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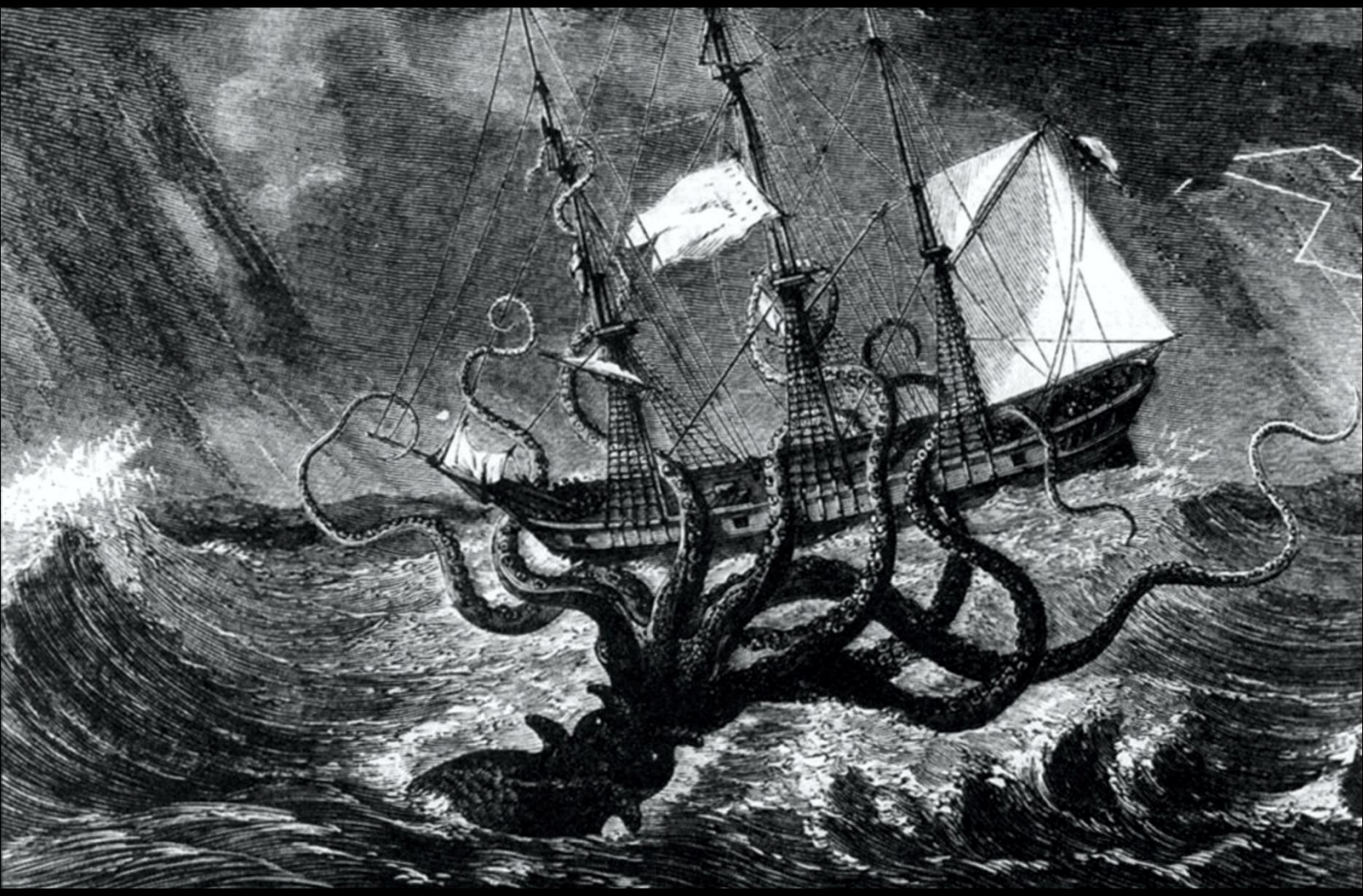

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The heritage futurism of *Blade Runner: 2049*

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Blade Runner: 2049 (Columbia Pictures/ Warner Bros.) is the most archaeological film I have ever seen, and even though it features neither excavation nor rugged men in hats punching Nazis, it is possibly the most archaeological film ever made. Written by Michael Green and Hampton Fancher, and directed by Denis Villeneuve, the sequel to Ridley Scott's *Blade Runner* (Warner Bros., 1982) embodies and explores archaeology, digital heritage, and heritage futurism in nearly each one of the film's 164 minutes without appearing to do so consciously.

The traditional definition of "Archaeology" is that it is the study of human history through excavation and analysis of artifacts and other physical remains. *Blade Runner: 2049* does this on film. Humans are (arguably) defined by the things we use, which comprise our material culture. As we become increasingly digital and post-human, the archaeology of our things changes to accommodate for the synthetic and immaterial. What follows is an examination of the archaeology of Villeneuve's film[1], what that means to a 2017 audience, and how we can plan for an archaeology of 2049 and beyond.

Blade Runner: 2049 is a film about (among many, many other things) memory and being remembered, a feat accomplished through materials, through things, and through how the characters interact with them. The appearance and usage of things are supplemented by action: forensic and archival research, radiation testing, and off-screen excavation. More generally the film succeeds in demonstrating how people and media-obsessed culture in the near future choose to recall the past, living in the present among discarded artifacts and landscapes of abandonment. *Blade Runner: 2049* also recalls the original film through recycling symbols, creating a meta filmgoing experience where the viewer at times is watching both movies at once. In the interest of simplicity, I will review the archaeology of *Blade Runner: 2049* in the order in which things appear as the film plays (I'd say "unspools", but that would be an anachronism). Think of it more as a video game walkthrough, or an excavation of the film.

Blade Runner: 2049 opens on a tight shot of the eye of replicant blade runner "K" of the LAPD. Eyes feature heavily in both films, and become artifacts in each as proof of personal identity. We know from the original film that

[1] Warning: major spoilers throughout.

eyes are manufactured, bioengineered for both replicants as well as humans who desire body modification, a post-human trait. One minute into the film, ideas are already in play about accuracy and authenticity, especially when considering the reproduction of original things. Late in the film, original blade runner Rick Deckard meets a reproduction of his wife Rachael, but notes that his wife's eyes were green. The reproduction's are brown. While the replicant conveys authenticity, it is not 100% accurate. Archaeologists face this question when completing digital reconstructions of ancient structures. Where do we draw the line between authentic and accurate, and can something convey the feeling of authenticity without being completely faithful to the original? I can imagine that in the future archaeologists could attempt to recreate digitally not only structures, but also the people who inhabited them.

The replicant Rachel in the original *Blade Runner* (left) and a reproduction of her in *Blade Runner: 2049* (right). Credit: Warner Bros, Columbia Pictures/ Warner Bros.

K's first mission takes him to a farm run by bookish replicant Sapper Morton. The flight over Los Angeles and surrounding geometric farmlands reveals a world and a landscape in ruin and continued decline. However, the farmhouse occupied by Morton is clean and full of things hearkening back to the mid-20th century: a gas stove, a cast iron pot, simple, old furniture, an upright piano, and hardwood floors. We learn later that wood is a precious commodity, and becomes a symbol for the film. The things that are the most "real" to the characters are always made of wood. For Morton, it is his house and the tree outside, symbolizing a rich internal life, and a rich past. For K, it is his wooden toy horse. For the spiritual heir to replicant-creator Eldon Tyrell, Niander Wallace's offices are paneled with rich wood. Wood has permanence; the digital is temporary. For the duration of the film, the loss of the digital is always either happening or is about to happen, without any way of retrieving what is lost. But this loss of digital things, as communicated by K's digital companion Joi,

makes things feel more real. Even though we live in a blended environment, our emotions remain real. Our attachment to digital things are quite real. And when real things cannot mitigate our loneliness, we turn to digital surrogates. We make these things to comfort ourselves, yet they continue to bring us pain. But that pain, as Wallace reminds Deckard later, proves to us that our happiness is real. These emotions throughout the film are governed by the presence and absence of things.

K and the tree outside Morton's house. Credit: Columbia Pictures/ Warner Bros.

At the conclusion of the opening confrontation, K removes Morton's eye; it becomes an artifact. It is used as proof-of-capture, but before that serves as a trigger for K's melancholy. The presence of this thing — the eye — binds both replicants together with their shared experience, but K is a Nexus-9 replicant; Morton is a Nexus-8, an older model able to think and behave more freely. The newer generation must "retire" the old. We destroy our past in order to bury it. But burying it also serves as an act of preservation for the future. The buried must become "reactivated" through excavation and study, creating a new

(or at least modified) history based on the presence of something newly discovered in the archaeological record.

K notices via a remote-sensing drone that something is buried at the base of Morton's tree. It is a crate that holds the bones of what K will later learn might be his mother, a "miracle" of a sexually produced live birth of a replicant child with two replicant parents. We never learn how replicants are assembled under the skin, so the presence of DNA is assumed as part of the creation of a non-human workforce. And we never learn why replicants (at least by Tyrell Corporation) where given a functional reproductive system. What's interesting is that when the bones are analyzed in the LAPD's forensics lab, K discovers inscriptional evidence: a serial number inscribed on one of the bones. Archaeologists are always looking for inscriptions, and the presence of the inscription in the bone points to a thing that is made, not born.

In an interlude early in the film, K returns home, passing by biocentric, anti-replicant graffiti on his way to his quiet sanctuary. The humans who remain on Earth resent their non-human neighbors, and mark their environment accordingly. Even though he's a replicant, K clearly has human — perhaps designed — needs, which are satisfied by things: cooking pots, a shower, entertainment, including paper books. The food is instant, practical, and disposable. The scene is driven by a dialogue with a woman off-screen, revealed over time to be an AI. K's relationship with "Joi" helps him with his loneliness. He uses a thing as a human proxy, reminding viewers of Spike Jones' AI film *Her* (Warner Bros., 2013). Joi is tied to K's apartment via a hologram projector on the ceiling, and she appears to K in a variety of outfits conveying tropes about the women men theoretically want (at least as the media portrays them): 1950s housewife, 1990s manic pixie dream girl. Clothing serves as an icon communicating time as well as presumed values. The things K possesses help define his character: he is simple and practical, lonely, longing for conversation and meaningful interaction. I imagine he could have easily chosen a pornographic hologram to welcome him home, but instead he has selected a woman companion to keep his brain company, to make him feel welcome and appreciated, something or someone who remembers him.

At the conclusion of the scene, K gives Joi a gift, an anniversary present. It is a portable projector so Joi can travel with K. This device delights the AI, and gives K a mobile companion who not only is a friend, but who also looks out for him and seemingly feels for him. The film's audience must remember that both of these characters are, at their simplest, robots, or at least synthetic people. They are both things that interact with each other and with other things (as well as people). The way humans interact with K (replicant) and Joi (portable AI) are reprehensible if one projects humanity onto the digital. It reflects the way modern humans treat their entertainment: disposable commodities that offer a brief reprieve from loneliness and boredom, yet will never be on equal footing with "authentic" experiences and relationships. To be a digital entity is to be abused. No wonder the Nexus-6s, 7s, and 8s rebelled against their creator and users. The fact that Nexus-9s (of which K is an example) were programmed for obedience confirms that

humans are fully aware of how they treat their things, and that things are ultimately disposable. We throw everything away, and these things neither resist nor resent their disposal. Everything is rubbish, and is therefore archaeology.

Armed with the serial number from the bones buried under Morton's tree, K travels to Wallace's headquarters, which contain its corporate archives. K shares the number with the archivist who recognizes it as from a very old replicant dating to before the Blackout, which wiped everything stored digitally. As K and the archivist walk into the archives, the archivist quips about the only thing permanent is saved on paper. He reminds K that everything digital can be lost forever. The interesting thing about paper is that it is a product created from wood pulp, and we are back to the idea of the analogue nature of wood yielding the only things of reality and of permanence.

Wallace's replicant-in-charge, Luv, finds K in the archives, and leads him into literal cold storage to listen to a digital audio recording maintained on a physical marble dropped into a reading device. Older media is read on older technology preserved in a cold, dark place. The more things change, the more they stay the same. K and Luv listen to a recording of Rachael (whose recovered bones contained her serial number) from the original *Blade Runner*. It is her interview with Deckard as he conducts his Voight-Kampff test on her to confirm if she is a replicant. This test recalls the Turing test for identifying AI. Future technologies are developed to satisfy the same needs of technologically enabled humans from 100 years ago. Although humanity's needs and desires have not appreciably changed during the history of the human race, the things people invent to satisfy those fundamental needs continually appear, are updated, are replaced.

Luv retrieving an old record from the archives. Credit: Columbia Pictures/ Warner Bros.

After the visit to the archives, K begins his search for Deckard in order to learn about Rachael, and finds himself interviewing Deckard's associate from the first film, Gaff, who is able to connect the dots for K about what happened to Rachael and Deckard, the mystery that closed the original *Blade Runner*. Archaeologically, the most interesting thing from the brief interview between K and Gaff is the origami sheep Gaff creates. The figure recalls the origami unicorns Gaff made and left in locations throughout the original film. It also recalls the eponymous sheep Deckard was saving to buy for his wife in Philip K. Dick's source story, "*Do Androids Dream of Electric Sheep?*" What we see in the new origami figure is an example of material memory, but for the viewer. The presence of the origami animal in the new film reminds us of what we saw and felt in the old film. The audience continues to experience the sequel in a meta way. Also, origami is a paper art, a medium that communicates something real. It separates Gaff, a human, from his replicant counterparts. At the same time, the origami sheep is a

facsimile, drawing a further distinction between real and virtual.

As the interview happens, Luv meets with Wallace as he prepares to witness the "birth" of a new replicant model. Wallace is blind (possibly intentionally), his "eyes" being six Bluetooth drones, which allow him to see in a more holistic way than a two-eyed person. Body modification continues to be a trope shared by humans of the future as we physically merge with digital technology, becoming post-human. Luv carries a box of computer chips with her, but only one is used to activate the eye-drones. As we saw in the first film and at the beginning of the sequel, eyes remain key to what is human, and what is "other."

Wallace and his Bluetooth implant. Credit: Columbia Pictures/ Warner Bros.

The birthing scene merges the organic with the synthetic. A replicant in the form of a naked adult female tumbles out of a clear plastic sac, covered in gel. She is clearly cold and afraid, and Wallace takes the opportunity to demonstrate how precious life is, even to something that is literally born digital. The newborn replicant's near-immediate death at the hands of Wallace (who uses an analog blade, something else conveying the meaning of "reality") shows again how humans treat their things, even their own creations. We make. We discard. The death of the nameless newborn contrasts with the tenderness taken to bury Rachael. In the latter case, replicants observed care in the afterlife of one of their own. For humans, replicants remain as objects. In fact, as we see later in the film, the whole of Earth has been abandoned by those humans who can afford to make the voyage, leaving a planet that exists as a global rubbish heap. We have thrown our own planet away, and it remains as one giant archaeological site. Wallace wants humanity to conquer the universe, to control everything natural, and to do so he needs to create replicants who can replicate each other through procreation. Humans, to Wallace, need a slave-labor replicant force to support their conquest of the stars. He must learn Tyrell's secret of live birth, but these records (along with all other digital records) were wiped out in the Blackout of 2021. Compare this to all of the science that was likely lost when the Library of Alexandria burned in 48 BCE and again in 270 CE and what needed to be rediscovered over the next 2,000 years.

Jumping back into the main mission of the film's narrative, K is ordered by his LAPD superior to return to Morton's farm to destroy everything. This is a kind of *damnatio memoriae*, a destruction of memory, a phenomenon familiar to Egyptologists and Roman archaeologists. Before he torches the house, K finds a baby sock hidden in a small box in the analog upright piano. The sock is a human thing, with its own material memory, kept because its owners saw it as precious. K's supervisor would later dismiss is as "just a sock,"

but it clearly had meaning to the replicants present at the live birth at Morton's farmhouse.

As with other historic buildings lost in history, the farmhouse then burns. K preserves the tree, however, the base of which contains another inscription written at the bottom of the trunk: 6.10.21. It's a date, likely a birthday, and is tied to the burial nearby. K literally finds his roots and returns to them. It's a human thing to do, to be curious about our parents, about previous generations. This is communicated in the landscape, but also in the objects with which we become connected. Seeing the date triggers a memory for K: as a young boy he was chased by other boys who wanted his toy wooden horse. Carved into the base of the horse is the date 6.10.21. We have inscriptional evidence tying the thing (wooden horse) to the tree. It is like finding a join between two pieces of pottery found far apart. They connect, yet come from different contexts.

K visits a human archives to search for DNA with Joi's assistance. Here the synthetic being researches the natural, discovering that two people (impossibly) share the same DNA, a boy and a girl. As opposed to the Wallace corporate archives where research is done digitally, K conducts his human archival research through a fiche-reader, something analog. Yet again, the analog is treated as real in the film. According to the archives, the girl died of a genetic defect, but the boy survived and was placed in an orphanage. K is playing the role of an archaeologist throughout this film, conducting research prior to heading back out into the field to find material remains.

K and Joi researching in the archives. Credit: Columbia Pictures/ Warner Bros.

As K approaches the ruins of San Diego, which has been turned into a gigantic disposal center for technology, he is shot down in his Peugeot police prowler. Scavengers attempt to kill him and seize the remains of his Spinner (flying car), but they are killed via a rocket-firing drone controlled by Luv from Wallace HQ as she gets her nails done: animated, luminescent cartoon figures. Looters are punished by death in order for K to track down the boy. This is not too far from modern history where in areas in Syria controlled by ISIS/ISIL, looters are killed if they do not turn in their finds to local antiquities processing centers, or if they are caught stealing antiquities to sell themselves. K enters a metal hut, and discovers that the orphanage contains hundreds of children tasked with recycling digital materials, something currently happening in modern-day Ghana and elsewhere in Africa. Humans continue to recycle and repurpose things for other purposes. In this case it is digital *spolia*.

The records K consults at the orphanage are kept in bound, printed volumes, pointing to the reality of what once was. The pages he needs are gone, ripped out of the book. K's dismay at losing physical evidence is heartbreaking, and it is as if that history is now lost forever. Before he leaves, K wanders through the remains of a factory attached to the orphanage. His presence within this architecture reminds him of the memory triggered by the date on the tree, and he finds his toy horse hidden where he left it 30 years ago. His material memory runs full-circle as he is reunited with his toy. It proves his memories are real, and he makes the connection that he was the boy who was born, and that Rachael and Deckard are his parents. The combination of landscape and artifact recalled history that K believed to be implanted. He acknowledges that in his time it is nearly impossible to determine what is "real", but as a cop, his appreciation of material evidence and the location in which it is found gives him the proof he needs.

Through an interlude with Joi, K comes to terms with his near-humanity, perhaps made more human because of his birth, birth imbuing the child with a "soul." Regardless of what your opinion is on the "miracle" of birth or the absence or presence of souls in people, the film gets at the question of what makes humans human, and how are they different from the things that they create. Humans make tools, and replicants are the superior tool, human-like but not human. One wonders how humans could identify their own humanity if there were no things at all. Joi gives K his birth name, "Joe." K, skeptical of memories, decides to visit Wallace's chief memory-maker, Ana Stelline, to determine if his memory of the horse is true and not an implant.

In 2017 we already know that digital media can be faked, and that the real can be enhanced. We know that human memory is unreliable. When K visits Stelline, she uses a camera-like tool with analog controls to manipulate the appearance of a digital insect, and later of a child's birthday party, the notion of a birthday hinting at K's origins. Humans speak through symbols and images, and it's as if Stelline knows something about K that he himself does not. They discuss the difference between real and manufactured memories. Real memories are messy; the synthetic is too detailed. Compare this to digital archaeological

reconstructions of structures, and we return to the idea of authentic versus accurate. The absence of things in the archaeological record makes for incomplete reconstructions that the archaeologist must fill in (or choose to leave as a void). The memory-maker is engaged with this kind of recreation, making conscious decisions about what to omit, what to leave messy to lend authenticity to the memory. She herself is a formation process, with the brain as an archaeological site.

K returns home to process what he's learned, and is met by both the holographic Joi and the real prostitute Mariette. They merge, the digital woman overlaying the real, turning a synthetic sexual encounter into a "real" one, merging the digital mind and desire of Joi with the physical surrogate of Mariette. As we've seen earlier, the digital is in control of the situation, manipulating the human to do something, in this case to have sex with a replicant. This is perhaps commentary on how our digital things control our lives (or at least our actions) instead of humans having the illusion of control. Wallace realizes this in his Nexus creations, but general consumers do not. We have stopped being able to make our own conscious decisions, and instead elect to purchase things, giving them license to have power over us. We have abdicated our freewill to the things we make.

In two scenes in the film, K must undergo a "baseline test" after a traumatic LAPD service event. He easily passes his first test after retiring Morton. He completely fails his second test after learning about his past. The phrases repeated in the baseline test come from Vladimir Nabokov's novel *Pale Fire*, which itself is a tricky piece of meta fiction and poetry that can be read in both a linear and nonlinear fashion. It is a reflection of the film (albeit from 1962), and the presence of the book in K's apartment, and the presence of its text in the baseline test, makes for another meta event in the film, bringing the film world and the real world together. The book is a clue about what is happening in the action of the film, the clue being given by the presence of a thing in its context. What is this book to K, and why won't he read it to Joi when she asks?

Returning to more traditional archaeology, K brings his wooden horse to an antiquarian, Doc Badger, who runs a radiation test in order to source the material. Instead of being from the tree on Morton's farm, the tritium signature points to Las Vegas. Doc Badger also notes the value of such a small piece of pre-Blackout wood, saying he could trade it in for a real horse, and that K could become a rich man. K won't part with his toy, speaking to the nostalgia we have for the things we each cherish. Our things possess our memories, or at least trigger them. Possession of things makes access to these memories easier.

The Las Vegas K visits is radioactive, vacant of people, dust-covered, with abandoned casinos and ruined sculptures. The colossal sculptures ruined in the dust recall Shelley's poem "*Ozymandias*," but in a perverse way. In the poem, the ruler Ozymandias laments what has become of his empire. In Las Vegas, the broken statues of objectified naked women mock Las Vegas and its permissiveness towards instant gratification of humanity's basic needs. This empire of entertainment has also fallen. K finds Deckard in the Vintage Casino, a place

that recalls an idealized mid-20th century America where he lives with his dog. “Is he real?” K asks. “I don’t know,” Deckard replies. “Why don’t you ask him?” K and Deckard’s introduction to one another comes by way of a fight in an empty cabaret where a glitched recording of Elvis singing “*Suspicious Minds*” plays on stage, occasionally interrupted by a moving image of Marilyn Monroe. We see what is already the future of entertainment, with dead entertainers (*e.g.*, Tupac Shakur) appearing digitally in front of a live audience, a technology being developed now by Japan’s Crypton Future Media. We see a futuristic jukebox in Deckard’s bar playing a Frank Sinatra tune while appearing as a 3D black-and-white hologram atop the player. Our analog musical heritage has become digital.

K examining a hologram of Frank Sinatra. Credit: Columbia Pictures/ Warner Bros.

Deckard and K have an uneasy conversation about Rachael, tying up more loose ends from the first film. K also notices several hand-carved wooden sculptures of animals on the bar, matching the size and style of his own toy horse. Luv arrives at the casino in order to kill K and to kidnap Deckard so that Wallace can interview him about the live birth event. Luv destroys the device K uses to take Joi with him; she is lost forever. Left for dead, K is rescued by a group of rebellious replicants who want K to help them find Deckard and Rachaels’ daughter, confusing him. His memory was manipulated by Selline to protect the identity and location of the daughter, proving that memory is always fallible no matter how true the possessor might find that memory. K returns to Los Angeles where he is approached by a colossal advertisement of a Joi model who says he looks nice but lonely, a good “Joe.” The AI was just an AI after all. It can be replaced and retaught.

As K returns home, Deckard sits in Wallace’s office with Luv and watches as a facsimile of Rachael enters the room. Deckard detects the difference in the eyes (a human trait and additional evidence of reality), and Luv executes the replicant, leaving Deckard shocked in the midst of his nostalgia, a thing-as-person (or person-as-thing) disposed of without hint of love or care. He sentences this Rachael to destruction by calling it a fake. Humans crave the real, the original, the first edition. Any copy is of lesser value, something that is evidenced in the antiquities marketplace.

After a fight in which Luv is killed and Deckard rescued by K, who has somehow learned that Deckard is being transported to the Off-World Colonies. K and Deckard return to the offices of Selline, who lives and works in a sealed environment because of her genetic condition. Selline is the true replicant child of Deckard and Rachael. Replicant meets replicant, a reunion of “soulless” things that are somehow no longer things, reconnected by love and memory, separated by a screen.

As the replicant (and real child) Selline works on a memory of snowfall inside her

creative space, the replicant K bleeds out on the steps to the office, catching real snowflakes in his hand. The snow itself is a metaphor for humanity, unique to one another, yet of the same shared materials, left to occupy the ground, resting atop each other over time, ultimately disappearing, ignorant of what came before and what will come after. It is no different that the pottery dumps at any number of archaeological excavations, where sherds are collected, counted, and weighed, then thrown away after yielding their data.

One wonders then what Ridley Scott thought after releasing the final edition of his *Blade Runner* film in 2007, 25 years after its initial theatrical release, if it would produce a sequel that shared the same DNA with his film. As already described above, watching Villeneuve's interpretation of the world and its characters proves to be a meta experience, seeing at once the original, analogue film overlaid with what was filmed and projected digitally. Both films are real, but are produced in two separate worlds. *Blade Runner: 2049* uses many visual and audible cues to recall its parent, ranging from Gaff's origami to Vangelis' "*Tears in the Rain*" from the original soundtrack. The ambient noise in K's apartment is re-used audio from Scott's 1979 film *Alien*. The clear raincoat Joi wears when leaving K's apartment for the first time recalls that of Pris in the first film. Deckard's original Spinner car from the first film makes a brief appearance in the casino where Deckard currently lives. Even the first scene where K confronts Morton was written for the first film (but not used), and instead introduces the second movie, old words in a new environment. This is a kind of archaeology of film, making connections between the things shared between original and sequel, actual props created for one and re-used in the other. It's recycled media in the service of a new story.

The archaeology of *Blade Runner: 2049* is complex and present throughout the film, focusing on materials and memory, about how people and things interact with each other, and about what separates humans from the things they create. We confront the traps of nostalgia. We recycle materials and memory. We occupy landscapes that affect our behavior. And we let our things determine our actions. As we look ahead to 2049 and after, we must consider the presence of our digital selves, how they manifest, and how they can be preserved, and what happens when our digital lives are lost. It's an attempt to communicate the new idea of heritage futurism, and serves as a cautionary tale for 21st-century archaeology and beyond.

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Dogū: from prehistoric figurines to collectible pocket monsters

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As an avid consumer of Japanese video games during my early teens, particularly of the RPG sort, I could not help but notice that some monsters would pop up in several games and typically had a pretty standard depiction. I have always been interested in mythology and could naturally identify the usual chimeras, griffins, phoenixes, and gorgons.

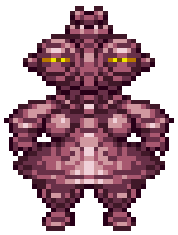

Figure 1. The monster called "Pocus Poppet", from the *Dragon Quest* series (Square Enix, 1986–present; artwork from the game). Other versions of this enemy (you know, those with different colors and more Hit Points) are called "Clay Doll / Terracotta Warrior" and "Dirty Dogu". Source: Dragon Quest Wiki.

However, these monsters shared their screen time with more unusual ones (or unusual to me at least) from Japanese myths and folklore. Maybe expectedly, I started to read about Japanese myths and to learn about kappa, tengu and many others. Still, one monster, in particular, was suspiciously absent from the books: a sort of statue-like creature with large round eyes (Fig. 1). I did not know its actual name and could not find information about it anywhere.[1]

Figure 2. The Pokémon Baltoy (left) and its evolution Claydol (right). Official artwork from the *Pokémon* series (The Pokémon Company, 1996–present). Source: Bulbapedia.

Then, I forgot all about this monster when I switched my geek focus to tabletop RPGs and my gaming preferences to Western hits (Bioware RPGs, Gears of War, etc.). This lasted until some years ago when I played *Persona 4* and *Pokémon: Alpha Sapphire* for the first time (I had skipped *Pokémon*'s Gen III back in the day); there and then, I re-encountered that weird statue-like creature (Fig. 2).

[1] Back then, in my home country, Internet connection was awfully slow and the service very expensive.

Even so, it was not until a recent visit to the British Museum that my interest was reignited. In their Japanese exhibition, I discovered that this creature was not a mythological monster after all — it was nothing like a tengu or a kappa! The damn thing was a prehistoric clay figurine (Fig. 3). As a category, these figurines are called “dogū”.

Figure 3. Dogū excavated in Tajirikabukuri, Ebisuda, Miyagi Prefecture (circa 36 cm in height; 1000–400 BCE). Source: Tokyo National Museum, Digital Research Archives (item J-38304).

Needless to say, I began searching for books and scholarly articles about dogū. Sadly, most of the literature on them (and prehistoric Japan in general) is in Japanese, which I cannot read and do not trust Google to translate it for me. Nevertheless, I wanted to report what I could find, just in case these figurines have captured the imagination of someone else out there (maybe someone like you, dear reader). So please keep in mind that my report here is based on the somewhat scarce literature available in English and thus it may lack some information and/or be overly simplified in some aspects.

Before we start, however, I need to briefly explain how Japanese prehistory is divided. So let’s get down to it.

ANCIENT JAPAN

Japanese prehistory can be broadly divided into two large periods: the Paleolithic and what may be informally called “Ancient Japan” (Table 1). The latter is a mixture of the usual Mesolithic, Neolithic and Bronze Age that has defied classification by archaeologists using this standard Western periodization (Imamura, 1996). This span of time contains three periods: the Jōmon, the Yayoi, and the Kofun. Here we are interested only in the first one, the Jōmon period.

Table 1. The main periods of Japanese prehistory and their approximate duration. Dates according to Henshall (2004), but these numbers are still much debated.

Approximate dates	Periods	
30,000 – 13,000 BCE	Japanese Paleolithic	
13,000 – 400 BCE	Ancient Japan	Jōmon
400 BCE – 250 CE		Yayoi
250 – 710 CE		Kofun

Taken literally, Jōmon means "cord-marked". This refers to the usage of cords to create decorative patterns on ceramics (Fig. 4), which was achieved by simply pressing a cord on the clay prior to firing (Kaner, 2009).

Figure 4. An example of Jōmon pottery (5,000–4,000 BCE), from the Tokyo National Museum. Source: Chris 73 (2005), Wikimedia Commons.

During the Jōmon period, Japan was covered by rich temperate forests (Imamura, 1996). This allowed people to live as hunter-gatherers, although there were phases (maybe seasonal) of sedentism, with some settlements growing quite large and possibly housing a few hundred inhabitants (Imamura, 1996; Henshall, 2004). There is also evidence of slash-and-burn agriculture and limited domestication of plant species, accompanied by skillful management of resources (Imamura, 1996; Habu, 2004). Furthermore, a good portion of the Jōmon people lived close to the coast, exploring marine resources (Henshall, 2004).

The Jōmon period was not, however, a single homogenous thing across all Japan. There was regional variation in habits and material culture, which changed at different paces throughout the country (Henshall, 2004). Furthermore, people from the continent migrated into Japan and added their share of knowledge, culture and genes to the mixture (Imamura, 1996). The Jōmon period ended with the start of rice cultivation and metallurgy.

Figure 5. Phallic stone rods (sekibō) are common ritual objects found in Jōmon settings. Source: Tokyo National Museum, Digital Research Archives (item J-34676; 1000–400 BCE).

Figure 6. The Ōyu Stone Circles, in Kazuno, Akita Prefecture (2,000–1,500 BCE). Source: G41rn8 (2016), Wikimedia Commons.

One important social aspect that gained strength during the Jōmon was how people dealt with the supernatural. Artifacts (Fig. 5), burial practices, and stone circles (Fig. 6) all indicate that religion and ritual were steadily developing throughout the period (Kaner, 2011). One type such artifacts was, of course, the dogū.

PAST DOGŪ

Dogū are ceramic figures produced during the Jōmon period. The earliest dogū dates back to the Incipient Jōmon (Table 2) and they remained restricted in numbers during the Initial and Early Jōmon (Habu, 2004). However, from the Middle Jōmon onwards, their manufacture thrived and their design became more elaborate (Kaner, 2009).

Table 2. Subdivisions of the Jōmon period. Dates according to Habu (2004); note how they do not exactly match the dates given in Table 1. The dates also vary regionally within Japan, as different parts of the country reached these phases separately.

Approximate dates	Jōmon subperiods
10,000 – 7,500 BCE	Incipient Jōmon
7,500 – 4,000 BCE	Initial Jōmon
4,000 – 3,000 BCE	Early Jōmon
3,000 – 2,000 BCE	Middle Jōmon
2,000 – 1,000 BCE	Late Jōmon
1,000 – 300 BCE	Final Jōmon

Most of the dogū are clearly female (some of them supposedly pregnant; Fig. 7), so some scholars believe they are representations of an earth-goddess. They claim that this mother-goddess worship is common in agricultural societies, but then again, agriculture was only incipient during the Jōmon period. Other scholars take into consideration the prominence of secondary sex characteristics and hypothesize that the dogū are just general fertility symbols[2], related to fertility rituals and magical protection during dangerous events such as childbirth. This latter option seems apparently more likely, as similar symbols are known from pretty much everywhere.

Figure 7. The so-called "Jōmon Venus" (2,000–1,500 BCE), from the Togariishi Museum of Jōmon Archaeology. Source: Takuma-sa (2012), Wikimedia Commons.

[2] The phallic stone rods seen above (Fig. 5) are also typically regarded as fertility symbols (Habu, 2004).

Nevertheless, considering that figurines such as these have only one function is careless, to say the least (Soffer et al., 2000). As such, other interpretations have appeared in the last decades. For instance, some authors link the increase in the production of dogū from the Middle Jōmon onwards to an increase of agricultural practices and the role of women in this subsistence shift (Togawa, 2003).

The actual functions of dogū remain unknown, but the constant debate makes archaeologists revisit old ideas, propose new ones, and slowly fine-tune our knowledge.

Figure 8. Heart-shaped dogū (2,000–1,000 BCE), from the Tokyo National Museum. Source: Daderot (2014), Wikimedia Commons.

There are several types of dogū, roughly classified by how they look. Because of that, they have some really amusing names (Habu, 2004): heart-shaped dogū (Fig. 8), sitting dogū, mountain-shaped-head dogū, goggle-eyed (or slit-goggle) dogū (Figs. 3, 9), horned-owl dogū.

It is still unclear if these different categories of dogū had distinct purposes or functions. Furthermore, dogū came in several sizes, from palm-sized figurines to large ones more than 30 cm high (Togawa, 2003; Kaner, 2009). As such, it is likely that they had different functions, ranging from personal belongings to probably community-wide ceremonial artifacts (Togawa, 2003).

Figure 9. Dogū excavated in Kamegaoka, Kizukuri, Aomori Prefecture (circa 37 cm in height; 1000–400 BCE). Source: Tokyo National Museum, Digital Research Archives (item J-38392).

PRESENT DOGŪ

Today, people can see all sorts of dogū in museum exhibitions around the world, like in the Tokyo National Museum and the British Museum. But they are not merely relics of an ancient past – Japanese people certainly have not forgotten them. For instance, there are some conspicuous monuments in Japan commemorating the most popular type of dogū, the goggle-eyed dogū (or shakōki-dogū).

Two of such monuments can be found in the city of Tsugaru, in Aomori prefecture. The Kamegaoka Site, an archaeological site dating from the Final Jōmon (1,000–300 BCE), is located there. This site is important because it is the place where the most textbook-famous dogū (a goggle-eyed one with a broken leg; Fig. 9) was found back in 1887 (Tsugaru City Board of Education, 2018). One of the monuments is a simple statue (Fig. 10), as could be expected, but the city's railway station (Fig. 11) is something else entirely!

Figure 10. Monument at Kamegaoka Site, in Tsugaru city. Source: Tomo HGS (2018), Mapcarta.

Figure 11. Kizukuri Station in Tsugaru city. Source: Bakkai (2008), Wikimedia Commons.

Box 1. Pseudoarchaeology

Unfortunately, the dogū (especially the goggle-eyed) became victims of human stupidity, just as several other archaeological icons (the pyramids, the Antikythera mechanism, the Nazca lines, etc.). That is, they were linked to alien activity by people who abhor scientific research and methodology and who prefer to make up their own wild stories about reality. Their "explanation" is that the goggle-eyed dogū resembles a person in a space suit. And no, I will not give the reference to their original "works" — these people should not be given the satisfaction of an actual citation!

POP DOGŪ

Given the cultural importance of the dogū in Japan and the increasing influence of television, mangas and video games, it was expected that these clay figures would make their way into pop culture.[3] This is especially true for the fan-favorite type, the goggle-eyed dogū (Rousmaniere, 2009).

The obvious examples, as I mentioned above, come from video games, especially RPGs such as the ever-present *Final Fantasy* (Square

[3] That happened to other weird beings, such as the cartoonish Egyptian god Medjed (Salvador, 2017).

Enix, 1987–present) and *Dragon Quest* series. The dogū are featured in various games, often just as meaningless enemies in random dungeons. Thus, I will not bore you to death with an extensive list of all dogū appearances. Instead, I will point out just a few examples that I find more meaningful.

One of them is the Pokémon Claydol (Fig. 2), which does not have the most creative name around. It is a Ground / Psychic type and most Pokédex entries on the series point out that it is a clay statue made by ancient people (Bulbapedia, 2018). The entries in *Pokémon Sapphire* (2002), *Black/White 2* (2012) and *Alpha Sapphire* (2014) date them from 20,000 years ago, which, as we have seen above (Table 1), is a clear exaggeration for the late parts of the Jōmon period.[4] However, the Pokédex entry in *Pokémon Ultra Moon* (2017) is much more problematic; it reads: "*The ancient people who made it apparently modeled it after something that descended from the sky*." *Pokémon*, of course, is not known for its scientific rigor (Tomotani, 2014; Mendes et al., 2017), but spreading ridiculous alien stories is irresponsible, to say the least (see also Box 1).

Another interesting appearance of the goggle-eyed dogū is in the *Shin Megami Tensei* series (henceforth *SMT*; Atlus/Sega, 1987–present), which includes the *Persona* sub-series. These games allow players to summon mythological monsters (and deities) from virtually all cultures around the world. Since it is a Japanese game, it focuses heavily on Japanese creatures. The goggle-eyed dogū from *SMT* is called Arahabaki (Fig. 12).

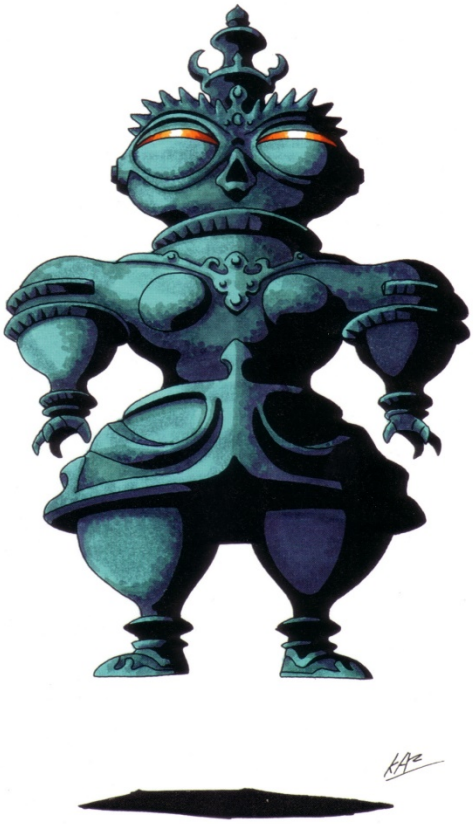

Figure 12. Arahabaki's official artwork from the *SMT* series. Source: Megami Tensei Wiki.

The entries about Arahabaki in the *SMT* games' lore describe it as a god (Megami Tensei Wiki, 2018), which we have already established is the less likely hypothesis. The game also refers to it as "he/him" (at least in the English translation), while clearly depicting it with a female body, like the original clay figurines. *SMT* uses myths as a basis for its setting and story, and infuse them with fiction, so it is hard to tell if their information came from somewhere or if they just made it up to fill a

[4] And talking about exaggerating dates, the Japanese archaeologist Shinichi Fujimura claimed to have found Paleolithic artifacts in Japan dating back to 600,000 years ago. However, it was later discovered that he fabricated his own artifacts and planted them on his excavation site so he could "find" them later (Romey, 2001; Normile, 2001).

narrative purpose. In any event, their description of the goggle-eyed dogū is off the mark.[5]

Last but not least, there's *Ōkami* (Capcom, 2006). The game is set in classical Japan and mixes lots of Japanese myths and folklore. In *Ōkami*, the goggle-eyed dogū (Fig. 13) is one among many demons that the player faces. The demon's entry in the game's bestiary (Okami Wiki, 2018) handles the matter much better than *Pokémon*: "*Of all the odd clay figures in this land, the Dogu is the strangest. Fascinated people have speculated that they originated on the moon*." Thus, the game makes clear that the whole alien thing is just a story made up by some crazy folk.

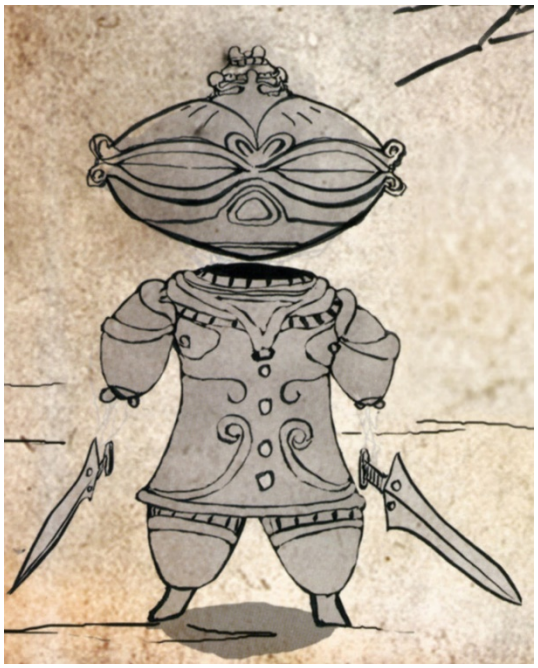

Figure 13. Official artwork of the demon "Dogu", from *Ōkami*. Source: Okami Wiki.

Dogū are also featured in several mangas (e.g., *Doraemon*), typically as the focus of one or a handful of chapters. However, one title features them prominently: it is called "Dogū Family" (translation) and was printed in the late 1980's and early 90's. The story focused on the everyday life of a family of goggle-eyed dogū in modern Japan. Unfortunately, I could not find the actual manga to read.

Dogū also appear in Japanese products and TV commercials, and there is even one TV show about them: *The Ancient Dogoo Girl* ("*Kodai Shōjo Doguchan*"; Fig. 14) and its sequel *The Ancient Dogoo Girls* ("*Kodai Shōjotai Dogūn Faibu*"). The series aired on MBS (Mainichi Broadcasting System) from 2009 to 2010.

Figure 14. *The Ancient Dogoo Girl* poster. Source: IMDb.

The series' plot is very basic Japanese stuff: Makoto, a hikikomori, finds a weird breastplate buried in the woods, touches it, and awakens a girl named Dogu-chan. She is a yōkai hunter

[5] Arahabaki's look was very different in early SMT games, such as *Megami Tensei II*, where it was depicted as a samurai of sorts. So maybe they just retained the name, alongside the original idea/description, and changed this monster's appearance to that of a dogū in later games.

from the Jōmon period and ends up living with Makoto. Dogu-chan has a familiar/assistant named Dokigoro (Fig. 15), which is a sentient goggle-eyed dogū that transforms into magical (bikini) armor for its master. The sequel had another five girls wearing armors based on other types of dogū.

Figure 15. A collectible figure of Dokigoro, from *The Ancient Dogoo Girl*. Source: HobbySearch.

The Ancient Dogoo Girl is a very weird and rather embarrassing show, even by Japan standards, as it involves a lot of breasts-based magic. I just skimmed through the first episode to write these paragraphs and already regret it. So if you are curious to watch it, know that you have been warned.

Aliens and bikini armor aside, it is amazing how Japan is always finding ways to keep its culture alive. Because of that, even prehistoric artifacts such as dogū still have a place in modern Japan – and not only a place in museums, as national treasures, but also as pop culture icons.

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Those figures presented here that were extracted from the Tokyo National Museum (Digital Research Archives: http://webarchives.tnm.jp/) and Wikimedia Commons, have been slightly modified (cropped, etc.) to improve presentation.

ABOUT THE AUTHOR

Dr. **Rodrigo Salvador** is a paleontologist and biologist, but is irredeemably fascinated with archaeology and mythology. Although his main "thing" remains Ancient Egypt, he is becoming increasingly drawn to the Jōmon and Yayoi periods of Japanese history. He has faced Japanese pre-historic monsters in many JRPGs, sometimes even summoning them to fight on his behalf – well, actually that last bit was just in *SMT*/*Persona*, because who on Earth uses a Claydol?

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One squid to rule them all

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When it was released in 2014, *Middle-earth: Shadow of Mordor* (Warner Bros. Interactive Entertainment) proved to be the game all Tolkien fans had been waiting for. Its sequel, *Middle-earth: Shadow of War*, released in 2017, improved and expanded the first game. Besides all the orc-slaying action, the game has a bunch of other activities, including the most staple of gaming side quests: collectibles.

Simply put, collectibles are items scattered throughout the game and completionist gamers go crazy hunting them. In most games, collectibles do very little or even nothing at all, but in *Shadow of War*, they reveal little tidbits of the game's lore. When dealing with any Tolkien-related story, we fans are always happy to have more information about the setting and this makes the collectibles in *Shadow of War* rather enjoyable.

One of these collectibles, a fossilized squid's beak, immediately and inevitably caught my attention. Since this fossil deserves more time in the spotlight than what it got in the game, I have devoted this article to analyze it more thoroughly.

Figure 1. The fossilized squid beak found in *Middle-earth: Shadow of War*. Credit: Monolith Productions / Warner Bros. Interactive Entertainment; screenshot from the game.

THE MORDORIAN SQUID

The fossil in *Shadow of War* can be found in Mordor and it represents a squid's beak (Fig. 1). In the game, the item is called "Kraken Beak Fossil" and is accompanied by the following comment by Idril, the non-player character responsible for the treasury of the Gondorian city Minas Ithil: "*Our patrols found this*

fossilized squid beak years ago. If it is proportional to the smaller squids that fishermen sometimes catch, the sea creature would be several hundred feet long."

The item is named a "Kraken beak" in allusion to the well-known fact that real-life giant squids were the origin of the Kraken myth (Salvador & Tomotani, 2014). So the characters in the game recognize they are dealing with a "giant version" of their common squids. But what exactly is a squid's beak? And can fossil beaks really be found in our planet's rocks? To answer these questions, we will need a little primer in squid biology.

SQUID BIOLOGY

Squids are animals belonging to the Phylum Mollusca, the mollusks, and more specifically to the Class Cephalopoda. Cephalopods are very diverse creatures and the group includes not only squids but also octopuses, cuttlefish, nautiluses and two completely extinct lineages: the belemnites and the ammonoids. Cephalopods live in seas worldwide (from the surface to 5,000 m deep) and are represented by over 800 living species; the fossil record, on the other hand, counts with 17,000 species (Boyle & Rodhouse, 2005; Rosenberg, 2014).

The first cephalopods appeared over 450 million years ago during the late Cambrian (Boyle & Rodhouse, 2005; Nishiguchi & Mapes, 2008). They achieved an astounding diversity of species during the Paleozoic and Mesozoic eras, but some lineages (ammonoids and belemnites) are now extinct (Monks & Palmer, 2002). Today, we have two distinct groups of cephalopods: the nautiluses, a relict group with just a handful of species, and the neocoleoids, a latecomer group that appeared during the Mesozoic and includes cuttlefish, octopuses, and squids (Boyle & Rodhouse, 2005; Nishiguchi & Mapes, 2008).

Squids are soft-bodied animals and their body is divided into three parts (Fig. 2): (1) the mantle, where most organs are located; (2) the head, where the eyes, brain, and mouth are located; and (3) the eight arms and two tentacles (the latter usually look different from the arms and can be much longer).

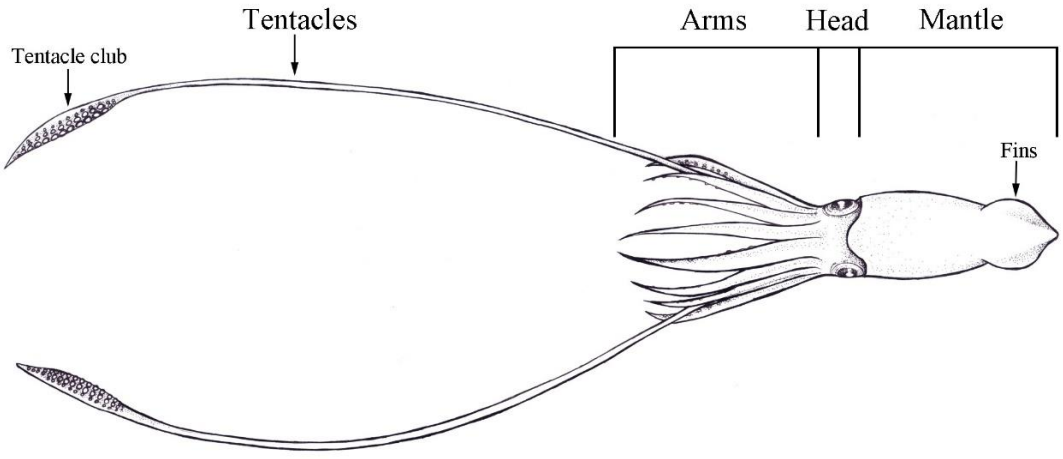

Figure 2. Diagram of a squid, with the names of their body parts. Credit: Barbara M. Tomotani; image modified from Salvador & Tomotani (2014: fig. 7).

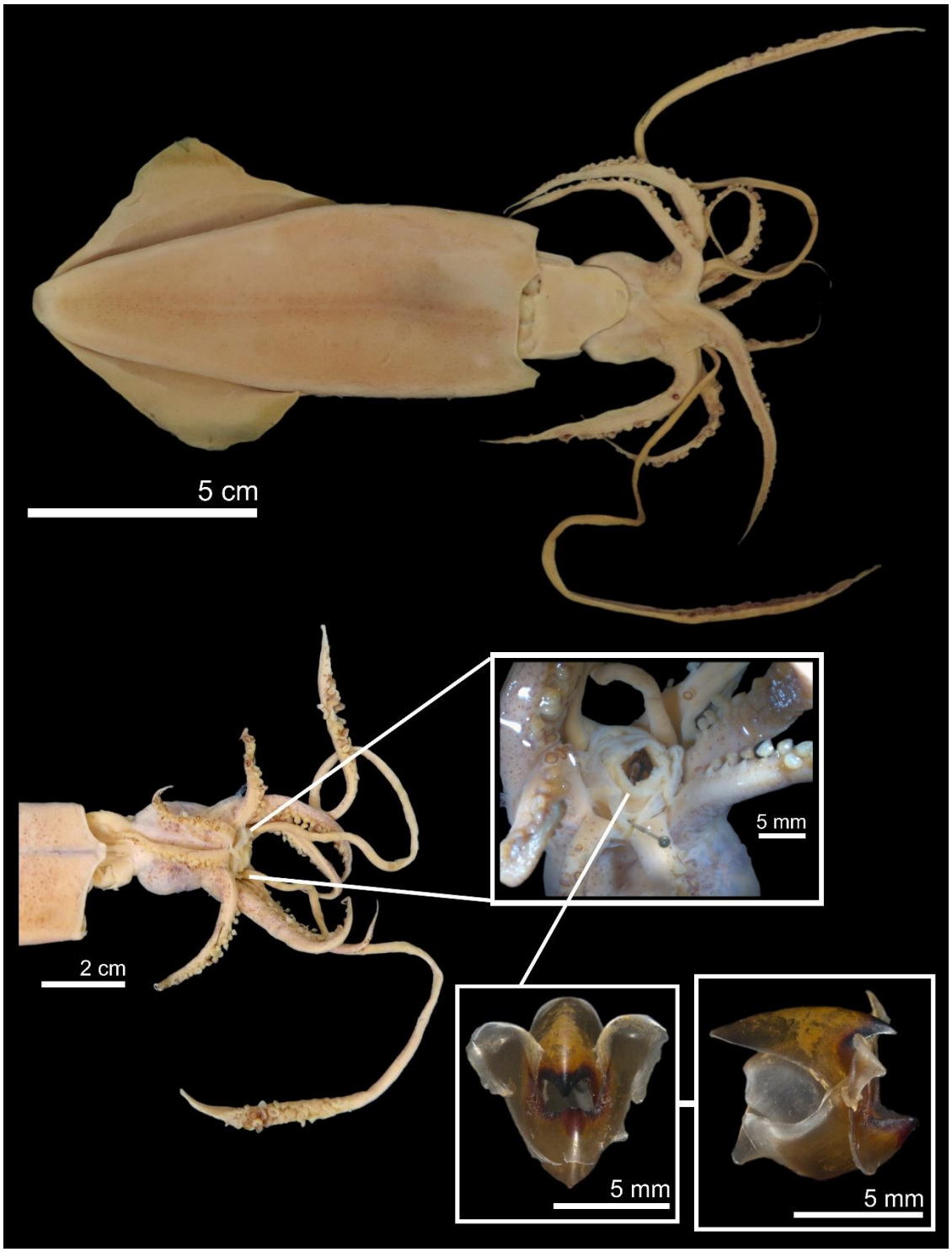

Figure 3. Example of a squid: a (dead) specimen of *Doryteuthis sanpaulensis* (Brakoniecki, 1984). Top: whole animal. Bottom left: mouth region (in the center of the ring of arms). Bottom right (upper inset): close-up of the mouth; the beak is barely visible. Bottom right (bottom insets): beak (removed from the specimen) in frontal and lateral views. The specimen is deposited in the scientific collection of the Museu de Zoologia da Universidade de São Paulo (São Paulo, Brazil) under the record number MZSP 86430. Photos by Carlo M. Cunha; image reproduced from Salvador & Cunha (2016: fig. 6).

The mouth of the squid is on the center of the circle formed by the arms. It contains a pair of chitinous mandibles, which together are called a "beak" because of their resemblance to a bird's beak (Fig. 3). Squids hold their prey with their arms, draw it towards the mouth, and take small bites off it using the beak. The beak and mandibles move by muscular action – they are connected by jaw muscles within a globular organ called "buccal mass" (Nixon, 1988; Tanabe & Fukuda, 1999).

Usually, the only parts of an animal to become fossils are the mineralized (and thus hard) skeletal structures, such as bone, teeth, and shells. Squids are almost completely soft-tissue animals and so are only preserved in the fossil record in exceptional circumstances. The beak of a squid is not mineralized; rather, it is composed only of organic compounds such as chitin (the same substance found on insects' exoskeleton) and proteins (Miserez et al., 2008). Nevertheless, the beak is reasonably tough and thus, it can become a fossil under the right circumstances. Indeed, several fossil squids (and neocoleoids in general) are known only from their beaks (Tanabe, 2012; Tanabe et al., 2015; Fig. 4) or their internal vestigial shell[1].

Therefore, it is plausible that a fossil beak of a squid could be found in Mordorian rocks. It could be argued that the fossil presented in the game is not morphologically accurate, especially the frontal part of the beak, which seems to be a single piece instead of two (Fig. 1), but we can disregard this here and accept the Mordorian fossil for what the game says it is: the remains of a squid that lived long ago. The game's description of the fossil implies that the animal would be huge – but how can we know the size of the animal only from its beak? And how big can a squid get anyway? I will try to answer those questions now.

Figure 4. The fossil beak (lower jaw, viewed from several angles) of *Haboroteuthis poseidon* Tanabe, Misaki & Ubukata, 2015, a squid from the late Cretaceous period (roughly 85 million years ago) of Japan. Image reproduced from Tanabe et al. (2015: fig. 7).

GIANT SQUIDS

Besides Idril's comments about the fossil in *Shadow of War* and how large the actual animal must have been ("several hundred feet"), we have no real indication of the fossil's size – no scale bar alongside its depiction, for instance. Knowing the actual size of a squid's beak allows

[1] Called "cuttlebone" in cuttlefish and "gladius" or "pen" in squids and octopuses, although some lineages have completely lost the shell. Other cephalopods, like the nautilus, have very prominent external shells, as is the norm for other mollusks (*e.g.*, snails, clams, etc.).

scientists to estimate the animal's size, based on data from recent species. For instance, Tanabe et al. (2015), described a new squid species based on a fossilized beak (Fig. 4). They named it *Haboroteuthis poseidon* and, by its lower beak of roughly 7 cm, estimated it to be the size of a Humboldt squid (*Dosidicus gigas* d'Orbigny, 1835), with a mantle length of 1.5 m – a giant in its own right. However, nature does not disappoint us in this regard and we have two amazingly huge species, aptly named Colossal squid and Giant squid.

The Colossal squid, *Mesonychoteuthis hamiltoni* Robson, 1925, is the largest living cephalopod species in terms of body mass. It is very bulky, weighing up to half a ton and maybe even more. The Giant squid, *Architeuthis dux* Steenstrup, 1857, is actually the largest invertebrate alive – it can reach up to 20 meters (about 65 feet) in length, from the tip of its mantle to the tip of its long tentacles. However, *Architeuthis* has a slender build and even though it is larger, it weighs less than *Mesonychoteuthis*. Centuries ago encounters on the open sea with *Architeuthis* left Nordic seafarers in awe, giving rise to the legend of the Kraken (Salvador & Tomotani, 2014).

But since Idril did not take her time to actually measure the fossil, we cannot estimate the body size of the Mordorian squid. Her estimate of several hundred feet is way larger than the "modest" 65 feet of *Architeuthis* and extremely unrealistic for any kind of animal (both soft-bodied and with a hard internal skeleton); thus, it can be dismissed as a guesstimate of someone without training in zoology. However, given the large "prehistoric" proportions of other animals in Tolkien's legendarium, such as wargs and oliphaunts, we could expect the Mordorian squid to be really big – but good old Biology would not allow a much larger size than *Architeuthis*.

But what about the Middle-earth canon? Did Tolkien provide us with some nice Kraken-like legends to settle this matter?

SQUIDS IN TOLKIEN'S LEGENDARIUM

Judging by videos and forum discussions on the Internet, most of the players that found the fossil in *Shadow of War* just considered it to belong to a monster akin to the "Watcher in the Water" from *The Fellowship of the Ring* (Tolkien, 1954a). Of course, that simply cannot be, because the Watcher is not a cephalopod; for starters, he is watching from a pool of **fresh**water. Its physiology and behavior do not really match those of cephalopods. The Watcher's physical description (Tolkien, 1954a) is vague enough to match virtually any kind of "tentacled" monster; people just assume it is a cephalopod because of the tentacles[2] (*e.g.*, Tyler, 1976).

In his Tolkien Bestiary, Day (2001) took a huge liberty and gave the name Kraken to the Watcher.[3] Tolkien, however, never mentioned a Kraken (or cephalopods) in his writings – and surely did not relate that name to the Watcher[4] (even in manuscript; C. Tolkien, 2002a).

As Tolkien scholarship is very complex, I reached out to the American Tolkien Society

[2] Since people always get this wrong, just let me clear things up: squids have 8 arms and 2 tentacles, while octopuses have 8 arms and no tentacles whatsoever.

[3] Day also took another huge liberty in using the opening verses of the poem *The Kraken* (Alfred Lord Tennyson, 1830) without giving proper credit to the poet.

[4] Being stricter, the Watcher, like the Nazgûl's flying mounts, remained nameless.

just to be safe. They confirmed the absence of krakens and squid-like beasts in Tolkien's works (A.A. Helms, personal communication 2017).

We must remember, however, that the video games (including *Shadow of War*) are not part of the accepted Tolkien's canon, which includes only the published writings of J.R.R. Tolkien and the posthumous works edited and published by his son Christopher. Games like *Shadow of War* are thus allowed to deviate from the core works and invent new things to amaze and surprise its players. And one of these things seems to be the fossil giant squid.

Therefore, we can think of *Shadow of War*'s squid as a new discovery: a new species hitherto unknown to Science. New species discoveries always get the public's attention, but few people actually know how scientists are able to recognize a species as new and what they do to formally describe and name it. So let us take a closer look at the whole process.

DESCRIBING A NEW SPECIES

The beaks of recent cephalopods have been widely studied by zoologists (*e.g.*, Clarke, 1962; Nixon, 1988) and so they provide a good basis for comparison when someone finds a new fossil. By comparing the morphological features of the new find with previously known species, it is possible to decide if it belongs to one of them or if it represents a new species.

Now let us imagine that the Mordorian fossil was compared to all known cephalopods and we discovered it is, in fact, a new species. How do scientists formally describe a new species and give it one of those fancy Latin names?

The science of defining and naming biological organisms is called **Taxonomy** and it deals with all types of living beings, from bacteria to plants to animals. Zoologists have long ago come up with a set of rules for describing new species; it is called the *International Code of Zoological Nomenclature*, or ICZN for short.[5] We are now in the 4th edition of the ICZN, from 1999. The "Code" gives us guidelines for naming species and for what is considered a good (or valid) species description. For a new species to be recognized by the scientific community, its authors (*i.e.*, the scientists describing it) have to provide a set of crucial information: (1) a description or a diagnosis of the species; (2) a holotype specimen; (3) the type locality; and (4) a scientific name. So let me explain each of these.

The **description** of a species is very straightforward: the researcher lists all the features (called "characters") from the species. This includes morphology (*e.g.*, shape, color), anatomy (*e.g.*, internal organs), behavior (*e.g.*, feeding habits, courtship), ecology (*e.g.*, preferred prey), habitat, etc. As Mayr et al. (1953: 106) put it, the characters listed in the description are limited "only by the patience of the investigator".

The **diagnosis**, on the other hand, is a list of just those characters that distinguish the new species from all the other species in the same group (like a genus or family). The word "diagnosis" comes from the Greek and originally means "to distinguish between two

[5] Botanists (and mycologists) have their own code, the *International Code of Nomenclature for Algae, Fungi, and Plants*. Bacteriologists have their code as well, the *International Code of Nomenclature of Bacteria*.

things" (Simpson, 1961). Both description and diagnosis are written in a peculiar telegraphic way, which will seem very odd for people not used to it.

The **holotype** is a single physical specimen chosen by the author to be the name-bearing specimen of the given species. That means the scientific name of the species is forever linked with that specimen and this will form the basis for the definition of the species. The holotype should ideally represent the species well, but this is not always the case: it can be an entire animal, such as a squid preserved in a jar of ethanol, or just part of the animal, such as the squid's beak. The latter case is especially true for fossils, where the whole animal is not preserved. Finally, the holotype should be preserved and kept in a museum or university collection, thus allowing access to anyone interested in studying it.

The **type locality** is the place where the holotype comes from; the more precise the locality (*e.g.*, GPS coordinates), the better. For fossils, it is also common to indicate the **type stratum**, that is, the layer of rock where the holotype was found.

Finally, the author gets to choose a **scientific name** for the species. The scientific names of species are formed by two parts; let us have as an example the species *Corvus corax*, the common raven. The first part is actually the name of the genus, *Corvus*, which includes not only ravens but also species of crows, rooks, and jackdaws. The second part of the name (*corax*) is called the "specific epithet". However, one should always remember that the species name is not simply *corax*. The word *corax* by itself means nothing unless it is accompanied by the genus name. Thus, the complete name of the raven species is *Corvus corax*.

When choosing the specific epithet, the author can use anything he wants, but most commonly people use a word that denotes: (1) a morphological feature, such as *Turdus rufiventris*, the rufous-bellied thrush (naturally, *rufiventris* means "rufous-bellied"); (2) the place where the species can be found, such as the Abyssinian thrush, *Turdus abyssinicus* (Abyssinia is a historical name for Ethiopia); (3) an ecological or behavioral trait, like the mistle thrush, *Turdus viscivorus* (*viscivorus* means "mistletoe eater"); or (4) a homage to someone, like Naumann's thrush, *Turdus naumanni*, named in honor of the German naturalist Johann Andreas Naumann (the suffix "-i" in the specific epithet is the Latin masculine singular form of the genitive case). The explanation of where the name comes from is called **etymology**.

Furthermore, when writing a scientific name, it is good practice to also include the authorship of the species; this means including the name(s) of the author(s) who originally described it. In the example above, the complete species name would be *Corvus corax* Linnaeus, 1758. Linnaeus is the scientist who first described the species and 1758 is the year he published the description.

So now that the formalities of taxonomy were presented, let us see how our new Mordorian species could be described. If the species in question cannot be placed in an existing genus, a new genus might be described and the same ICZN rules above apply. So let's start by naming the genus ***Mordorteuthis* n.**

gen.[6], which reflects the place where the fossil was discovered ("*teuthis*", from the Greek, means "squid").

The new species could then be formally described as ***Mordorteuthis idrilae*** **n. sp.**[7], named in honor of Idril (the suffix "-ae" in the specific epithet is the Latin feminine singular form of the genitive case).[8] The holotype would be the specimen recovered by Talion (Fig. 1) that originally belonged to the treasury of Minas Ithil. For safekeeping, the holotype should then be handed over to a decent academic institution, like the Royal Museum of Minas Tirith (yes, I just invented that). The type locality would be Mordor, close to the Sea of Núrnen; the type stratum, however, remains unknown, as this information is not provided in the game (it is suggested, however, that the fossil was found on a beach of the Sea of Núrnen). The diagnosis should give a list of features (such as its large size) that can distinguish it from other fossil squids from Middle-earth; a hard task, given that this is the very first fossil squid described from Middle-earth. The description would be a full account of the fossil's shape, proportions, and fine structures; this can be boring even for trained taxonomists, so I won't do it here (for an actual example, see Tanabe & Hikida, 2010).

Finally, we might glimpse some information about the squid's habitat: the fossil was found close to the Sea of Núrnen, which is an inland saltwater lake, like our Dead Sea (Tolkien, 1954b). Both the Sea of Núrnen and the Sea of Rhûn to the north are thought to be remnants of the old Sea of Helcar from the First Age (Fonstad, 1991; C. Tolkien, 2002b).[9] The Sea of Helcar would be much larger and thus, perhaps a fitting place for large squids to thrive. Besides, its old age makes it a likely point of origin for a fossil.

Of course, a new species description is only valid if published in the scientific literature. Therefore, our little flight of fancy with *Mordorteuthis idrilae* here is not a valid species description, but it can sure serve as a nice introduction to taxonomy and to how scientists describe new species.

Finally, it is always worthwhile to mention that several taxonomists have paid homage to Tolkien by naming their genera and species after characters and places from his writings (Isaak, 2014). For instance, we have the genera *Smaug* (lizard), *Beorn* (tardigrade), and *Smeagol* (snail), and the species *Macropsis sauroni* (leafhopper), and *Bubogonia bombadili* and *Oxyprimus galadrielae* (both fossil mammals). But there are many others. That may be inevitable in a sense, as several nerds end up becoming scientists. In any event, geeky names such as these sure make an otherwise arid science a little bit more colorful.

[6] The abbreviation "n. gen." after the name means "new genus" and indicates that the genus is being described here for the first time.

[7] Likewise, "n. sp." means "new species" and indicates that the species is being described here for the first time.

[8] The nomenclatural acts on this article are presented simply for hypothetical concepts (a Middle-earth squid) and are disclaimed for nomenclatural purposes, being thus not available (ICZN Articles 1.3.1 and 8.3).

[9] In earlier writings, the names are usually spelled Nûrnen and Helkar.

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Dr. **Rodrigo Salvador** is a malacologist who has made his peace with the fact that virtually no one knows what a malacologist is. In case you’re wondering, it means “a zoologist specializing in the study of mollusks”. Despite being a Tolkien fan through and through, he does think that Middle-earth could use more zoological diversity.

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