i.e.*, they walk on the soles of their feet. However, it has been suggested that the dsungaripterid *Noriopterus* may have been one of the few digitigrade pterosaurs (Hone et al., 2017). Whether this is coincidence or a feature intentionally borrowed from *Noriopterus* is unknown.

A second form of Rodan appears later in *Godzilla Singular Point* (Figs. 1, 3). This one more closely resembles traditional Rodan designs, with paired head crests and a dark brown color scheme. This version of Rodan also takes design cues from azhdarchid pterosaurs such as *Quetzalcoatlus* and *Pteranodon*, bearing a longer neck and a long, pointed skull. This new form of Rodan also resembles azhdarchids in that it hunts terrestrially. One well-supported hypothesis for azhdarchid lifestyle is the “terrestrial stalking” hypothesis, in which the pterosaur walks around on the ground picking up small prey items, using its long limbs and neck to get leverage. This lifestyle is practiced today by long-legged, long-necked birds such as storks and cranes (Witton & Naish 2013). In *Godzilla Singular Point*, there



Figure 3: The second form of Rodan in *Godzilla Singular Point*, displaying the same confusion a real pterosaur would upon seeing a vending machine. Screen capture from the animation.

are more scenes of Rodan stalking people on the ground than attacking from the air.

Second form Rodan's skull still has teeth, but now they do not cover the entire inner surface of the mouth. Although the second form has scutes on parts of the body, close-up shots reveal that it also bears a dorsal covering of pycnofibers. Pycnofibers are a fuzzy external "plumage" that have been known in pterosaurs since 1971, and appear to be omnipresent in the group. They were likely present ancestrally in pterosaurs, and are probably homologous to dinosaur feathers (Yang et al., 2019). Relatively few media depictions of pterosaurs give pterosaurs their pycnofibers, however; seeing them on Rodan is a welcome addition.

There are several unusual biological anomalies that the series comments upon in this incarnation of Rodan. It is noted to communicate via radio waves, which it emits in its calls. A Rodan corpse is noted to contain the radioactive element radon (which provides an in-universe explanation why its name in Japanese is ラドン *Radon*). Suffice it to say, no animal communicates with radio waves or naturally bears radon in its body. Rodan is also noted to lack an organ that functions as a stomach. Believe

it or not, this is possible. A few vertebrates, such as platypuses and lungfish, also lack stomachs; the digestive system goes straight from the esophagus to the intestines (Castro et al., 2014).

Rodan is also noted to lack homeobox genes. Homeobox genes regulate the development of organisms, and are found in the vast majority of eukaryotes. The most famous type of homeobox genes is Hox genes, which determine what different regions of an embryo will develop into. One of the very few real animals that lack important homeobox genes include sponges, which lack Hox and ParaHox genes (Pastrana et al., 2019). Sponges notably have amorphous, asymmetrical body plans, unique among living animals in this regard. Ctenophores (comb jellies) also lack Hox and ParaHox genes, but retain LIM homeobox genes (Moroz et al., 2014; Simmons et al., 2012). Without homeobox genes, it is doubtful that Rodan would be able to develop into the bilaterally symmetric, well-organized creature that we see. It does serve as foreshadowing, however, for how the kaiju in this series may be able to control their own development. Without spoiling too much, this becomes relevant later on in the series.

Overall, the new incarnation of Rodan is a welcome redesign. It more closely resembles real pterosaurs, particularly dsungaripterids, and several allusions towards real biological concepts are made. The writers and designers, notably lead monster designer and Studio Ghibli alumnus Eiji Yamamori, did their research here, and have created a version of the monster that balances science with science fiction well. The entire series is like this, alluding to many scientific concepts, especially in theoretical physics (the show has gained a reputation for being very dense and intellectual). That's what you get when your series' writer, Toh EnJoe, has a PhD in physics (EnJoe, 2013).

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ABOUT THE AUTHOR

Henry Thomas has a BA in Integrative Biology from the University of California, Berkeley. He is now the world's foremost author on Rodan biology, which is not particularly high praise.

NOTES

¹ The species *Dsungaripterus parvus* was first named by Bakhurina (1982), based on relatively scrappy fossils. It was given its own genus name *Phobetor* by Bakhurina (1986) after more material was found, revealing significant differences between it and the type species *Dsungaripterus weii*. Unbeknownst to Bakhurina, it turned out the genus name *Phobetor* was already used for a species of sculpin, *Gymnocanthus* (= *Phobetor*) *tricuspidis* Krøyer, 1844. The pterosaur "Phobetor" awaits a new genus name, alongside further study of the fossil material (Hone et al., 2017).

² A scute is a scale overlaid with horn, seen, for instance, on the feet of birds and the skin of crocodilians.



An eldritch anecdote of death's-head hawkmoth from *The Silence of the Lambs*

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The Silence of the Lambs (1991) is an American psychological horror film that was reconstructed from a 1988 novel by Thomas Harris. The film was directed by Jonathan Demme and written by Ted Tally, starring Anthony Hopkins, Jodie Foster, and Ted Levine. It tells the story of a young FBI rookie, Clarice Starling. After her training days are spent at the FBI academy in Quantico, Virginia, the head of the Bureau's Behavioral Science Unit, Jack Crawford, assigned her to interview Dr Hannibal Lecter, who is a former psychiatrist and incarcerated cannibalistic killer. Meanwhile, the character "Buffalo Bill", who is a psychopath serial killer, has already killed five women and removed the skin from their bodies. Buffalo Bill had been chased by Crawford and her team for a while but no progress had been made until Clarice started interviewing Hannibal Lecter.

The purpose of interviewing Dr Lecter was to obtain insights that might help in pursuit of Buffalo Bill. While interviewing Dr Lecter, Clarice already realized that in order to gather any insight from him, she had to go along with his mind games: Dr Lecter agrees to make some statements about the serial killer only if she tells him about her past. During the course of these events, Buffalo Bill kills his sixth victim and this time he leaves a calling card, which was a rare death's-head hawkmoth. The killer placed this calling card in the throat of his victim. That was the time when this case took a major turn, based on the analysis of Buffalo Bill's case made by Dr Lecter and



Movie poster. Image extracted from IMDb.

the evidence in the form of a calling card. Clarice and the FBI make a move to look for the seventh victim of Buffalo Bill. During the pursuit of the killer, Dr Lecter escapes from custody. Later, Clarice traces the location of Buffalo Bill and kills the serial killer in a shootout. The movie ends when Clarice graduates from the Academy and receives a cryptic phone call from Dr Lecter during the graduation day ceremony.



Acherontia atropos, the death's-head hawkmoth. Image extracted and modified from Wikimedia Commons (D. Descouens, 2021; Collection of Laurent Schwartz, MHNT.CUT.2011.0.165).

THE DEATH'S-HEAD HAWKMOTH

Taxonomic classification

Kingdom: Animalia

Phylum: Arthropoda

Class: Insecta

Order: Lepidoptera

Family: Sphingidae

Genus: *Acherontia* Laspeyres, 1809

Species: *Acherontia atropos* (Linnaeus, 1758)

The death's-head hawkmoth (*Acherontia atropos*) belongs to the family Sphingidae of the order Lepidoptera. Sphingidae, is a polyonymous family, that is, known by many names like hawkmoths, sphinx moths, hummingbird moths, while their caterpillars are known as hornworms (Capinera, 2008). These moths are commonly identified by their sleek-looking body with narrow forewings and shorter hindwings.

The characteristic morphological feature of the death's-head hawkmoth is the vaguely skull-shaped pattern ornamenting the thorax. This unique imprint on the thorax bestowed this moth species both its scientific name as well as its common name. The species inhabits Southern Europe, Middle East and most of Africa (Robischon, 2019). Members of the genus *Acherontia* demonstrate a unique behavioral defense when alarmed: the adult moths squeak by producing a loud chirp from their pharynx. This behavior is very unique because most of the moths from other families and insects from other orders produce sounds by rubbing their external body parts (Brehm et al., 2015).

The name *Acherontia atropos* is associated with death and 'dark' subjects. The genus *Acherontia* is named after the River Acheron in Greece, and the name Acheron directly refers to the underworld (Britannica, 2018). The species name '*atropos*' is associated with death, as Atropos, the Greek goddess of fate and destiny, is the one who cuts the thread of humans' lives (Greek Mythology, 2015). Thus, in many places, *Acherontia* moths are considered as omens of death.



Alternative poster. Image extracted from IMDb.

FILMMAKING & INSECT SCIENCE

Science-based movies play an important role in bringing scientific awareness to the general public, making people comprehend the importance of science which is an integral – but sometimes imperceptible – part of our daily lives. Insects are the most thriving animals ever to colonize the terrestrial environment. From our homes to the streets, towns, cities, countryside, forests, and to ponds and streams – insects are everywhere. Apart from pollinating 80% of the global crops (Riyaz et al., 2018), many insects are directly or indirectly helping the restoration and remediation of our ecosystems (Crespo-Pérez et al., 2020). Moths, like bees, flies and butterflies, also take part in pollinating flowering plants. Besides pollination, moths are part of the diet of many birds, lizards, spiders and a whole range of other animals, making them an extremely important part of our ecosystems and remarkable creatures in the animal kingdom. However, with the increasing population, climate change and other human activities, the populations of insects are gradually

decreasing (Sánchez-Bayo & Wyckhuys, 2019), which is an alarming issue.

So, films should not just explain their science, but also be able to promote scientific disposition and curiosity in the public. The misrepresentation of science in movies should stop, as it might increase public mistrust in science. Films could instead be more mindful and promote science, including conservation and management of biodiversity, stimulating viewers to embrace science in their everyday lives.

CONCLUSION

The caterpillars (larvae) of several moth species feed on the leaves of many species of plants for their survival. As the larvae transform into pupae or chrysalides, they start to develop and grow to later emerge as adult moths. This transformation needs a lot of energy, so that is why larvae have to store that from their food. The caterpillars of moths are equipped with biting and chewing mouthparts while adults typically have the long proboscis for sucking nectar from flowers. The *Silence of the Lambs* is a film that focuses on base identity and transformation. Dr Hannibal Lecter, in a scene that didn't age quite well, succinctly summed up how Buffalo Bill's moth ties into his psychosis of transformation and change (Orquiola, 2021).

The Silence of the Lambs is an extraordinary masterpiece that won all the major Academy awards, from Best Director and Best Picture to Best Actor, Best Actress, and Best Adapted Screenplay. It makes into the list of most awarded movies in the history of cinema. Apart from its appearance as a calling card and key evidence in that film, the death's-head hawkmoth was also featured many times in other films and literary works, like *Dracula* by Bram Stoker (1897) and *Un Chien Andalou* (Les Grands Films Classiques, 1929). In many of those cases, the moth is also used as a symbol of death.

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Muzafar Riyaz is a budding Research Scientist in Entomology, whose research focuses on the molecular phylogenetics, Mitogenomics, next-generation sequencing (NGS), taxonomy, and biodiversity of moths. He is also engaged in conservation and management of Insects. *The Silence of the Lambs* is one of his favorite movies.



The Astolfo Effect: the popularity of *Fate/Grand Order* characters in comparison to their real counterparts

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The *Fate* franchise started with the computer game *Fate/stay night* back in 2004. To put it briefly, it is about mages fighting to obtain the fabled Holy Grail. The mages (a.k.a. Masters) summon heroic spirits (Servants) to aid them in their battle. A bit like *Pokémon*, but the servants are not kawaii monster mascots, but rather figures from worldwide myths, legends, history, and literature. For instance, Napoleon is a servant who's a historical figure, while Heracles is a

mythological one, and Sherlock Holmes is a literary one.

The franchise has grown quite a lot since its inception, with numerous novels, manga, anime, games, and all sorts of merchandise. Its current main product is *Fate/Grand Order* (henceforth FGO), a game developed by Delightworks (mobile version, 2014) and Sega AM2 (arcade version, 2018). It is one of the top-grossing mobile games worldwide,



Final Ascension artwork of Napoléon and Heracles. Source: Fate/Grand Order Wiki (©Aniplex).

with most of the money being spent on it by the Japanese public (Chapple, 2020; Orr, 2021).¹

The popularity of the franchise can have a peculiar effect on the Internet because its characters are almost all taken from real-world material. As Salvador (2020) commented, many historians, archaeologists, and literature scholars will eventually curse *Fate* when they do a Google search on a given character and are flooded by *Fate* entries. So, we decided to see how biased by *Fate* Internet searches truly are.

We hypothesize that the most obscure characters will have more hits about their *Fate* incarnations than their original ones. Furthermore, those Google hits will appear sooner rather than later in the search. For instance, we expect Astolfo and Bradamante to be such cases, as the stories of Charlemagne's paladins are not as well-known as, for instance, the (inferior²) stories about King Arthur.

Conversely, widely popular characters will have fewer hits about their *Fate* incarnations and those hits will appear later in the Google search. In this category, we expect characters like Holmes and Moriarty, who have endless movie incarnations.

Our hypothesis is simple and intuitive, but we can't just take it for granted. We need to test whether this "Astolfo Effect" is real. And so, we did.

METHODOLOGY

Even though we are interested in the Fateverse as a whole, for our purposes we considered only the characters present on its currently most popular and top-grossing entry, FGO. We excluded servants from

other games, novels, etc.³ We compiled a list of FGO characters from the mobile version of the game considering both the American and Japanese servers in their state in June 2021, when the last announced character was Mysterious Idol X.

We used Google Search to look for the name of each character. For those characters that have yet to be released in North America, we used the names as given by the Fate Grand Order Wiki (<https://gamepress.gg/grandorder/servant-availability>). We used the names as spelled in FGO, which can be a bit off sometimes; we will discuss this matter in more detail later on.

We did the searches on Google Chrome, with clean cache, cookies, and history, using an Incognito tab. A VPN client was used to obtain an IP address from Michigan, USA. We were interested in the Images search rather than the regular website search. SafeSearch was deactivated (we're talking about *Fate*, after all). Search of images of any size and any publication date were allowed in the results.

After the results of the search were obtained, we counted the number of images that were about the FGO characters in the first 50 results on Google. Those images could be official artwork, fanart, memes, cosplay, figures, etc., provided it was clearly related to the incarnation of the character in the Fateverse. We also noted the position (1st, 2nd, etc.) of the first *Fate*-related image to appear.

Of the 308 servants in the game in June 2021, we excluded repeated entries of the same character, such as Alter, Summer, Prototype, etc. versions. We also excluded: original characters, such as best kouhai Mash, for obvious reasons; and servants that were based on real-world stuff but in a way that makes them exclusive to the Fate-

¹FGO is based on gacha mechanics. To learn more about the global academic and legal discussions on the evils of gacha, see the articles by Hood (2017), Wiltshire (2017), and Drummond & Sauer (2018).

²This is the opinion of RBS and he owns it. He blames British imperialism for the prevalence of the Round Table over the Paladins. Now, can we have Charlemagne in FGO?

³Sorry, Charlemagne.

everse (Hessian Lobo, Kijyo Koyo, and Senji Muramasa). In total, we had 191 servants.

Name problems

For some of the servants used in our searches, we had to tweak their names a bit. For Zhuge Liang (Lord El-Melloi II) and Sima Yi (Reines), we only used the names of the Chinese strategists, not of the *Fate* original characters. The same is valid for Ganesha (Jinako). For Henry Jekyll & Hyde, we used simply ‘Jekyll and Hyde’; and for Scathach-Skadi, simply Skadi (because there is already another Scathach servant). We reverted the names of Altria Pendragon and Altera to their actual forms, Arthur Pendragon and Attila; otherwise, only *Fate* images would pop up in our searches. The same logic applies to First Hassan, Beni-enma, and Miss Crane, for whom we used the names Hassan-i Sabbāh, Shita-kiri Suzume, and Tsuru no Ongaeshi,⁴ respectively.

Other potentially problematic names are those with non-standard spellings. Some of these cases are just weird choices, like Brynhildr or Asterios. But the real problem lies with Japanese servants because FGO does not make use of macrons for their romanization, preferring instead the use of two vowels. The unusual spelling resulted almost exclusively in FGO entries in our searches, while the standard spelling resulted almost exclusively in the “proper” historical/mythological character. As such, the following servants were excluded from our discussion below (standard names shown within brackets): Amakusa Shirou (Amakusa Shirō), Ashiya Douman (Ashiya Dōman), Asterios (Asterion or Asterius), Brynhildr (Brunhild), Fuuma Kotarou (Fūma Kotarō), Housouin Inshun (Hōzōin Inshun), Ibaraki-Douji (Ibaraki-dōji), Katou Danzo (Katō Danzō), Minamoto-no-Raikou (Minamoto-no-Yorimitsu), Okita Souji (Okita Sōji), Sakamoto Ryouma (Sakamoto Ryōma), Sasaki Kojirou (Sasaki Kojirō), Shuten-Douji (Shuten-dōji), Tawara Touta (Fujiwara no Hidesato), Ushiwakamaru (Minamoto no

Yoshitsune), Xuanzang Sanzang (Tang Sanzang).

A few people were better known by names other than the ones used for the servants. As such, searches using the less-usual version of their names would result almost exclusively in FGO entries. Thus, we also had to exclude Avicbron (a medieval Latinization of his name, Solomon ibn Gabirol) and Nagao Kagetora (his birth name, but he was later known as Uesugi Kenshin). Another case would be Iskandar, which is the eastern/Persian rendition of the name; he’s better known as Alexander the Great or Alexander III. But that one has the benefit of having a kid version in the game with the name Alexander. Yet another case would be Ozymandias, which is the Greek name for Ramesses II. However, we have not excluded him because the name Ozymandias is equally famous in *za wārudo*, from art (poetry and painting) to art? (Watchmen).

All that clean-up left us with “only” 172 servants: 79 female, 85 male, and 8 servants that FGO classifies as ‘Other’. We used the game’s classification for the sake of simplicity in our statistical analysis (see below), even though we consider it a rather poor and debatable one, as it includes gender-diverse servants, as well the genderless construct Enkidu, and the Dioscuri, which are a brother-sister duo (i.e., one male and one female). This category includes Astolfo, Caenis, Chevalier d’Eon, Dioscuri, Enkidu, Kiichi Hogen, Qin Shi Huang, and Taira no Kagekiyo.

RESULTS

Number of hits

Three servants dominated the searches, with all results out of the first 50 being related to FGO or the Fateverse. They are: Nitocris, Sitonai, and Yu Mei-ren. (For Yu Mei-ren, the game’s spelling with a hyphen doesn’t make a difference, as the result is the same if we use the more common spell-

⁴ Note that Tsuru no Ongaeshi is actually the name of the tale, not the character. It translates to ‘The crane’s return of a favor’.

Table 1. Characters with over 50% of search results being related to Fate.

Servant	Search hits	Servant	Search hits
Nitocris	50	Qin Liangyu	43
Sitonai	50	Suzuka Gozen	43
Yu Mei-ren	50	Jing Ke	42
Astolfo	49	Kiyohime	41
Li Shuwen	49	Mordred	40
Mandricardo	49	Edmond Dantes	40
Nero Claudius	49	Taira no Kagekiyo	39
Osakabehime	49	Sakata Kintoki	37
Scathach	49	Tamamo-no-Mae	36
Yan Qing	49	Watanabe no Tsuna	35
Bedivere	48	Henry Jekyll & Hyde	34
Caenis	48	Queen Medb	33
Diarmuid Ua Duibhne	48	Yagyu Munenori	31
Okada Izo	48	Kiichi Hogen	31
Mori Nagayoshi	47	Paracelsus von Hohenheim	30
Ereshkigal	46	Sei Shonagon	30
Oda Nobukatsu	46	Enkidu	28
Bradamante	45	Chen Gong	27
Fergus mac Róich	43		

ing, Yu Meiren.) Yu Mei-ren and Sitonai are obscure characters and don't seem to have any easily findable representations. Thus, the search results are easily flooded by *Fate* entries.

Nitocris is a special case because she was neither a real person nor a legendary/literary character. Rather, the idea of a female Pharaoh being the last ruler of the 6th Dynasty was a complete misinterpretation of the archaeological record, as we have explained elsewhere (Salvador, 2020). The actual Pharaoh was a man named Netjerka-re Siptah (sometimes spelled as Neitiqerty Siptah). As such, *Fate's* Nitocris dominates any Google search.

Next (see Table 1), we have seven servants with 49 out of 50 results being *Fate*-related (the other hit is typically the entry from Wikipedia). They are: Astolfo⁵, Li Shuwen, Mandricardo, Nero Claudius, Osakabehime, Scathach, Yan Qing. All of them

are rather obscure characters, though their names might be well-known in their countries of origin. However, there is one glaring exception: Emperor Nero is really (in) famous for being implicated in the Great Fire of Rome. However, that freakish red Saber seems to be even more famous.

Next in line are: Bedivere, Caenis, Diarmuid Ua Duibhne, and Okada Izo with 48 hits; Mori Nagayoshi with 47; Ereshkigal and Oda Nobukatsu with 46. All equally obscure characters with the possible exception of Ereshkigal, whose representations are well-known from archaeological sources. Though confusion of her names and identity with other Mesopotamian goddesses could cloud the search results. Either way, Ereshkigal has a legion of very devoted⁶ fans.

Among the other characters with over half the results being related to *Fate* (Table 1), there are a few that warrant further com-

⁵ A surprising number of hits (seven) were dakimakura. Actually, maybe that's not that surprising.

⁶ And constantly disappointed.

ment. First, the high number of *Fate*-related hits for Jekyll & Hyde is due to the use of the ampersand. A search using 'and' returns no *Fate*-related entries whatsoever. Bradamante had 5 non-FGO hits, which is more than we expected. She seems to have been more commonly featured in art than her cousin Astolfo.



Bradamante valorosa [The Valiant Bradamante], etching by Antonio Tempesta (1597), from the collection of the Staatliche Kunstsammlungen Dresden (Germany). Source: Wikimedia Commons.

Conversely, Kiyohime and Edmond Dantès are characters from very famous stories, so the number of *Fate* entries in the results is surprising. The lack of recent movie adaptations of *The Count of Montecristo* (the last one is from 2002) might explain this in the case of Dantès (besides, he is popular and one of the most grailed servants). In the case of Kiyohime, we thought it was a bias due to searching in English. However, when we did a search using a Japanese IP address and her original name 清姫, we got even more *Fate*-related hits! So, her servant incarnation seems to be quite popular. The same is more or less valid for Tamamo-no-Mae. FGO renders her name as 玉藻の前, and a search using this rendition resulted in

a flood of *Fate* entries. However, her name can be rendered in additional forms in Japanese, which resulted in almost no *Fate*-related hits in the searches.



Kiyohime, illustration by Toriyama Sekien, from his book *Konjaku Hyakki Shūi* (今昔百鬼拾遺), 1870. Source: Wikimedia Commons.

Nearly all the servants with no hits are all extremely famous (like Caesar and Cleopatra), have very common names (like David and Gareth), or are simultaneously famous and also a bird (Nightingale). As such, there was no space for *Fate*-related imagery on the top 50 search results. The exceptions are Nemo, Europa, and Paris, who are not such well-known characters, and Chacha, who is a very obscure figure. Our search for Nemo resulted in us finding plenty of fish. Europa and Paris are also names of places, which complicates the search. The word 'chacha' means several other things in others languages and the search results were an assorted mix of random stuff. The historical figure Chacha is better known in English by the names Yodo-dono or Yodogimi; searching for Yodo-dono resulted in two entries from FGO.

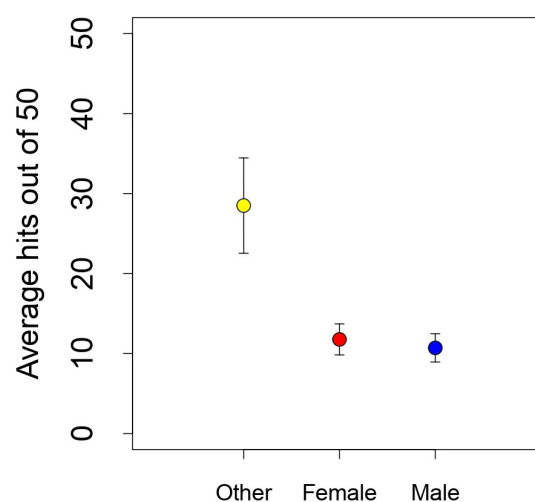
And what about *Fate*'s face? The poster girl Altria Pendragon, the original Seiba. Surprisingly enough, when searching for Arthur Pendragon, 9 of the 50 hits were from *Fate*, though 8 of them were of the male Prototype counterpart. Though there are many representations of the character in other media, including numerous films and series (such as BBC's *Merlin*), this is still a surprisingly high number of *Fate*-related hits. For the full ranking of servants by search hits, please see the Appendix at the end of this article.



Yodo-dono (*Chacha*), painting from the 17th century, from the collection of the Nara Prefectural Museum of Art (Japan). Source: Wikimedia Commons.

Finally, considering that FGO is blatantly a waifu-bait gacha game, we were curious to see if there was any correlation between

our results and the servants' gender. We tested whether the number of hits differed in relation to the gender of the servant. To that end, we did a Zero-inflated Poisson regression using the package 'pscl' (Zileis et al., 2008) and used likelihood-ratio tests to obtain p -values in R (R Core Team, 2020). Servants classified by FGO as 'Other' had significantly more hits on average, compared to male and female servants ($p < 0.01$). When only male and female servants were considered, there was no significant difference between their number of hits ($p = 0.48$). The probability of having zero hits was the same for all categories ($p = 0.99$).



Graph showing the average (and standard error bar) of the number of hits that servants had on a Google search (out of the first 50 hits), according to gender.

First hit

We also noted the position in our search results of the first hit that was a *Fate*-related image. The idea was to find out which characters are more famous for their Fateverse incarnation than their original one. Obviously, for those three servants for which all the 50 results were from *Fate* (Nitocris, Sitonai, and Yu Mei-ren), the first hit was always the 1st search result. Thus, the discussion below only considers the other servants that had 49 or fewer *Fate*-related hits.

For thirty-seven characters, the very first search result was from *Fate*, even superseding entries about their real-world counter-

parts from sources like Wikipedia. Most results were consistent with our expectations. For instance, *Fate's* Astolfo and Bradamante are more famous than their *Matter of France's* counterparts. Some of the surprising results from above (number of hits) repeated themselves here, like Dantès, Ereshkigal, Kiyohime, Nero, and Tamamo-no-Mae.

There were, however, a few additional surprises. Lu Bu, for instance, of whom we were expecting a Dynasty Warriors entry to top the search instead. Others were famous mythological characters for whom there are many artworks available, such as Stheno, Semiramis, and the Dioscuri. Though the latter are better known by their individual names, Castor and Pollux, rather than by the term Dioscuri. Sei Shonagon was also surprising, as she is a rather well-known writer in the West.

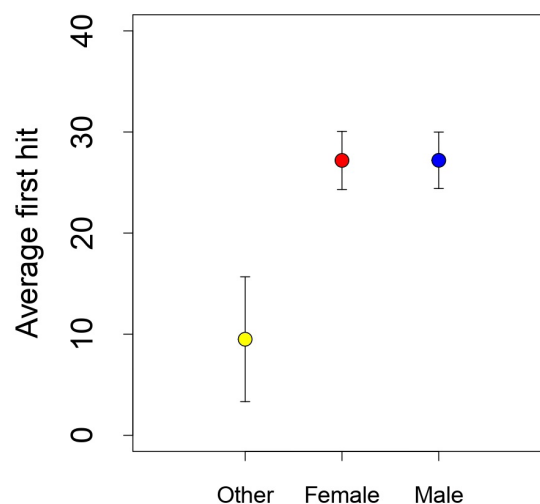


Castor and Pollux, oil on canvas by Robert Fagan, between 1793 and 1795, from the collection of the National Trust, UK. Source: Wikimedia Commons.

At the other end, 32 servants were nowhere to be seen in the first 300 search results. All of them were famous people, real or fictional, that have multiple and/or well-known representations in photographs, art, films, series, and other games or manga/anime. Some examples are Robin Hood, Sher-

lock Holmes, Medusa, Shakespeare. For the full ranking of servants by “first hit”, please see the Appendix in the end of this article.

We also did a statistical analysis to compare the first hit on our searchers. Because in several instances the count stopped at 300 (those 32 servants from the previous paragraph), we did not have the exact value for the first hit for those servants. Thus, we first checked if different genders had a different probability of not appearing after 300 searches, which was not the case ($p=0.10$). Because of that, we focused only on the servants that we had an exact search value and used Poisson regression to check if the servant’s appearance was related to gender. We saw that servants classified as ‘Other’ have their first hit way earlier than male or female servants ($p<0.01$), supporting our hypothesis regarding the ‘Astolfo Effect’. Male and female servants, however, did not differ on average in their first hit ($p=0.99$).



Graph showing the average (and standard error bar) of the first hit that servants had on a Google search, according to gender and only considering servants that appeared within 300 searches.

FINAL THOUGHTS

In essence, we confirmed that the ‘Astolfo Effect’ is real.⁷ Consequentially, many historians and other scholars will continue

⁷ It should probably be best referred to as the ‘Nitocris-Sitonai Effect’. We’re keeping Astolfo in the name, though.



Astolfo and Saint John the Apostle fly back from the Moon after recovering Orlando's wits;⁸ photograph of the fresco (by Julius S. von Carolsfeld, 1819–1822) in the Ariosto Room of Villa Giustiniani Massimo, in Rome. Source: Wikimedia Commons (photo by Sailko, 2016).

to curse *Fate* and to wonder why their Google search was suddenly flooded by big-eyed anime characters – and, oftentimes, NSFW pics.

However, we once said (Salvador, 2019) that FGO could be a starting point for fans to go after information about History, Mythology, etc., and learn more about the real-world figures related to their favorite servants. We not only stand by that assertion here but also say that the other way around can work as well. Maybe some historians and literary researchers will become interested in FGO and otaku culture through this first contact with a servant on their Google search.

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⁸ Orlando is another spelling of Roland, who appears in Astolfo's interlude in FGO but who we are yet to see as a Servant.

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João Tomotani, MSc., is an engineer and Rin simp since the 2006 FSN anime, who likes to make huge Excel spreadsheets to study stupid phenomena. He is currently saving for the Ereshkigal banner in February 2022 after failing last year, but he is ready for all the salt.

Dr. Rodrigo Salvador is a curator in the Museum of New Zealand Te Papa Tongarewa. He has always been interested in mythology, ancient history, and literary works, not to mention manga and anime, so he was easily baited by *Fate*. Actually, no, that's a lie. He found the original FSN meh. But he came back to the series full force with FGO, as his growing Nendoroid collection can attest.

APPENDIX

Number of search hits (# out of 50)

50: Nitocris, Sitonai, Yu Mei-ren.

49: Astolfo, Li Shuwen, Mandricardo, Nero Claudius, Osakabehime, Scathach, Yan Qing.

48: Bedivere, Caenis, Diarmuid Ua Duibhne, Okada Izo.

47: Mori Nagayoshi.

46: Ereshkigal.

46: Oda Nobukatsu.

45: Bradamante.

43: Fergus mac Róich, Qin Liangyu, Suzuka Gozen.

42: Jing Ke.

41: Kiyohime.

40: Edmond Dantès, Mordred.

39: Taira no Kagekiyo.

37: Sakata Kintoki.

36: Tamamo-no-Mae.

35: Watanabe no Tsuna.

34: Henry Jekyll & Hyde.

33: Queen Medb.

31: Kiichi Hogen, Yagyu Munenori

30: Paracelsus von Hohenheim, Sei Shonagon.

28: Enkidu.

27: Chen Gong.

25: Mochizuki Chiyome.

24: Stheno.

23: Musashibou Benkei.

22: First Hassan.

21: Charles-Henri Sanson, Dioscuri.

20: Lu Bu Fengxian.

19: Atalante, Gawain.

18: Cu Chulainn.

17: Ishtar, Semiramis, Xiang Yu.

15: Abigail Williams, Ashwatthama, Yang Guifei.

13: Anastasia Nikolaevna Romanova.

12: Red Hare.

11: Karna.

10: Fionn mac Cumhaill, Jeanne d'Arc, Tomoe Gozen.

9: Altria Pendragon.

8: Prince of Lan Ling.

7: Antonio Salieri, Chevalier d'Eon, Eric Bloodaxe.

6: Astraea, Gilgamesh, James Moriarty, Saito Hajime.

5: Anne Bonny & Mary Read, Darius III, Euryale, Murasaki Shikibu, Oda Nobunaga, Qin Shi Huang, Vritra.

4: Beni-enma.

3: Hijikata Toshizo, Kama, Lakshmibai, Saint Martha.

2: Charlotte Corday, Helena Blavatsky, Nezha, Quetzalcoatl, Scathach-Skadi, Sigurd.

1: Arjuna, Asclepius, Boudica, Edward Teach, Hektor, Katsushika Hokusai, Lancelot, Medea, Miyamoto Musashi, Ozymandias, Penthesilea, Siegfried, Sima Yi (Reines), Solomon, Vlad III, William Tell, Zhuge Liang (Lord El-Melloi II).

0: Achilles, Alexander, Altera, Arash, Bartholomew Roberts, Beowulf, Billy the Kid, Calamity Jane, Caligula, Carmilla, Chacha, Charles Babbage, Chiron, Christopher Columbus, Circe, Cleopatra, David, Elizabeth Bathory, Europa, Francis Drake, Frankenstein, Gaius Julius Caesar, Galatea, Ganesha (Jinako), Gareth, Georgios, Geronimo, Gorgon, Hans Christian Andersen, Heracles, Himiko, Ivan the Terrible, Jack the Ripper, Jaguar Warrior, Jason, Leonardo Da Vinci, Leonidas, Marie Antoinette, Mata Hari, Medusa, Mephistopheles, Merlin, Miss Crane, Napoleon, Nemo, Nightingale, Nikola Tesla, Odysseus, Orion, Paris, Parvati, Paul Bunyan, Phantom of the Opera, Queen of Sheba, Rama, Robin Hood, Romulus, Salome, Scheherazade, Sherlock Holmes, Spartacus, Thomas Edison; Tiamat; Tristan; Valkyrie; Van Gogh; William Shakespeare; Wolfgang Amadeus Mozart; Wu Zetian.

Position of 1st *Fate*-related hit

1st: Astolfo, Bedivere, Bradamante, Caenis, Chen Gong, Diarmuid Ua Duibhne, Dioscuri, Edmond Dantès, Ereshkigal, Fergus mac Róich, Henry Jekyll & Hyde, Jing Ke, Kiichi Hogen, Kiyohime, Li Shuwen, Lu Bu Fengxian, Mandricardo, Mochizuki Chiyome, Mori Nagayoshi, Musashibou Benkei, Nero Claudius, Nitocris, Oda Nobukatsu, Okada Izo, Osakabehime, Qin Liangyu, Sakata Kintoki, Scathach, Sei Shonagon, Semiramis, Sitonai, Stheno, Suzuka Gozen, Taira no Kagekiyo, Tamamo-no-Mae, Watanabe no Tsuna, Xiang Yu, Yagyu Munenori, Yan Qing, Yu Mei-ren.

2nd: Atalante, Ishtar, Mordred, Paracelsus von Hohenheim, Queen Medb, Red Hare.

3rd: Ashwatthama, Fionn mac Cumhaill, Karna, Saito Hajime, Tomoe Gozen.

4th: Charles-Henri Sanson, Enkidu, First Hassan, Gawain.

5th: Eric Bloodaxe, Yang Guifei.

6th: Abigail Williams, Cu Chulainn, Gilgamesh.

9th: Murasaki Shikibu.

10th: Hijikata Toshizo, Vritra.

11th: Qin Shi Huang.

12th: Altria Pendragon.

13th: Anastasia Nikolaevna Romanova, Astraea, Darius III, James Moriarty, Oda Nobunaga.

16th: Prince of Lan Ling, Sigurd.

17th: Chevalier d'Eon.

18th: Penthesilea, Quetzalcoatl, Siegfried.

19th: Antonio Salieri.

20th: Charlotte Corday.

21st: Anne Bonny & Mary Read, Miyamoto Musashi.

22nd: Euryale, Jeanne d'Arc, Saint Martha.

23rd: Asclepius.

28th: Arjuna.

29th: Beni-enma.

31st: Lakshmibai, Medea, William Tell.

32nd: Scathach-Skadi.

36 th : Zhuge Liang (Lord El-Melloi II).	135 th : Valkyrie.
38 th : Kama, Ozymandias, Vlad III.	181 st : Himiko.
42 nd : Solomon.	183 rd : Phantom of the Opera.
43 rd : Helena Blavatsky, Sima Yi (Reines).	184 th : Spartacus.
44 th : Nezha.	185 th : Queen of Sheba.
45 th : Lancelot.	187 th : Jack the Ripper.
47 th : Boudica, Katsushika Hokusai.	193 rd : Mata Hari.
49 th : Edward Teach, Hektor.	200 th : Rama.
60 th : Miss Crane.	201 st : Francis Drake.
64 th : Mephistopheles.	211 th : Nightingale.
66 th : Scheherazade.	215 th : Parvati.
67 th : Bartholomew Roberts, Galatea.	223 rd : Gaius Julius Caesar.
72 nd : Tiamat.	227 th : Georgios.
76 th : Wu Zetian.	244 th : Caligula.
77 th : Heracles.	250 th : Merlin.
81 st : Romulus.	259 th : Hans Christian Andersen.
95 th : Chacha.	262 nd : Charles Babbage.
99 th : Carmilla.	263 rd : Billy the Kid.
101 st : Leonidas.	282 nd : Geronimo.
105 th : Jaguar Warrior.	>300 th : Achilles, Alexander, Altera, Beowulf, Calamity Jane, Chiron, Christopher Columbus, Circe, Cleopatra, David, Europa, Frankenstein, Ganesha (Jinako), Gareth, Jason, Leonardo Da Vinci, Marie Antoinette, Medusa, Napoleon, Nemo, Nikola Tesla, Odysseus, Orion, Paris, Paul Bunyan, Robin Hood, Salome, Sherlock Holmes, Thomas Edison, Tristan, Van Gogh, William Shakespeare.
110 th : Gorgon.	
112 th : Ivan the Terrible.	
114 th : Wolfgang Amadeus Mozart.	
120 th : Arash.	
124 th : Elizabeth Bathory.	

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