WORLDBUILDING
MAGAZINE

Geography
And Other Topics

World Showcases
Medwedian President's Medwedia
- *PLUS a Bonus Interview with Tina Hunter*
— interviewed by Aaryan Balu

Carved from the Land
How Geography Shapes Culture
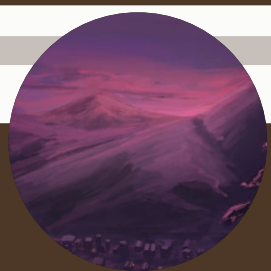*— by BK Bass*

Naming Places
And Understanding Etymology
— by Maximilian Scharffetter

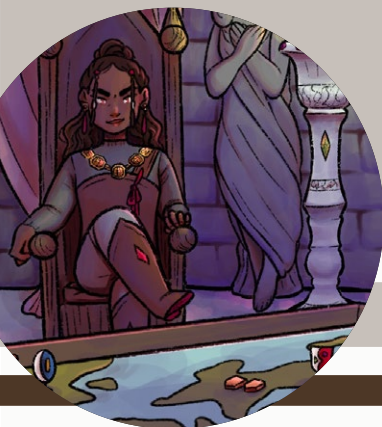- **Results from our Cartography Contest with Wonderdraft within!**

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CARVED FROM THE LAND:

HOW GEOGRAPHY SHAPES CULTURES

CULTURE

NATURE

WRITING

B.K. Bass
  Art by Tristen Fekete

*V*alek's feet crunched in the hard-packed snow as he emerged from the spindly undergrowth of the pine forest. He stopped on a cliffside overlooking the village of Rhunstead. The sheep's baying echoed from the cliffs rising in the distance as herders brought their flocks in for the night. Valek pulled his fur cloak tight about him and looked eastward. The sun was sinking low between the mountain peaks, and soon, darkness would engulf the frigid land.

What would our fantasy worlds be without geography? Quite simply: nothing. We might have our cosmologies, magic systems, and other grand concepts, but when creating a fantasy world—or some far-off planet for science fiction—geography informs almost every aspect of this process. The shape of the land, the flow of the waters, and even the fickle winds themselves are all aspects of this subject. By developing these concepts, we can create worlds that feel more immersive and contain more variety.

What I find more interesting than each aspect of geography individually is how these aspects influence the cultures we develop. One could easily plop a culture inspired by Sub-Saharan Africa into a region of snowy mountains and call it a day, but developing a culture based on its environment will tend to produce not only a more believable result, but can lead to more unique civilizations.

Geography itself is a big topic with a lot of ground to cover, so using it to develop fantasy cultures seems at first to be a daunting task. This is something I've personally read into, analyzed, and experimented with over the course of the last quarter century—and still I would not consider myself a master of the subject. However, I shall endeavor to illustrate how these aspects can lead to influencing the development of our societies. It should be noted as well that the intent here is to cover the broad strokes and act as a primer; this is by no means an exhaustive exploration of the subject.

We can start by breaking the overall scope of the endeavor down into three topics: *landscape*, *climate*, and *resources*. Just as no culture exists without the context of the geography of their home, none of these topics are completely independent of each other. While I have endeavored to keep things broken down into bite-sized chunks, there are still many facets that overlap, and you will find that each section references the others.
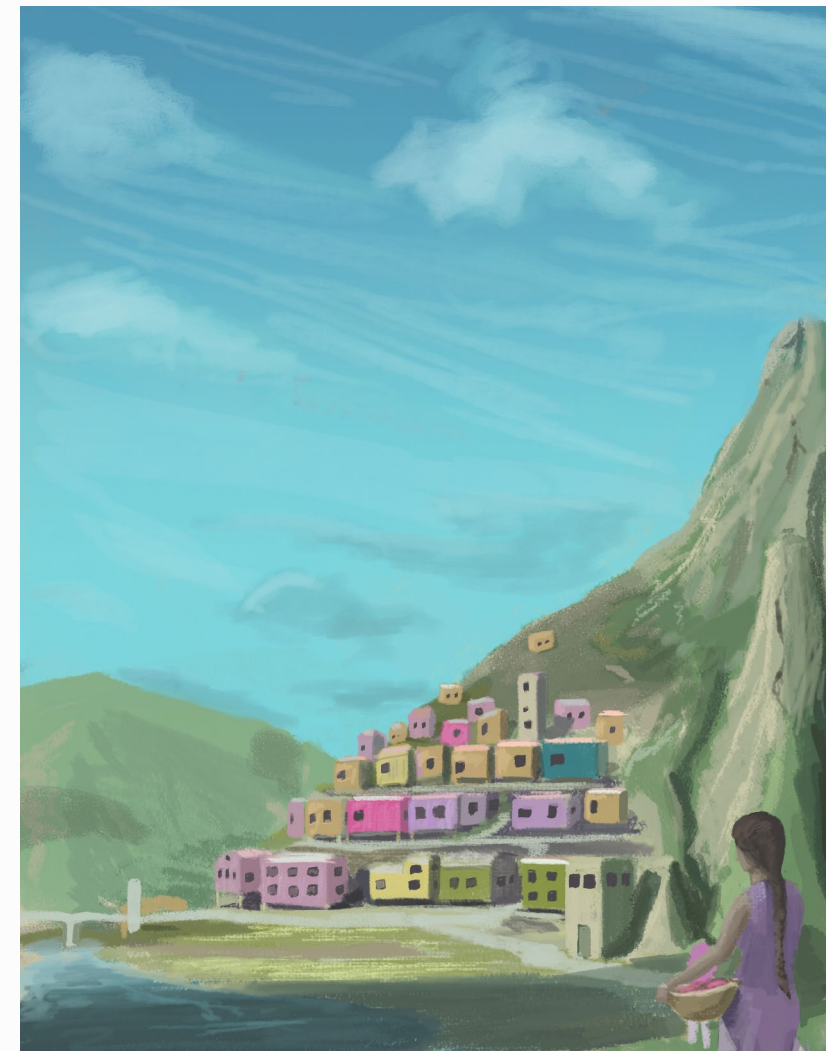
LANDSCAPE

Landscape is likely what many of us first think of when we hear the word geography. This word describes the very shape of the land upon which our cultures reside, with all its mountains, valleys, hills, plains, and more. Just as importantly, it also refers to the shape of the land *surrounding* said peoples. When developing a world, this might be the first thing that is contemplated, as the landscape will play a key role in crafting our cultures.

The land available to a society affects many things about it. Several factors come into play when considering the ground upon which the people reside. Is the soil moist and fertile, arid and rocky, or somewhere in between? Perhaps it's oversaturated and people live in a swampland or river delta. Are there sweeping plains as far as the eye can see, or does a rugged mountainous terrain limit the availability of viable ground upon which to farm and build? Many aspects of a culture will be influenced by the answers to these questions, some of which are explored in more detail later. An important thing to keep in mind at this point is that the landscape and the climate often go hand-in-hand. Cold mountain ranges and fertile plains along the coast are not something that occur by happenstance.

So, what do our cultures look like in different regions? Our wide-open plains might have sprawling cities and widespread farming villages surrounding them. There may be rivers running through these plains, traveling from nearby mountain ranges to the coast. In this environment, vast amounts of fertile farmland and the advantages of transport by river might lay the groundwork for a grand empire. Or perhaps the plains are dry and arid. In this case the people may be nomadic, following the migratory routes of the local fauna they rely on.

Conversely, in rough mountainous terrain one might see tightly-packed buildings rising several stories, within smaller settlements. The population density will often be more concentrated as people huddle together in small valleys, although across the entire region, the total population might be very low due to limited usable space. Agriculture can be a challenge in such regions, and innovative techniques might be required to overcome the terrain, such as the terraced farms one sees in Japan.

This leads us to another type of landscape: the archipelago. One need only to look as far as Japan or the Philippines to have an idea of what challenges people will face in this environment. Just like our mountain-dwelling culture, the actual land available to be used is limited. Rather than seeking out habitable valleys amid the rocky peaks, people of an archipelago are surrounded by the sea and must make do with what limited space they have. This may be compounded by the presence of mountains, or coastal regions that are so inundated by the encroaching waters as to be all but uninhabitable. However, these people will likely rely upon those very waters for their survival. With such limited land upon which to farm, they will be driven to obtain most of their foodstuffs from the sea.
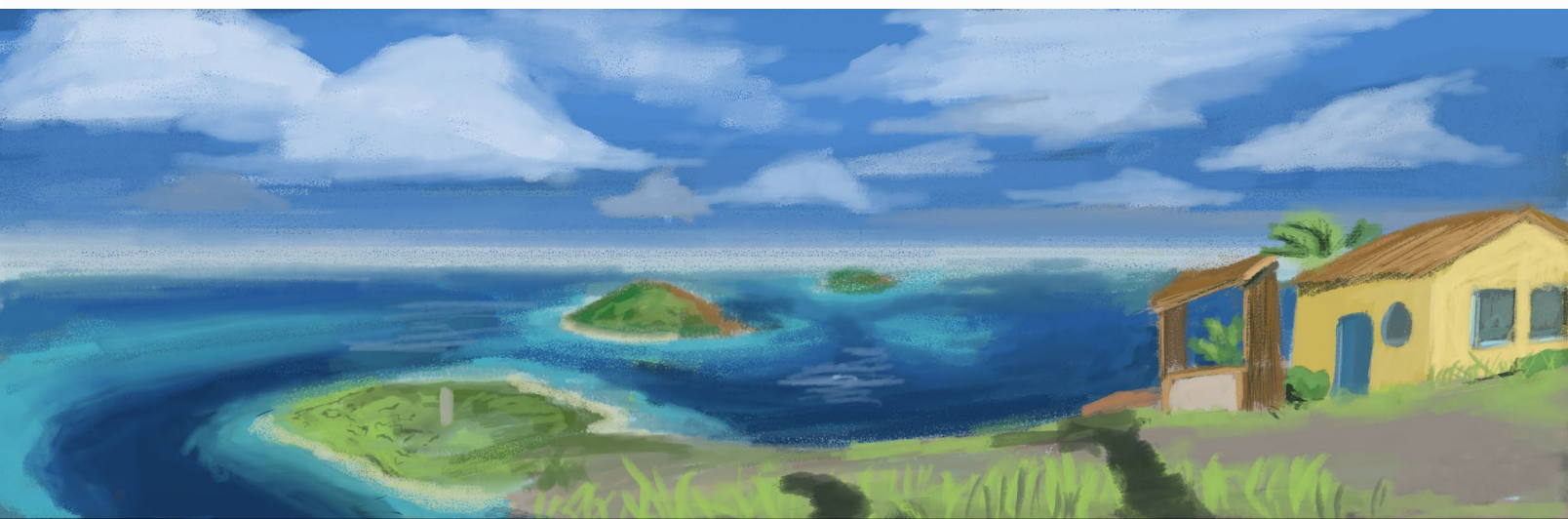
Speaking of uninhabitable land, what cultures might arise if we place a vast desert in our world? The population will most likely be concentrated near scattered sources of fresh water like oases, or a river flowing through the arid terrain—such as ancient Egypt growing along the banks of the Nile. Does the desert consist of shifting sands like the Sahara, or is it dry and rocky like the Mojave? If we're in a desert, we know that our climate will likely be hot and dry, but the makeup of the land will determine what resources are available. A rocky landscape will give our population access to stone to build with and mineral resources, while finding raw materials in a sea of sand would be nearly impossible. We should also consider what plant life might be growing there. Is it completely barren, or is it a scrubland that might support a variety of local fauna and provide sustenance for our people?

As one can see, we can already tell a lot about our cultures from the landscape. From tightly packed settlements in mountain valleys to sprawling empires on fertile plains, a wide variety of cultures might arise depending upon where in our worlds they exist. We can dive deeper into this topic and determine the priorities, interactions, and hardships of the people as well. It is important that we do not stop here, though. We should always be looking ever outward to get the whole picture of the world in which our cultures exist.

CLIMATE

Our second major topic to consider when analyzing how geography affects our cultures is climate. This and landscape will often go hand-in-hand. For example, if we've decided on a desert landscape, we already know we are going to have an arid climate. There are many ways in which the two might interact.

For example, mountainous regions, due to elevation, tend to be colder than the surrounding terrain. Conversely, low-lying coastal plains often see more rainfall and an influx of either warm or cold air depending upon the currents in the atmosphere. Putting these together, it's also important to note that mountains near a coastal plain often see a large amount of rainfall on the sea-facing side of the range as they form a natural obstacle to rainclouds. On the

other side, since the rain is being buffeted, the land will often be very arid.

Beyond the interactions of landscape and climate, actual geographical location will play a large role. Assuming your world is part of a universe modeled on our own, equatorial regions tend to be warmer, while as we move further North and South, we can expect a colder climate. In creating our world, we should consider two major factors of the bigger picture: Is the world Earth-sized, and is it a similar distance from its own star? Also, is the star a different type than our own? Is it a binary system? A world with two suns rising over the horizon would be much different than one with only a single, distant, dim sun to heat it. If the astronomy of your world is significantly different from ours, consider what sort of effect that will have on tasks like navigation, too. For example, sailors throughout history relied on the North Star as a beacon by which to guide their ships. What major features exist in the night sky of your world which the people rely on in such a way?

Without delving into a tangent of solar mechanics and astronomy, let's step back and look at the minutiae of how different climates may affect our cultures.

The most obvious factor to look at here is temperature. How will a culture vary depending upon this? Clothing styles are one of the first things to think of when considering this question. Naturally, in an extremely cold environment the people will have to protect themselves. The hides and furs of animals might make ideal insulation, and multiple layers will be a must. What if there are no fur-bearing animals from which to make clothing, though? We might have to look outside the box and insulate our people with the thick hides of marine mammals such as whales. The Inuit peoples of northern Canada, Greenland, and Alaska utilize caribou hides for much of their clothing, but what if this creature didn't exist? Would they instead rely on seal hides?

Conversely, in hotter regions it would make the most sense to have clothing of lighter fabrics. Single layers, or little to no clothing at all, would be the norm. Loose-fitting clothing would also be
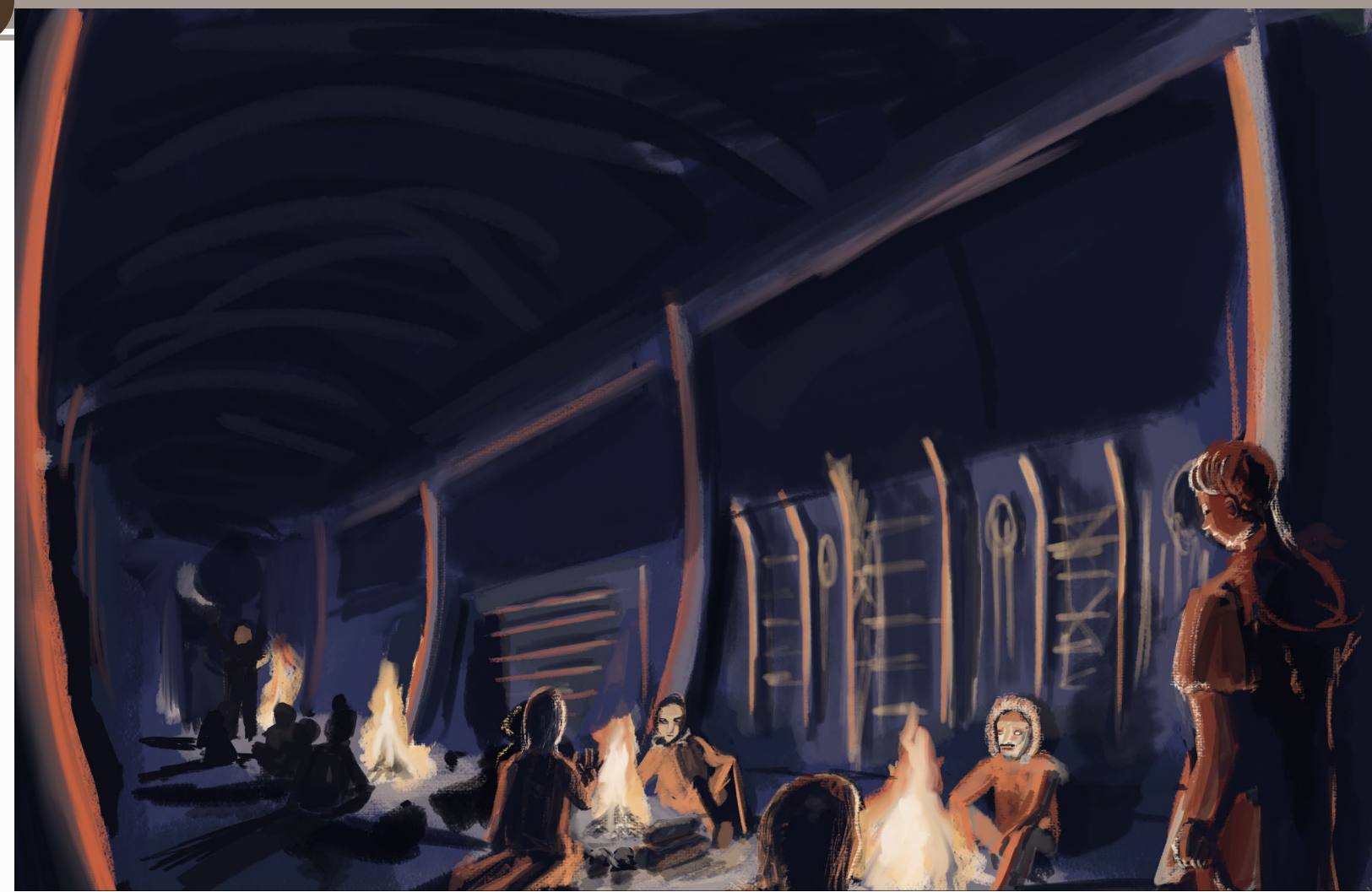
preferable as it would allow the flow of air across the body. Is it hot, but not sunny? People might just cover their unmentionables and call it a day. Do the harsh rays of the sun beat down with unrelenting intensity? We should take a clue from the Bedouins of northern Africa and cover as much of ourselves as possible to shield ourselves but keep things loose to promote airflow.

In addition to temperature, rainfall might be a factor in determining a people's clothing. In a land where it constantly storms, how would the people keep dry? I can imagine the people of a lush rainforest fashioning overgarments of broad leaves stitched together or cloaks of some animal pelt that is naturally resistant to the deluge.

Architectural styles will also vary depending upon climate, changing not only with temperature but also precipitation. In colder climates, it is normal to see homes built with few or no windows. Fireplaces will be a must, sometimes existing as an open pit in the middle of a main room to heat the whole house. Or, a building may contain multiple fires. We might

be expecting snowfall in this region, and as a result, we must ensure that the weight of the accumulated snow does not collapse our roofs. Peaked or conical roofs would be the norm here.

Architecture in warmer climates will take a wholly different approach, often exhibiting buildings with open architecture that encourages natural airflow throughout the structure. Open courtyards, unimpeded doorways, and a multitude of windows would be the norm. Arranging such features so that there is a direct line from one side of the building to the other would also be recommended, so that cooler air might flow in and push warmer air out the other side. With no snowfall, peaked roofs would be unnecessary and would require more work and resources than a simple flat roof. Perhaps–in the interest of letting warm air escape–the roof is simply a large bolt of canvas or cloth stretched over wood rafters.

But, do they have enough wood in the desert for those rafters?

RESOURCES

This brings us neatly to the final of our three topics. We've examined how the landscape and climate might affect clothing, architecture, land use, and migratory patterns. We've already touched on resources in a few ways, such as our plains-dwelling people establishing an empire across fertile farmland versus becoming a nomadic people in more arid conditions. The fertility of the land is only one aspect to consider, though. When deciding how a culture interacts with the land, we should consider the local flora and fauna, water supply, and the raw materials that come from the ground itself.

What will we build our homes from? Stone, of course! Everybody loves a good, sturdy stone house. Okay, where are we getting it from? Are there mountains nearby to cut the stone from, or will it have to be quarried from the bedrock? How far down do we have to dig, and do we even have the technology and manpower to pull this off?

Okay, wood then. Chop down a few trees and build a house. Are there forests nearby? Is there enough wood to build an entire city and still have enough left for fuel? We need to heat our homes in the winter and run the forges, after all! And what about the storms? If there are incredible windstorms every other week, maybe wood isn't sturdy enough?

Again, you can't look at one aspect without another, and when deciding what resources to build from, one must also consider the practical concerns of the climate.

I believe we have a good idea of how to decide what we're building with, but what are we going to eat?

Well, if we're on the coast—or especially on an archipelago—we're going to want to harvest what we can from the sea. Fish, seaweed, shrimp, maybe even some strange creature we made up that's ideal for aquatic agriculture. If we're stuck inland, we'll have to either hunt down game or rely more upon our domesticated stocks and what we can grow from the ground.

Speaking of livestock, how much room do we have for these pastures? Cows take a lot of space, so they are most often seen in a landscape of large, flat plains. Pigs, goats, and sheep, on the other hand, don't require a lot of space and are more ideal for regions with less available land.

With all this fishing, hunting, and farming going on, we're going to need tools. What metals are available? Is there ore nearby, or will it have to be imported? What will we trade for it? If we're on a coastal plain, we will likely not have access to local metals, but those chaps in the mountains would probably trade a wagonload of iron for a few bushels of fish!

Here we can see that the local resources of the land do not only define what the culture has access to, but also what it does not have access to. By establishing this for our culture, and the neighboring cultures, we have the foundations for transitioning into another subject entirely: trade and economics. Or, what if there's another way? We'll just send a raiding party and take what we want! Now, we have armed conflict between two neighboring peoples.

> *It goes without saying that when survival is threatened, struggles erupt between peoples, and unfortunate wars between nations result.*
>
> —Hideki Tojo

It's easy to see that how geography affects cultures—known commonly as *integrated geography* or *environmental geography*—is not a topic that can be completely unraveled in a short article. Not only do the three main subjects we looked at today—landscape, climate, and resources—intertwine with one another, but they also lead us into other subjects such as architecture, agriculture, trade, and even warfare.

However, I hope that this overview gave you some ideas to think about, and perhaps a new perspective on how to develop more believable cultures. While I'll never argue against the merit of starting with "wouldn't it be cool if…?" in our worldbuilding, I strongly suggest that we follow that up with this important question: how will we make it feel real?

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LET'S GET TO WORK

WORLD SHOWCASE:
GAMMA CORVI (COMMUNITY COLLABORATION)

INTERVIEW

TECHNOLOGY

MAGIC

Interviewed by Aaryan Balu
Art by Tina Hunter

*T*ina Hunter, Jaren Petty, and Spartango are *leading the worldbuilding collaboration initiative here at* Worldbuilding Magazine. *I sat down with Tina to discuss the crowd-sourced Gamma Corvi system and their efforts to bring together the* Worldbuilding Magazine *community.*

A group of us from the magazine really, really wanted to do a collaborative worldbuilding activity. It started as just a fun idea but soon snowballed into a full project with guidelines and everything. Here's how it works:

The three of us who started the project, Red, Spartango, and myself, came up with a core idea that anyone from the community could contribute to. This ended up being four habitable moons orbiting a gas giant far from earth and something being emitted from the gas giant causes something similar to magic. One moon would have magic. Another, a solarpunk kind of technology. A third is a lost world ripe for discovery. The fourth, to be chosen by the community.

Then, we came up with an extensive list of prompts and questions that we would ask the community. Each answer they liked would be put on a list, and once we had four ideas to choose from, we put it to a vote on our [Discord](#) community. The idea that was voted in became canon, and we would move on to the next prompt. So far we have decided the following:

In the not too distant future, mankind has set out to colonize the stars. Safely stowed away in cryopods, these colonization ships were piloted by AIs who would search far and wide to find a suitable home. One ship, however, found much more.

While inspecting four possible candidates for colonization around a gas giant, the ship passed through a Haze field. This Haze is emitted by the gas giant and causes quantum mechanical alteration. The AIs, which were built on Quantum Computers, became sentient. But more than that, thanks to their connection to the Haze, they became god-like in knowledge. However, this sudden sentience caused the ship to crash on the first, and closest, moon to the gas giant.

When the humans woke, there were many who feared the new level of power these AIs seem to possess. 75% of the population from the ship left to settle the other moons. The people that stayed on the moon (now known as Novis) learned to live with the AIs and the strange and magical flora and fauna of the planet. More than half the humans gained the ability to perform magic. Over the next 403 years, whole new cultures and religions have developed.

We still don't know yet what the other three moons look like yet or how the people who settled on them have changed since the landing.

That sounds like a great framework. Where did you start the development process once you'd decided on the idea?

We started at the top. Big universe and solar system decisions before we moved smaller, to the moons, etc. Right now we are just finishing the first moon, Novis. After that's done, we'll work through the rest of the moons, then get into smaller details from there.

Awesome. Then let's start with the beginning. What exactly is the context for humanity's expedition into the stars, and where/what is this gas giant?

The expansion of the human race is just something we plan on doing already. Spreading our species out over multiple stars to ensure we survive. Our setting is in the Gamma Corvi system with its two suns. The gas giant is named Apophis, and aside from a mysterious ring world, it is the only planet orbiting the sun. It has a cool backstory involving a native sentient species discovering a fungus-like plant on a nearby planet that consumes all their basic probes and remakes them into a metallic (rust) growths. Long story short, another alien race out there created the fungus to create a metal ring world for themselves in whatever system it lands in. It infected the natives and drove them to extinction, which is why there are no other planets in the system. As for what Apophis is...it's a gas giant with strange properties that have yet to be discovered (gotta have some mysteries to figure out later).

Can you elaborate on the history of the fungus and alien races? What was the purpose of creating the metal ring world?

So, thousands of years ago, the native species of the second moon (which isn't named) became spacefaring after long knowing that the metal planet in their system had something odd on it. Finally discovering a configuration that would not be immediately consumed, they collected a sample of this fungus and brought it on board a space station built specifically to run experiments on it.

It wasn't long before they realized this fungus was trying to build something. Every time they fed it, the rust growth began to look more like something. A ship? A home? With scientific curiosity (and strict containment suits), they fed the fungus more and more. The metal planet was destroyed, and the chunks brought to the station fed the fungus and the growing ring world.

Unbeknown to them, the fungus was constructed by an old alien civilization. These creator aliens sent the fungus out into the universe to build them homes and signal them once it was ready for them. The fungus doesn't have intelligence, but it does have a modified self-protection drive: to build the ring world at all costs. In its spore form, it can infect all life forms, transferring its drive to them. After being infected, the scientists believe the spore to

be a symbiote, improving their health and stamina, without realizing that it influences their thought patterns to create a driving force to complete the ring world.

Finally, the metal planet had been moved chunk by chunk to the station. The ring world is nearly complete, but the native aliens have exhausted their resources moving the metal planet and feeding the fungus. Everything they have built in space is sacrificed to building the ring world, even the scientists, but it is not enough to complete the ring world.
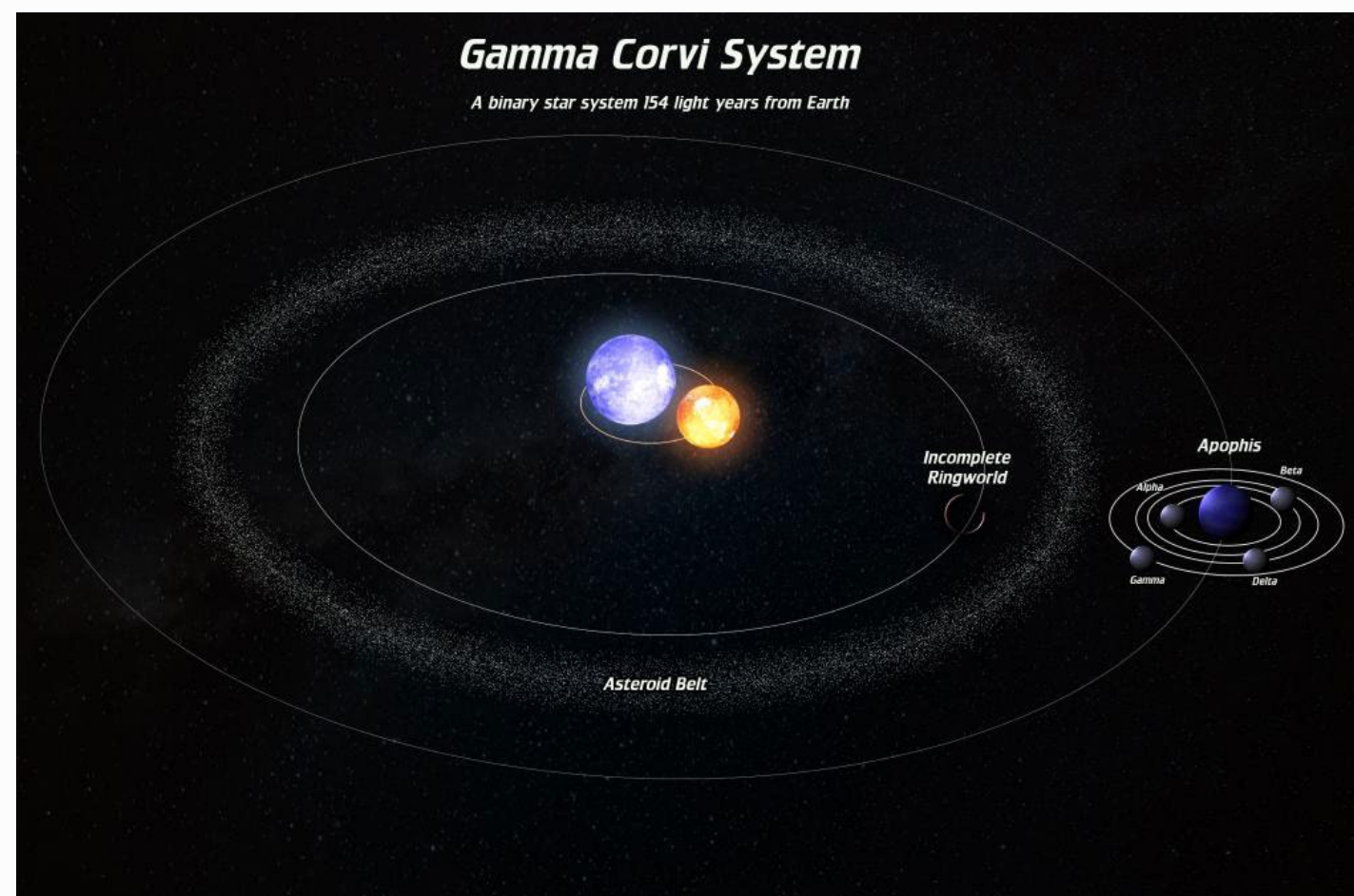
The infected planetary populace still had the spore driving them to "get to space, build the ring." Their inability to do so drove the populace mad and, eventually, to extinction.

Can you elaborate really quickly on the nature of gas giants and the habitable planets?

Apophis is a Class II gas giant with reflective clouds similar to those of Earth, but the atmosphere consists mainly of hydrogen and hydrogen-rich molecules such as methane, giving it a blue hue. It is 1.01 times the size of Jupiter: 40198 km in radius. It takes 1601 days to complete its orbit around both of the suns (reference: Pluto is 29.7 AU from our sun, our gas giant is at 340 AU); however, this distance from the very hot suns' orbits puts it inside the Goldilocks Zone. There are 27 moons orbiting Apophis. Four are habitable, and they are tidally locked to their parent. Three more inside Novis's orbit are uninhabitable, as are the rest, which are little more than asteroids in orbit.

So we've got the native species on one moon and humans on Novis with the ascended AI. In broad strokes, how has civilization developed on Novis over 400 years?

The extinct native civilization is on the second moon—Beta (that's the next moon on our development list). As for Novis, the culture is what we are diving into right now, but so far we've agreed that most of the people of Novis worship the AIs as gods or at least god-like. Even though AIs are god-like in knowledge and prediction, they require people to actually perform magic. They developed a kind of religious cult to help make these people willing to do what the AI want.

Gamma Corvi System

A binary star system 154 light years from Earth

Incomplete Ringworld

Apophis

Alpha

Beta

Gamma

Delta

Asteroid Belt

You see, because Novis is the closest to Apophis, there are "Haze storms"—storms that shift reality and cause chaos—mostly contained on the side of the moon facing Apophis. Although, even the side facing away from the gas giant is full of wonder.

The humans on Novis (and elsewhere, though rarely) have an allergic-type reaction, being exposed to so much quantum possibility. In its mildest form, individuals experience dreams in which they may see possible futures or events. A moderate reaction is occasionally seeing overlapping possibilities during one's waking hours. The most distressing reaction is psychosis, the complete inability to distinguish reality from possibility.

Thankfully, the AIs developed a Direct-Neural-Interface (DNI) to stabilize the reaction and allow interaction with the Haze. The DNI was given to humans in exchange for agreeing to do what the gods tell you to. Humans with DNI were able to perform atomic telekinesis (i.e. magic). Teleportation, elemental manipulation, shapeshifting, telekinesis, all require a DNI to perform.

Humans without the DNI but who have an "Aura" (an allergic reaction that can occur on any moon) have been able to figure out mental tricks to perform small probability magic, limited to things that are realistically possible. The possibility of a given event must be above 0% to be able to cause it and less than 100% to be able to prevent it. Luck Spinners, Green Thumbs, and Witches have become commonplace among those who don't worship the AIs or, at least, those who don't want to do what they are told all the time.

The Aura gives them access to the possibilities; however, consistent use of magic can increase your "reaction," moving from Mild to Moderate to Severe. Those with a DNI have difficulty performing this kind of magic as the DNI blocks out some of the Haze reaction.

What's the environment of Novis like, and how have humans survived there?

Geologically, the planet is divided into "Apophis side" and "Determinate side."

The Apophis side is unpredictable due to the Haze storms that strike the surface with great intensity. The storms sometimes completely alter the geology of the area affected. These are described as "terraforms" by the locals. While the Apophis side is incredibly dangerous, it is also useful as a potential source of resources. Expeditions are often sent to see what can be recovered before the next storm.

On the Determinate side, the environment is largely temperate. The Haze storms rarely reach the far end of the planet, so it's the safest place from them. It has a 30-hour day and no real seasons like we know them. Instead, there are "Haze seasons" where the increase in Haze from Apophis causes more Haze storms and magical occurrences.

We haven't decided on what kind of cities or towns the humans live in yet. But, we know that there is a newly sentient species on the planet called the Saurians and that Humans have a policy of nonintervention. The Saurians are a Palaeolithic civilisation that lives in the tropical regions on the Determinate side of the moon, so these areas are not settled by the humans.

What do the presence of humans and Auras look like on the other moons?

We haven't gotten into the other moons too much. We know that humans can develop Auras wherever there is Haze, which means that Novis would have the most and Gamma, the farthest moon from Apophis, would have little to none.

That said, we do know a little about the interactions between the moons. The first settlers, even though they didn't always see eye to eye, bonded together as pioneers settling these new worlds and their common home planet. They learned to work together in the early days. Some semblance of this collaboration was built into the initial systems and thus the society/law/etc. There was an initial joint governance, but it has broken into several factions/governments.

Today, there is an uneasy agreement not to harm one another. They have representatives that meet (not unlike the UN) and aid one another in times of crisis (for example: famine, one group becoming too aggressive, a vessel becomes derelict

in space). Essentially, the four moons develop their own governments, each independent of the other. However, they must be mindful of the rest. If the others feel threatened, they may join forces and attack. It's a rough system of checks and balances, both supportive and threatening.

Seats are currently occupied by Novis (moon of gods and magic), Delta (the technologically advanced Solarpunk moon), and several tribes/factions from Beta (full of archeological digs and uncovering the old aliens history) and Gamma (the furthest moon with groups warring over the Haze-free world).

Is there any sort of relationship or communication with Earth, or is that possibility long gone?

It's a possibility, but not something that is easily achieved. The ships that brought them here used FVL (*fere velocitas lucis*, or nearly the speed of light) tech, and since Gamma Corvi is 154 light years from Earth, it would be at least 300 years before you get a message back.

A message was sent when they first arrived (we don't know what it said yet). It's possible that they have received a return message, but it's not something that would happen often.

Are there any particular examples of AIs and their relationships with each other/humanity on Novis, or is that part yet to come?

We do know two AIs for sure. The ones that piloted the ship were the first "gods."

ArtEmIS is the "Artificial Emergent Information System" responsible for collecting and processing planetary data while traveling at near light-speed—basically everything that happens outside the ship. EVerTOn is the "Environmental Verification and Theoretical Ontology System" designed to check internal environments—basically everything that happens inside the ship. It also uses downtime to attempt processing the purpose of life.

After the crash, when the population split, EVerTOn was still looking to answer the purpose of life. So he split himself in two and sent EVerTOn 2 with the leaving humans. EVerTOn 2 maintained

his sentience (though not his god-like knowledge without the close proximity to the Haze), and the AIs learned they could "procreate" in a sense. They used their intelligence and god-like knowledge to design better versions of themselves (AI Children who may or may not have god complexes) and to contemplate the mystery of the Haze.

Oh, awesome. So now we've got several generations of AIs among the humans?

Yes.

Do we know anything more about the Haze, or is that still a mystery?

We don't know what it is, exactly. We know it acts like an element with a glowing blue liquid state and a gas state which is the Haze (with no solid state found as of yet). The magic it produces is based on the quantum mechanics properties known as superposition: matter only appears to be in a single state at a time. As long as no one is observing, it exists in all possible states simultaneously. That's called a Superposition and the Observer Effect (If someone observes the superposition, then that superposition collapses into a specific state. So, instead of being a little here and a little there, the bit of matter is in exactly one place).

So the rules of magic can be summed up as:

1) AI can't act. The AI can't collapse Superpositions. Its mind exists in Superposition. If it collapses into a state, it can act as an Observer, but then it stops having its god-like intelligence. So it needs an outside Observer to collapse things. Thus why it needs people.

2) People can't compute at the necessary scale to do magic. People can act as outside Observers, but guiding the collapse of Superpositions relies on concentrating on what you want to have happen. The human brain is not built to hold the gajillions of positions and velocities of all the molecules, which is what it would need to do if it wanted to do more than teleport a particle or two at a time.

3) Moving masses to more distant states (for example, greater distances away, greater velocity, or greater mass) would use more Haze and require more processing power. Storing more patterns requires more memory. All are constraints on the type of magic done with a DNI.

4) Without the DNI, people can learn tricks to circumvent their lack of processing power and memory, but it limits them to simple magic (they can learn a single pattern with great effort, maybe) and is unpredictable. If you do AI magic, you know what you're going to get. If you do magic without the AI, you can try to nudge reality in a particular direction, but you can't really hold it all in your head. It's likely to sort of turn out like you intended, but maybe not entirely.

Does Haze get used up? How limited of a resource is it?

Think of Haze like a water mist in the air. When there is a lot of it, it pools up in puddles. When there is a little, you might not even notice it.

But since the Haze comes from Apophis in waves, there is always more coming. There are high and low seasons, and the puddles are collected to use during low seasons or to trade with other moons.

When you use magic, your body absorbs the Haze, leaving a blue glow where it disappeared—commonly through the hands.

Gotcha, so it's almost like sunlight in terms of being a resource—that is, apparently infinite within the "system" of the planet itself but coming from a finite source in Apophis.

Right. We don't know much about Apophis yet, and it's exciting to think about all the things that we'll come up with before this is done.

Yeah! About how far into the overall process of building this world are you all?

I'd say about halfway. We are in the detail half now, deciding what the moons look like and who lives on them. But this half also takes a lot longer because there is a lot you can get into.

Right. How skewed do the public votes end up? How much of the finer detail comes from community discussion, and how much comes from you three?

Actually, the votes are awesome. People who don't participate in the discussion but want to vote help make sure that it truly is the best idea of the bunch.

As for what comes from the three of us, we put forward ideas just like everyone else, but if the community doesn't vote that way, then so be it. It's the community's choice. We are here to help encourage discussion, grease the wheels with questions, and get people talking.

That said, it's our job to ensure consistency and to make sure that everything meshes well together. Sometimes that means "massaging" an idea to make it fit after it's been voted in.

Great to hear. I'm excited to see what comes next. 🪐

You can read about this world in progress on *World Anvil*, or join the effort to build the Gamma Corvi system in the #worldbuilding-collab channel on the *Worldbuilding Magazine Discord server*.
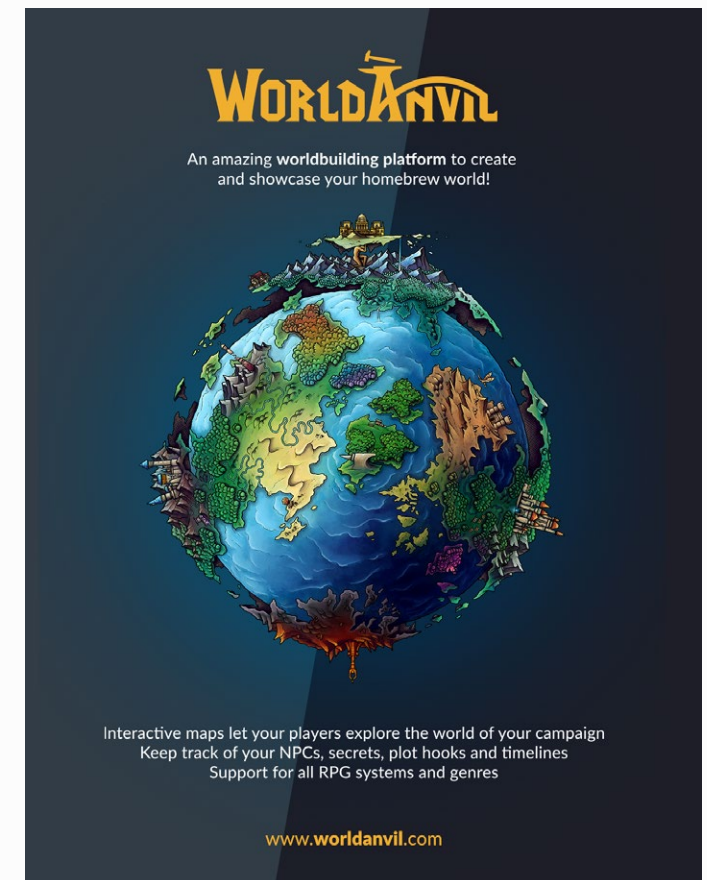
THINKING SIDEWAYS

ABOUT HAVING A BALL

BY ROBERT MEEGAN

GEOGRAPHY • FANTASY • SCIENCE FICTION

As it happens, the *Worldbuilding Magazine* community is absolutely loaded with smart, creative individuals (who you can interact with on the *Worldbuilding Magazine* Discord server, adding another widget to your worldbuilding toolbox). Recently, one of them asked a seemingly simple question: "How do you create a functional, realistic world that's flat?" I started to type up a quick answer, which rapidly grew to several paragraphs, and then things started to turn sideways. I had to tell him that answering his question was going to take a little more time than I had originally thought.
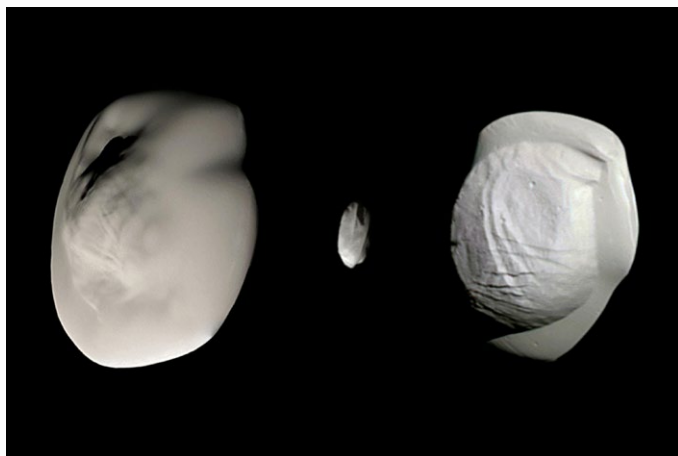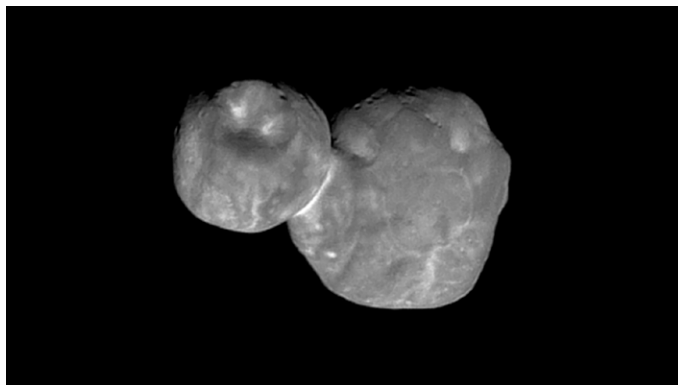

NASA. Above, Kuiper Belt Object MU69. Below, Moons of Saturn

First, and most importantly, a flat world is an inherently unnatural thing. I'm not talking about things like the Kuiper Belt Object MU69, which the New Horizons space probe revealed to be a pair of puck-shaped blobs that bumped into each other and stuck. Saturn has several moons that are more or less flat. Pan appears to be too large of a hamburger patty on too small of a bun. Atlas bears an uncanny resemblance to a fallen scoop of ice cream melting on a sidewalk. Tiny Daphnis has the misfortune of looking like something unpleasant that you might find when you clean under the refrigerator.

Sadly, they all fall rather short as worlds. If the gravity is so weak that you can permanently depart a place by leaping off it from a standing start, it's going to be difficult to do much in the way of epic worldbuilding.

For a number of physical reasons, a flat world that is large enough to use for storytelling is simply not going to occur naturally. Gravitational forces will squeeze any large enough body into something close to a sphere. How large? That depends upon what the world is made of. For a rocky world, it's a radius of around 300 km. If the world is mostly ice, it's about 200 km. It's possible to spin something fast enough to flatten it out, like someone tossing a pizza crust, but anyone who has stood on a playground merry go round knows that someone in the middle will be dizzy and anyone near the edge is going to be flying off long before you get to speed that will start to deform rocks.

In general, the solution is going to require either outright magic or technology of a nature that brings it into the realm of Clarke's third law: "Any sufficiently advanced technology is indistinguishable from magic."

Rational and self-consistent flat worlds have been created before, but they lack realism. Edwin Abbott Abbott's *Flatland* may be the seminal work in this particular genre. This novella takes place on a plane with a narrator who's a square, not in the quaint sense of an uptight individual but literally a four-sided geometric figure. It may be one of the most amazing examples of thinking sideways in literature, but it's clearly not the answer to the question.

A century later, Terry Pratchett created *Discworld*, which he explored in a series of novels. Like *Flatland*, the intention was satire, but Pratchett's world is much more tangible. In many ways, it is the answer to the question of how to create a functional flat world. Where it falls short, for our purposes, is that it's not physically plausible. While astronomers have discovered a menagerie of planets, none of them found to date are sailing through the cosmos on the backs of four elephants standing on a turtle.
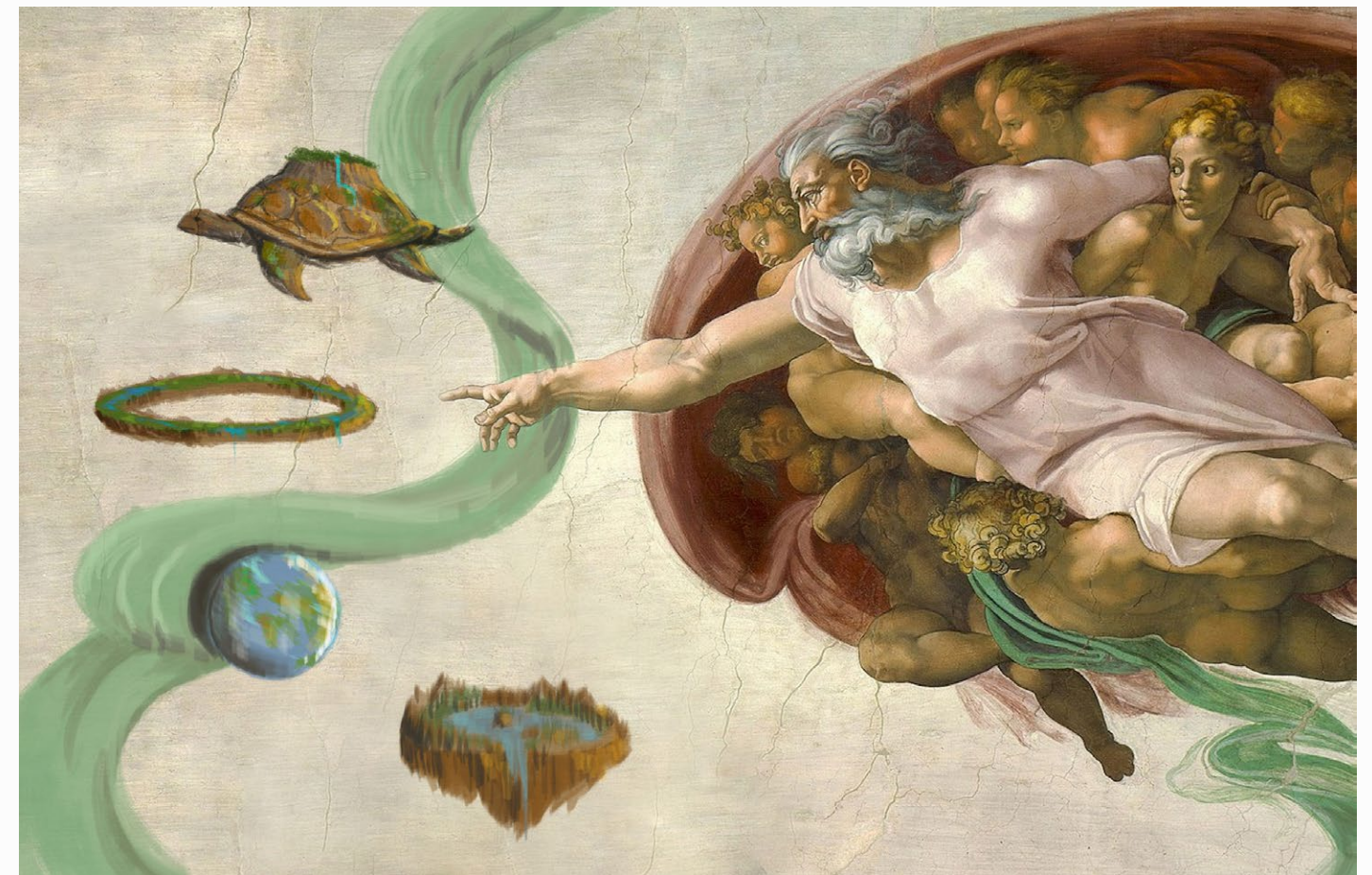
deificat

Discworld is the *sui generis* flat world. It's hard to imagine anything matching the depth and richness that Pratchett has given it. Rather than try to duplicate his work, let's look at alternatives that might conceivably exist in *our* universe. For the purposes of this article, we'll define "realistic" as "not requiring active magic or super-science to maintain its existence or to support life." This means that we'll need heat and light, an atmosphere and water that don't just drift off into space, and gravity.

IN INFINITY, YOU CAN'T MAKE ENDS MEET

The simplest solution to the flat world is an infinite plane. Well, not entirely planar. You can still have local topology such as mountains, oceans, and the like, but instead of curving over the horizon, the world just stretches on forever. As a worldbuilder, this is actually rather elegant, because you can start building wherever you want, and then when your stories take you in a new direction, you just add on as you go.

Edwin Abbott Abbott's world was literally two-dimensional, but that doesn't limit us to the same constraint. We can have creatures walking around on the surface, flying through the air, swimming in the ocean depths, and boring underground.

In a fantasy setting, it seems reasonable for the divine creators to go with the simplest solution rather than mucking around with countless little marbles whizzing about the cosmos. The choice of an orb complicates things, bringing up nasty decisions such as which of the various bits orbit which other bits. If the gods put the world at the center of the universe, the next thing you know, there are chalkboards out in the halls of Valhalla as everyone tries to figure out the various epicycles needed to make things work.

An infinite flat world can be hand-waved away in fantasy, but could it work in a science fiction environment? Such a world would likely be constructed as a virtual reality. This concept has been used quite successfully for concepts as different as Philip José Farmer's *Riverworld* novels and the

Wachowskis' *Matrix* movies. Computer scientists and philosophers have published articles in scholarly journals exploring the possibility that we live in such an environment. Many experts are of the opinion that it's not a matter of whether it would be possible to create such a reality, but when it will happen.

Infinite worlds have a few problems that require thinking sideways because every other option leaves us running around in circles. To explain why, I'm going to make the statistically safe assumption that if you're reading this, you're probably a resident of Earth and that you're not currently living in an underground bunker or polar region.

Every morning, the sun rises in the east. Every evening it sets in the west. Even if it's cloudy, you're probably willing to accept that these events happen. And, unless you're a flat-Earther (in which case this article can be considered non-fiction), it's likely that you accept that this is a result of the Earth's rotation on its own axis—the sun isn't actually flying across the heavens every day but is relatively stationary.

That doesn't work on a flat infinite world. The sun can't rise, at least not in the conventional sense. It could pop out of the plane somewhere and either rise up and then come down in the same place, or it could make an arc across the sky and come down somewhere else. The problem with this is that it's going to be awfully bright and potentially rather warm close to where it touches the surface. Really warm, like the surface of the sun. On the other hand, far away from where it goes up and down, it's going to appear low to the horizon—infinitesimally. To understand why, imagine that someone has just kicked a football over a goal (don't worry, this works the same for all kinds of footballs). If you're in the goal that the ball was kicked at, it passes high over your head. If you're in the other goal, you don't need to look up at all to see the ball. If you go even farther away, it hardly seems to be above the ground. Now, remember, that this world is an *infinite* plane. Infinity isn't something that most people are good at thinking about, but, mathematically speaking, infinity minus anything is still infinity. This means that even if the sun rises high above the surface, for an infinite area the sun will be so low as to be essentially on the ground.

At the same time, light intensity falls off as the square of the distance, so if you're twice as far away, the sun will be one-quarter as bright. Regardless of how bright any single sun is, as long as it's not infinitely bright, an infinite amount of the world will be in perpetual darkness. One way to look at this is if you have a bucket of water and draw out a cup of it, you'll be able to see the water level drop. If you draw the same cup out of the ocean, the level will not change in any perceptible amount. With an infinite world, lighting any finite area, even if it were hundreds of times the size of the Earth, would not change the fact that an infinite amount is still dark.

There's a simple solution to these problems with the sun: have the entire sky brighten during the day and then fade during "nightfall." For the sake of ambiance, the color could be bright white at mid-day, warming through yellow, orange, and red as it fades away, perhaps into a purple-blue blackness. What about the night sky? There's no reason why random lights can't be scattered across the heavens. Dim little lights, of course. Creating a moon, however, brings back the whole sun problem again, so it's probably out of the question, at least if it is to work like a real moon. There is nothing preventing some of the skylights from being bigger and/or brighter than others.

Navigation can be as much of a problem as you want it to be. The composition of the plane could be perfectly uniform, which would have the unfortunate effect of making daytime navigation when out of sight of any major landmark almost impossible. The world could possess a magnetic field or some equivalent so that a compass-analog could provide directional bearings. Knowing one's position on the plane would be impossible during the day since there would be no way to use a sextant to "shoot the sun." At night, assuming that there were stars that were fixed in place, it would be a different matter. An accurate star chart could allow a navigator to determine position even without a functional clock. What's more, because the stars of this world are not moving with time, navigation could be done with an accuracy that would not have been possible until the very end of the nineteenth century here on Earth.

DISK WORLD CROSS-SECTION

4,200km

10,000km

149,600,000 km

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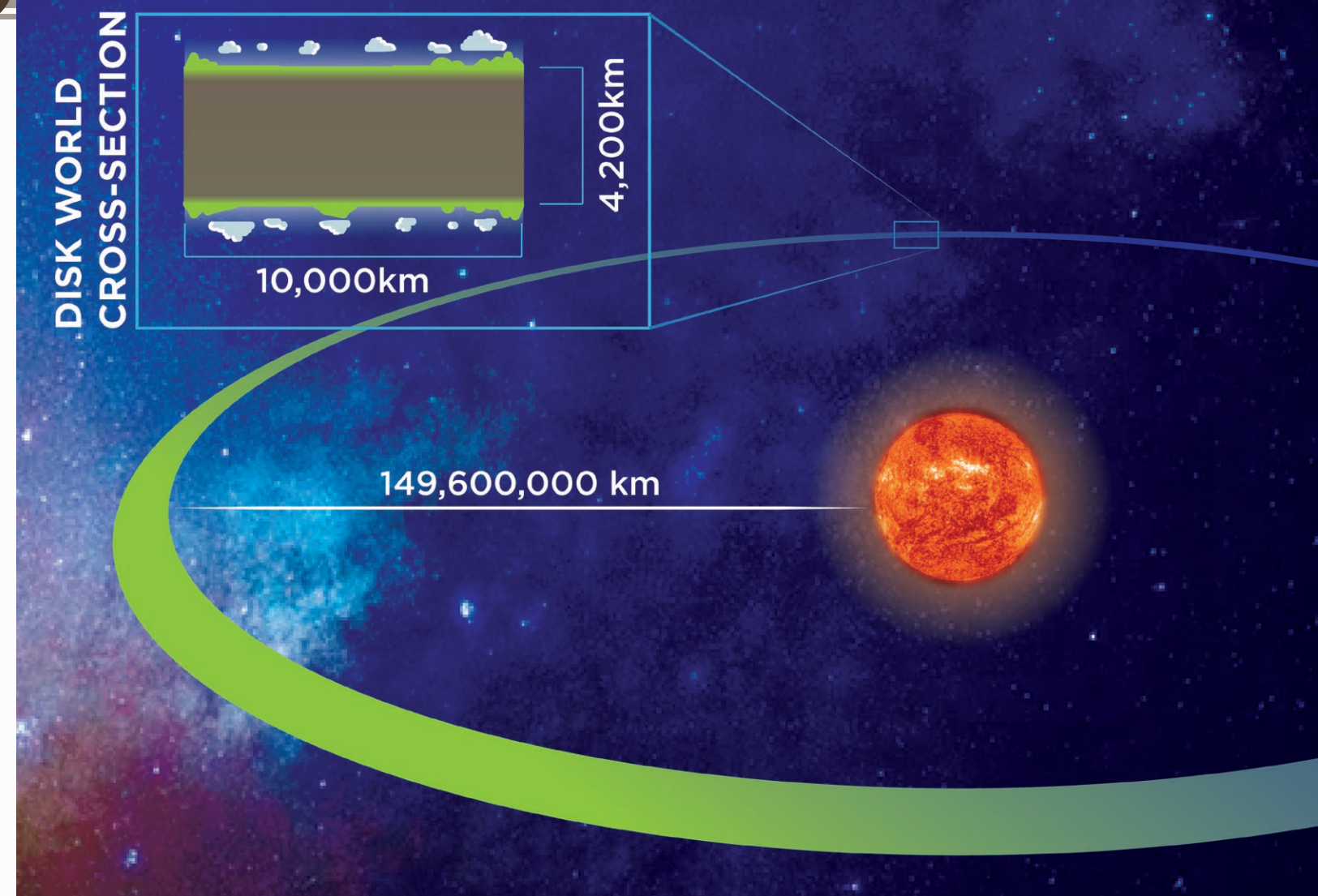
This setting has the potential for epic exploration. Ventures into the limitless unknown will require astronomers capable of extending the existing star charts as well as navigators who can map the land and sea.

WHAT GOES AROUND COMES AROUND

The next option for creating a flat world, one that isn't infinite, is a disk world. Remember, we're not talking about Terry Pratchett's *Discworld*. Instead, this world, depending upon your age, is just like a Blu-Ray disc or a 45 rpm record. We'll put a star in the center hole because both nature and people have a preference for things that are symmetric. Easy-peasy. This sounds like simple engineering.

Let's start with the presumption that we're talking about a star similar to our own sun. Nothing fancy, no binary systems or red giants to worry about.

We can make the disk the width of the "Goldilocks zone," the region that appears to have the right conditions for supporting life as we know it. Just to be safe, we'll use the most conservative estimate for habitability. That gives us a width of about 4.5 million km and an area equal to a little more than 8.2 million times that of the Earth. *On each side*.

A little math indicates that the disk will have a bit more than seventy-four times as much mass as the sun. Our sun makes up nearly 99.9% of the mass of the entire solar system. If we want to build this huge world, we're going to need to raid something like the Orion nebula to find the raw materials. Perhaps starting with something a little more modest would be best. If the story ever starts to outgrow it, more can always be added on later.

Let's create a disk with a width of ten thousand kilometers from the inner edge to the outer edge. We'll also put it right at the average distance of the Earth from the Sun. After all, we know that works for life like us. Even this much narrower disk provides more than enough space for worldbuilding. In fact, this disk has the area of roughly 18,400 Earths on each side.

Is it scientifically possible to build such a thing? Well, in order to avoid simply falling into the central star, the disk is going to have to orbit the central star at a velocity equal to or greater than that of a planet or spacecraft located at the same distance from the star would need (the reason for this is long, technical, and not particularly relevant to this discussion). When you do the math, the velocity required is about 107,250 kilometers per hour. This might seem ridiculously fast, but on average, everyone on Earth is moving at that speed right now. The reason that no one notices is that the Earth is moving at the same speed. The same is true for the residents of the disk.

The composition of the disk requires some calculations for reasons that are fairly easy to understand. Get a piece of modeling clay or bread dough, roll it out into a long, thin cylinder, then bend it into a ring and seal the ends together. Now put it around your finger and twirl it. As you spin it faster, it starts to stretch and eventually it breaks. This is because the centripetal force pulling it out is greater than the force holding it together. As it happens, this has implications for industries other than bagel making.

In 1876, railroad engines were getting faster. People began to ask how fast the wheels could spin before they came apart. In England, John William Strutt, known to later generations of scientists as Lord Rayleigh, was one of the most brilliant physicists alive at the time. He thought about the problem and realized that as long as the thickness of the spinning ring was small relative to the distance from the center, the calculation was actually very simple. In the case of railroad engines, the driving wheels were made of steel and were about a meter in radius. Knowing the breaking strength of the steel and its density, Lord Rayleigh was able to show that the locomotive wheels would hold together at speeds

of up to 800 kilometers per hour, a speed far greater than any train has actually reached even today.

Working backward from the orbital speed of the rim reveals that there aren't many materials that have the strength needed to resist flying apart. In fact, there is only one that is known to exist: carbon nanotubes. These are tubes made with carbon walls exactly one atom thick and they are strong enough to do the job with strength to spare.

This brings up a rather weighty problem. Unless there are artificial gravity generators buried in our disk, it's going to take a lot of material to provide gravity equivalent to that of Earth's surface. In fact, assuming that the rim is the same average density as the Earth, it will have to be about 4,200 km thick.

ANOTHER BRICK IN THE WALL

The next issue to be dealt with is the edge of the disk. Unless there's a barrier of some sort, things are going to wander off. While it's annoying to come home and complain that your cow decided to fall off the edge of the world, it gets downright serious when it's your atmosphere that's blowing away. A top isn't needed for the same reason that a spherical planet doesn't need one: gravity will keep too much air from escaping straight up.

The sides are a trickier problem, though, particularly the outside. Gases and liquids are funny things. In a solid, it's a reasonable approximation to say that all of the molecules that make it up are moving with the same velocity. In a fluid, the most that you can describe is the *average* velocity. This means that some molecules are moving much faster or slower and in random directions. In physics, there is an explanation for what happens in this situation called the "drunkard's walk."

Imagine someone who is intoxicated walking along a sidewalk. On the right side is a wall and on the left side is the curb. As the drunk walks, his average velocity is forward, but he might take a step to the right or to the left. If the chances of a left step or a right step are equal, he will, if he walks far enough, end up falling off the curb. Why? How far he can go to the right is limited by the wall. Once he gets to that point, he can't make a right step. On the left side, there is nothing pushing him back into play. If

he reaches the curb, there is an even chance that he'll fall off.

The atmosphere of our world works the same way. If a particle is in the middle of the disk, it doesn't matter which way it moves, but if it's at the edge of the disk, there is a statistical probability that it will end up flying off the face of the disk. This is a good news/bad news scenario. The good news is that the gravity on the inside and outside edge of the disk is about two-and-a-half times greater than on the top and bottom, so the air and water won't just fly off into space.[1] The bad news is that there will be incredible storms and currents as all of the air and water will eventually try to work its way over an edge.

It would be possible to build tunnels with pumps and fans to suck water and air from the inside and outside edges and then pump it back onto the faces of the disk. This would require incredible engineering, whether mechanical or magical, and it could be used to spectacular effect. What would happen to creatures and objects that were swept over the edge of the world, sucked through huge pipes, and spewed back out can be left to conjecture, but it's a fair assumption that significant wear and tear might be experienced. All of this would need to happen almost immediately after the edge, as the outer side would be in perpetual shadow and would quickly freeze both the water and the air, creating an ever-growing layer of ice.

Some form of barrier on the edge to limit or eliminate this flow might be in order. This could be a magical or transparent force field that simply holds everything in, or it might be a solid wall of the same material of which the disk is made. If there is a desire to appear "natural," the simplest approach may be to follow that used by Larry Niven in his *Ringworld* novels and simply put mountains up against the walls. This barrier does not need to be complete; there could be gaps left where winds howl and the sea is roiled by treacherous currents.

What wonders and terrors lurk over the edge? That's the stuff of lore.

BLINDED BY THE LIGHT

It's time to return to the issue of lighting. Unlike the infinite plane, this world has a real star, but it's right in the same plane as our rim. Even without walls around the edges, the world is going to look like a dark room with a flashlight lying on the floor. Everything will be glare and shadows. An opaque inner wall will turn the world into a vast mineshaft with only starlight for illumination. A clear wall or some kind of force field still won't provide much help. The sunlight coming from the side is going to pass through a lot of the atmosphere, as much as 10,000 km at the outer edge. Think about how much dimmer the sun is on Earth at sunset, compared to noon. That's because it's passing through about 1500 km of air, as opposed to less than 100 km. At best, the light is going to look like a blood-red sunset. For most of the disk, it's going to be eternal night.

Alright, this is getting depressing. We need to turn a light on. Perhaps we could give the star our world orbits a giant companion—a much bigger star that it would orbit at a great distance. We need to be far enough away that the giant companion won't destabilize the orbit of the disk around its central star and we want it to be bright enough to approximate Earth daylight. There are many examples dotting the heavens that we could use. The system would end up looking something like Uranus and its rings orbiting the sun. In fact, it's possible to do away with the need for the star at the center of the disk and just have the disk orbit the giant star on its own. The orbitals in Iain M. Banks's *Culture* series are variations upon this theme; although not being constrained by our flat world principle there, the residents populate the inner edge of the disk as a ring.

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[1] The gravitational field very near the edge of the disk or plate is rather complicated. If you could stand at the very edge without leaning over, you'd feel half of the gravity as you would in the center of the disk. What's more, instead of pulling you straight down, it would be pulling you at a 45° angle toward the center because there is nothing outward of you to counterbalance all of the mass pulling you inwards.

Walking as little as ten meters away from the edge would bring the gravity up to over 99% of that at the center. It would be much more balanced as well, with only a tiny tug inward. While it might seem counterintuitive that such a small change could have such a large effect, it results from your very small height relative to the great width and thickness of the world.

In our disk configuration, the giant star would rise over the outer edge of the disk, pass overhead, and then set on the opposite side half a year later. This would make the length of a day the same duration as a year, which does turn out to a bit of a problem.

If we pick our stars so that the side facing the giant companion is pleasantly comfortable, the side facing away from the giant star is going to get very cold—cold enough for the atmosphere to start to condense. Life would either have to migrate from one side to the other or undergo very long cryogenic hibernation. The phrase "winter is coming" would have profound implications. If we select a relatively "small" giant star, the disk would be in an orbit where the day was 200–300 Earth years long. Considering the time needed to thaw the atmosphere and oceans come spring, this would be too short. Inhabitants of such a world would either be in constant motion or like desert flowers, exploding in a burst of life with long periods of dormancy. An alternative would be to use a star such as δ Canis Majoris, which is a ridiculously bright supergiant. This would place the disk at a distance such that the years (and hence the days) were 1150 Earth years long, allowing civilizations several hundred years in the sun before they had to pack up and head to the other side.

LIKE SPINNING PLATES

There's one more way to have a flat world that can be considered passably realistic. Instead of building a massive world that encircles a star, we can build a much more modest one in the form of a flat plate in orbit around the star of our choice. With a radius of about 12,700 km, such a disk would have a surface area (on one side) roughly equal to that of the Earth. While this might not satisfy the most ambitious of worldbuilders, this amount of space has worked pretty well for humanity up until now, so we can definitely use it as a starting point. This world would orbit somewhere in the Goldilocks zone, but this time with one face of the plate pointed toward the star.

The same considerations regarding barriers at the edge would exist as on the disk world. In the case of the plate world, simply having the ocean and atmosphere spilling over the edge and then getting pumped back to the center would have the unfortunate side effect of creating a natural wind that would persistently blow toward the edge. Furthermore, any large bodies of water near the edge would develop currents moving outward as well. In a non-technical civilization, this would make waterborne navigation a one-way proposition. If the decision was made not to have an edge barrier, an outer ocean would be very difficult to make work. Some rivers could still flow over the bare edge and the captured water could be pumped back to raised areas near the edge, creating rivers that naturally flowed back to lower land nearer to the center of the disk.

Creating a natural cycle of day and night would be far easier on a plate world. Imagine cutting a paper plate in half and pushing a pencil through it near the cut edge. Hold the pencil with the eraser touching your nose and the tip pointed at the sun—half of your face is in the shadow of the plate and the other half is lit. If you then slowly roll the pencil between your fingers, the shadow will move around your face until it falls on the other side. If you continue to roll the pencil, the shadow continues to move until it returns to the original position. In a sense, you've passed a day on your face.

If we do the same thing for our plate world, minus the pencil, the results will be the same. This second half-plate, a "sun shade," could be placed between the sun and the plate world and spun at one revolution per day. Half of the plate world would be in sunlight and the other half in darkness at any time. Conveniently, there is a natural location known as the L1 Lagrange point where the gravity of the world and the star both pull on it evenly.

Instead of being so massive as to require robbing entire nebulae for the materials needed to build the plate, the bits and pieces found around the solar system would be sufficient (albeit with some nuclear alchemy to get the right elements). The stresses on a plate would be a fraction of those on a disk world, making the choice of materials less critical. The world could be designed to keep itself properly oriented through a gravitational gradient—essentially weighting it like an inflatable clown that can right itself after receiving a punch. This is the cheap and dirty solution used for low-cost satellites today.

If we want a fantasy setting, our plate could be the shield of a god, dropped in divine battle. The sun shade is the god's helm, spinning from the blow that sent them sprawling. The oceans are the sweat of combat beneath the burning sun. A few great mountains could be the heads of arrows that have penetrated the shield.

I USED TO THINK THE WORLD WAS FLAT

Why a flat world would exist, whether created through science or magic, is an interesting question. All of the options for flat worlds discussed here possess the potential for great worldbuilding. Each presents problems and opportunities for their creators. Undeniably, all of them impose constraints, but imagination is fired by limitations, and the constraints provide opportunities to look at an environment from a different angle.

The infinite world screams for stories of exploration. In many ways, it provides the opportunity for space opera adventure in two dimensions—with limitless expanses, it's easy to imagine multiple great powers engaged in grand schemes to control territory. Exotic new species could be lurking just off the edge of the map. The lack of space constraints also allows for vast oceans, where small islands take on disproportionate importance, or boundless steppes that can swallow huge armies, whether on horseback or in armored vehicles. The negatives are the need to control scale and the danger of repetition. It would be very easy to spread things too thinly, creating dreary slogs across the countryside. This would get worse if the response to finally reaching and scaling that distant mountain range was to say, "Oh, look. It's another endless plain (or ocean). How wonderful."

The thin disk world was disappointing from the perspective of plausibility. While it seemed to be a much more reasonable solution than that of the infinite world, the geometry makes it much more challenging, particularly with respect to heat and lighting. If you are building an open world, where stories and adventures arise organically, it's probably not a practical option. On the other hand, the

Robert Meegan

scenario of a civilization needing to reboot itself every few hundred years does present some interesting opportunities. In the end, any novel or campaign set upon such a world would likely need to be focused upon answering the question, "Why?" There are so many better alternatives that solving the mystery of why the world was created and settled would be an elephant in the room for any other plots.

The plate world is simple and elegant. It works for fantasy, as described above, but also for science fiction. Why would an advanced civilization build such a thing? If no suitable rocky planets were available in the system, converting the existing material to create a plate might be the simplest solution. It could probably be built with a considerably smaller portion of heavy elements such as iron and other metals, which might be in short supply (and are rather difficult to produce even through nuclear fusion). There is also the possibility of discovering a plate built by some unknown culture (à la *Ringworld*).

Not every world needs to be realistic. Internal self-consistency is generally far more important. In this case, the effort of exploring what realism actually meant and how to resolve all of the problems that definition created was the most valuable part of the exercise. If we're going to build worlds inside of vast spaceships, hollow worlds, or even normal planets with three suns and a ring, we need to consider the implications of those decisions and what they mean to the environment and to the characters. Many of the great works of speculative fiction resulted from asking the question, "Is there some way to make this type of world work?" 🪐

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CARTOGRAPHY CONTEST RESULTS

CARTOGRAPHY
ART
CONTEST

Curated by Worldbuilding Magazine & Wonderdraft
Foreword by Adam Bassett

A few months ago we partnered with Wonderdraft to host a cartography competition. The three illustrations you see below are our top three winners chosen by a panel of voters from both of our communities.

Not familiar with Wonderdraft? It's a map-making program you can purchase to quickly create gorgeous fantasy maps like these. You can learn more on their website or by visiting their community's Reddit page.

It was a pleasure to work with Wonderdraft on this, and I hope that we have the opportunity to do so again. Special thanks to them for partnering up with us for this, and to everyone who participated in this competition!

CENTRAL ASCENSION

By Steven Nix

In the beginning, there was Form, and then there was Light. The first People, those who stepped from the Light and beheld the world, became the Gods' favorites. The Void, that which lurks behind the light of the stars, grew in its jealousy, and begat its Children to steal into the homes and hearts of men. The Gods saw the People's fear and their hearts wept. They provided the People their own Light to safeguard against the Void and its Children.

The Void grew ever more spiteful and slowly built an army in secret at the far reaches of the continent. The attack, when it came, was sudden and vicious. With the Gods' Light leading them, the People were eventually able to push back the Children, though it cost them dearly. The land became blighted and none dared venture where the Children still roamed, striking out when and where they could in service to the Void.

Thus was born the Phospect Order in an effort to safeguard and maintain the Light which the Children fear. Formed in the city of Prester's Watch, we maintained order and vigilance on the blighted lands the Children call home for hundreds of years. The Light burned bright both within and without the city, until a single night when the light failed to repel the Children. The Why fell to me.

I was born in Ascension, both in the actual and the abstract. My mother was human, my father was...unsure. His disappearance left many to speculate, but then what are the city elders for if not to gossip? My time as ascendant essentially guarantees my father was at least ascendant himself, if not a deity. Though without powers or prowess for which the Halfies of the world are known, life as a Phospect did earn me a modicum of respect at home, and thus I was chosen to investigate the failing of the Light.

Who better to provide reason, than the masters of answers themselves. The Knowing, as they call it, is

Central Ascension
986 P.C.E.

The Unknown Basin

Greater Expanse

The Cloying Sea

Winnowing Blade Gulf

The Searing Dawn

Barren Shores

Orsen Ocean

The Hinterlands

The Blight Selvage

Cliffwatch Strait

Broken Shores

The Risen Lightlands
Forbidden Realm of The Emperor of Cressvyn
Lord to the Risen Sun

the eternal truth for which the Sons of Knowledge are known. They alone would hold the key. And so, through desert and plain, mountain and forest I traveled until the day I reached the Tower Hierom, spoke with the Sons, and found that the Void is the one veil of truth they cannot pierce.

"The Knowing is not for us," they said. "Only those of the Basin can provide you the answers you seek." This is not ideal, for only two men have ever returned from the Unknown Basin and the stories they told of the Eaters of the Blue Moon were too fantastic even for those with the most fanciful imaginations. There are some races of men too foreign in thought and deed that their Knowing is unknowable even to the Sons.

Now I descend. I am told a Halfie entering the Basin is unprecedented and so there is hope. Whether or not I will find the answers I need, remains to be seen. Whether or not I return, I suppose is up to the Gods. If I meet my fate in that unholy pit, let it be known that one way or another the People need answers. The Light must not fail them again.

Gods grant you favor,

Stathis, Prior Phospect and Brother of the Woven Light

TERRA GOTHENYA

By Clay Liford

Gothenya is a world bereft of gods, specifically because they were accidentally destroyed by man. The holy wars over Mt. Celene, the ancestral home of the gods, were bitterly fought by the many factions of the Faith Zenithal (the six primary gods).

In attempting to seize power for themselves, each faction contributed to a cataclysmic explosion, wrought from their destructive magic, that rocked Celene to her core. After this event, the gods suddenly fell silent. Some believe this lack of contact to be born of their anger towards man, while others think the gods to be dead (or at least severely injured and unable to communicate). Now, the wreckage of the holy mountain is off limits, protected from entry

by the order of powerful monks known as "The Staying Hand." This, however, has not kept those needing answers from attempting to break into the hollow mountain depths, searching for answers.

This world was the basis for my role playing group's long-standing D&D campaign (which is currently still trudging forth). We've been broadcasting it as a "live play" program on our local

cable channel in Austin, TX since September 2018. The party is comprised of adventurers tasked with collecting lost "holy relics" pilfered from Mt. Celene in the days after "The Sundering" that silenced the very gods themselves.

Iron Mountains

Dread Waters

Arcanbreak

Ancient Altar

The Twin Isles

Oakenforge

Haven

Ruins of Arkrest

Arkrest Heights

Whitescar Castle

The Last Beacon

Dragon Tides

Everfall Range

Morningstar

Eragon's Keep

Il'Khan

Pilgrim's Path

Zefyros

Larod

Orion Isle

Obsidian Circle

Monstralia

Dawn

Direcliffe

Giant's Valley

Manabar

Merchant's Bay

Royal Sea

Sorcerer's Point

Raven Isle

Aura

AURA

By *Kisuarts*

Aura (setting for an in-progress game by Kisuarts titled *For Evelyn*) was a land without magic or monsters for thousands of years, until one person created magical energies through alchemy. The world's first sorcerer had created such immense powers that it had raised huge amounts of rock and lava off the ground, creating the lone mountain on Raven Isle, called Sorcerer's Point.

Some people didn't believe him though, and passed off the creation of the mountain as a natural phenomenon. The sorcerer then wanted to prove that magic exists by going to show off his talents in the capital, Arkrest. Thousands of people gathered in the marketplace to see the so called sorcerer do his magic.

Something went terribly wrong however, and the sorcerer's alchemical concoctions backfired, resulting in a huge explosion, killing hundreds of civilians instantly. The ground shattered and the sea swallowed the city. The waters boiled and those who survived the blast were cooked alive. The alchemical elements used in the magical practices mixed with the waters of the whole world and it started the chain of events that lead the world into the state it is today. Animals started mutating, people went mad from the toxic water. But this was not, as some people had predicted, the end of the world.

The explosion broke off a huge piece of land from the main continent, which was then called Arcanbreak as was the event that had destroyed the capital of the land and changed the world forever.

The world was soon full of different monsters and magic practitioners. People had to process their water to filter out the toxins. But life went on, and the monsters were fought off from the civilized continents.

The toxins that had poisoned the water had its after effects. People who had consumed the water developed strange mutations, as some grew animalistic features like feline ears and tails, some grew horns and claws, a few even developed devilish looking features. These features passed down through the generations, and this is how the many different races of Aura came to be.

The once peaceful land was forever changed, to a restless place where magic and monsters were everywhere, and it seemed like more and more people got mad with the power of magic. It was soon after that a company of paladins was formed, called The Watchers, who started regulating the use of magic, making laws for all to follow, or be judged in front of the council. Brutal executions quickly calmed things down, but in the shadows more and more magic practitioners started gathering opposing The Watchers. This gathering followed the practices of the first sorcerer, and their main goal was to find a way to revive their master.
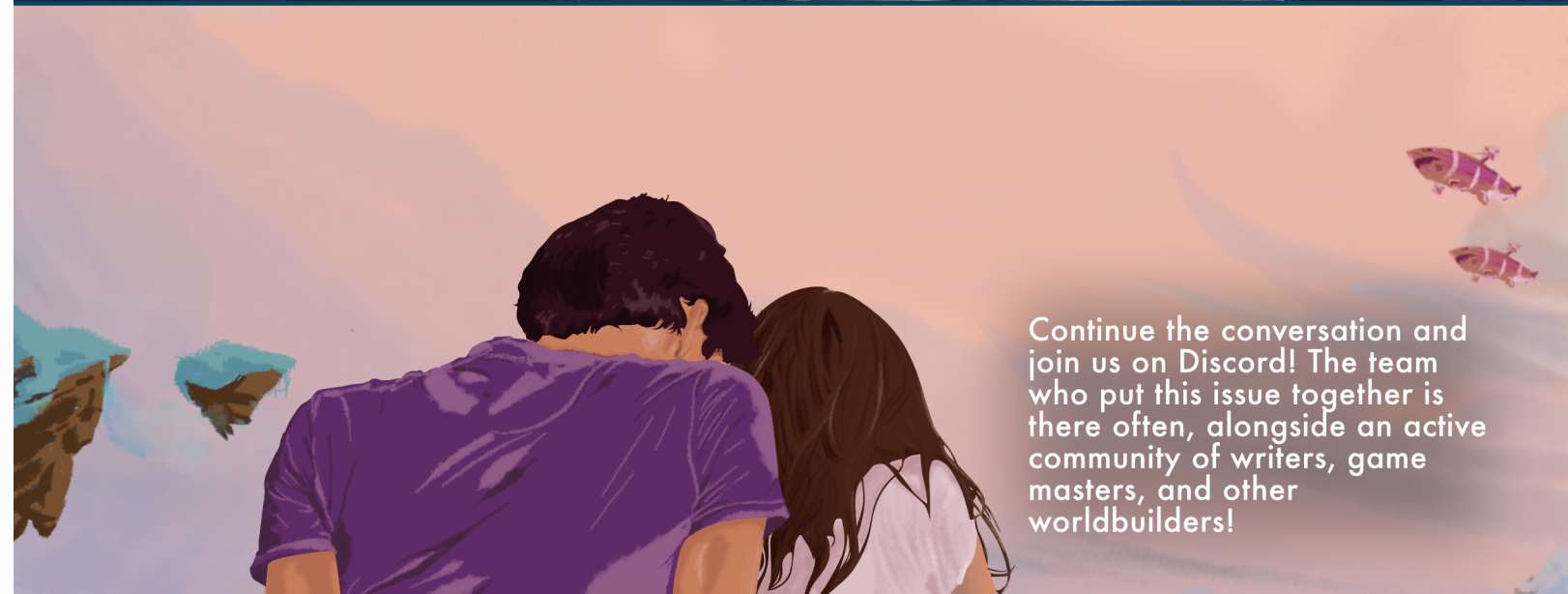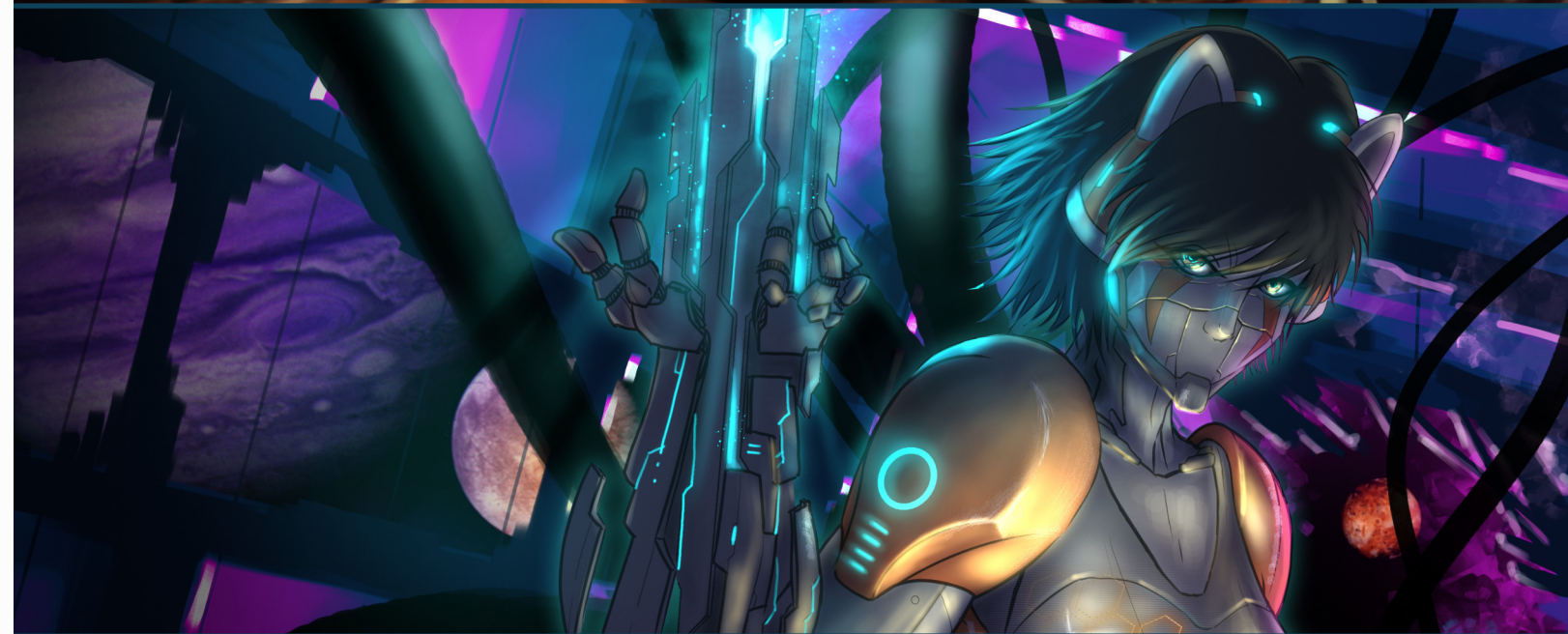
NAMING PEOPLE:
CREATING NEW NAMING CUSTOMS

CULTURE

LINGUISTICS

by Adam Bassett

Names have value. Aside from an identity, an individual's name offers something greater: a glimpse of the person's culture, history, and ancestry. Every culture on Earth has certain naming practices; some are very familiar, while others possibly quite alien. As worldbuilders, we should look out for ways to differentiate the cultures we create. Making all elvish, dwarvish, and human societies go by a first name + family name system is not the way to do this. By changing the way a culture names its children, we can inject meaning and intrigue into those names. As always, for this worldbuilding exercise we can look to reality for a vast array of inspiration.

In this brief overview, I'll cover a few of the common naming practices we find on Earth, but every one of the mentioned cultures have variations and details that I'm leaving out for the sake of brevity. If you're interested to learn more, please click on the references at the end.

This overview will include the following terms for name types, referred to as a way to show examples of how names from each culture may appear:

- Personal name: An individual's name.
- Middle name: An individual's middle name.
- Family name: An individual's family name.
- Father's personal name: As a component of his child's full name.
- Mother's personal name: As a component of her child's full name.
- Father's paternal family name: As a component of his child's full name.

- Mother's paternal family name: As a component of her child's full name.
- Patronym: A name derived from the personal name of the father.
- Grandfather's personal name: As a component of his grandchild's full name.
- Generational name: A name given to or used by a person according to their generation within a family.

English Names
- Personal name + middle name + family name
  John Caleb Smith

This is one we're likely all familiar with: English naming convention. It is often constructed of the three above components, albeit with less emphasis on the middle name (of which there may be multiple, though this is not a frequent occurrence). This structure is used in many cultures, originating in Europe and then becoming widespread through its influence during colonialism. However, it wasn't always structured this way.

Taking a look through history, in extreme brevity, English names have changed a great deal. Kristine Elliot wrote a good primer on this subject for the Society for Creative Anachronism[1]. For example, an old English name like *Edwin* was formed from two words that existed at the time: *ead* (prosperity, fortune, riches) and *wine* (friend). We find that some modern trends in English (and other cultures' names) began around the rise of Christianity. Elliot wrote that "Christians were encouraged to name their children after saints and martyrs of the church." This caused Jewish and Greco-Roman names to become abundant around the same time, including Mary, Matthew, Joseph, and John—all of which remain popular names in multiple countries[2].

Surnames went through multiple changes as well. Originally, they were bynames, identifiers given to further distinguish people from one another. P. H. Reaney discusses these in some detail in his book *Origins of English Surnames*. Reaney writes, "In the twelfth century we have an unsettled and varied type of nomenclature, often by way of description rather than actual name...we find men named by their font-name [first name] alone, or by this plus (i) their father's name in full, (ii) their father's Christian name, (iii) the name of their estate or their place of origin, or (iv) a byname descriptive of office, occupation, or a nickname." For example:

Odo balistaruus, arbalistarius, or de Wrthstede.

Things simplified over time, resulting in the current format of a Personal name + middle name + family name, the latter of which is inherited often through the father's lineage. However, the origin of many family names come from bynames, such as the ones used as far back as before the Norman conquest.

It should also be noted that Western culture often encouraged or forced people of other cultures to change their name if it didn't match this format. For example, many who immigrated to the United States of America changed their names to match the Western format. In other cases, immigrants with names that were difficult for Westerners to say may have changed their name entirely.

Russian Names
Personal name + patronym + family name
Mikhail Ivanovich Karlov

The standard naming convention in Russia is similar to the Western standard but swaps out the middle name for a patronym. Additionally, based on the child's sex, there will be a suffix attached to the patronym. For example, a Russian man whose father's personal name is Ivan might be called Mikhail Ivanovich Karlov, while his sister may be Natasha Ivanova. The personal name + patronym is often used as a standard form of address, much like I would address a friend as Travis (his personal name; dropping his middle and last names).

Additionally, there are masculine and feminine variants of Russian family names. The most common are shown below.

Masculine	Feminine
-ov	-ova/-ovna
-ev	-eva/-evna
-in	-ina
-iy	
-oy	-aya/-oya/-eya/-iaya
-uy	
-yn	-yna
-ski/-sky/-skiy	-skaya

Hispanic Names
Personal name + father's paternal family name + mother's paternal family name
Jesús María Romero [y] Gonzalez

Hispanic personal names are unique in that they are often composed of two parts, such as Jesús María. They may be addressed as Jesús (the first name in this example) but never as just María (the second).

Their family name also has two parts—one from the father's side and another from the mother's. They may be written separately or joined by a "y" (Spanish word for "and"). Either is correct. So, a child named Jesús María whose parents are named *Juan Romero Conde* (father) and *Luisa Gonzalez García* (mother) would be named: *Jesús María Romero y Gonzalez*.

[1] Elliot, Kristine. "A Brief Introduction to the History of Names." SCA College of Arms on the Web, Codex Herald, 1997, heraldry.sca.org/names/namehist.html. Accessed 28 June 2019.

[2] While it is true that names like Joseph and Mary are popular throughout much of the world, many cultures vary their spelling. For example, in Arabic you get spellings such as Yusuf and Mariam, respectively. In Russian we see Iosif and Maria. In Polish we get Józef and Maja—and so on. You can find more out about names and their variants at Behind the Name, an online names database.

Arab Muslim Names

1. Personal name + father's personal name + grandfather's personal name

    a. Ahmad Hussain bin Muhammad

2. Personal name + father's personal name + family name

    a. Ahmad Hussain Al-Shammari

Arabic names are often derived from Islamic names, such as Muhammad. Similarly, among Arab Christians, biblical names are commonplace.

Depending on the situation, there are multiple accepted formats among Arab Muslim names. In addition, they may use ancestral (typically beginning with Al- or ibn) or honorific names. In the first listed naming system for Arab Muslim names, "bin" is added before the father's or grandfather's personal name. While this is not always done, it is very common in regions such as the Gulf States, the Arabian Peninsula, and some parts of North Africa, where names can often include at least five or six generations of ancestry. For men, the father's and grandfather's personal names may be preceded by "ibn" or "bin" ("ben" or "ould"/"wuld" are regional variants) meaning "son of." The female equivalent is "bint."

Somali Names

Personal name + father's personal name + grandfather's personal name

Omar Elmi Dihoud

Although many Somalis traditionally only use the first two names to identify someone, all three must be used formally. In addition, it should be noted that there is no family name, and women (unlike in Western culture) do not typically change their name upon marrying.

Somalis commonly use nicknames. Whereas for many cultures a nickname is something shared among those who personally know one another, the Somalis take these a bit further. Nicknames are printed on ID cards, for example. There are generally two types of nicknames:

1. Overt: names used to address the person.
2. Covert: names used in conversation about the person, used while they're not around.

Justin Marozzi, writer for BBC, spent some time in Somalia and quickly discovered their love of nicknames[3]. The article is worth a read because it highlights a culture very different from many of ours. For example, Justin meets a young man named Abdifata, but he is referred to by everyone as Faroole. The name "Faroole" is an overt nickname, given to the man because of an incident wherein he lost two fingers. "Faroole" means "No Fingers." Nicknames like this are less common in the Western world, especially those that highlight negative traits, but in Somalia, such names are given to everyone. After enough time spent in the country, Justin even received his own nickname. They called him Timo Cadde, or "White Hair." It was an improvement over his previous nickname which they give to all foreigners/others: Gaal (translated: "Infidel").

Hindu (Indian) Names

Personal name [+ middle name] + family name

Raj Lal Vasani

A Hindu family name may denote class, so an individual may choose to drop their family name as a rejection of the caste system. In cases such as this, the middle name (if present) becomes their surname. Like Western culture, a newly married wife will take her husband's family name (in most cases).

I should note that there are many variants of Indian names. The structure of names changes based on location, religion, and other factors in India. Southern Indian, for example, drops the family name entirely. Gujarati-Hindu customs replace the middle name with the father's personal name. These are just two of several variants. What is outlined here is not accurate for these other practices. I would advise you read more on the other structures if you are interested in Indian naming conventions.

Chinese Names

Family name + personal name

Liu Xiao-Ping

A Chinese family name usually consists of one syllable, sometimes two, and comes before the personal name. A personal name can be one or two syllables, though two is more common. If it does contain two, it is connected by a hyphen or divided into two when romanized. Additionally, there are often many ways of spelling one name. For example, Liu, Liou, Lau, and Liew are all variations of the same family name.

Interestingly, a few years ago, there were reports of issues in China with mass amounts of people sharing the same names. According to a survey conducted by China's Ministry of Public Security in 2007, 88 million people shared the familial name Zhang, and another 92 million were named Li. Seven surnames (at the time) were held by 20 million Chinese citizens.[4]

Historically, the Chinese did not just have family and personal names. This is the modern trend, but if we look back to Zhu Yuanzhang, founder of the Ming Dynasty (1368-1644), we will find much more complex naming customs. He was known by a personal (childhood) name, Ming, which changed when he turned twenty. This was his given courtesy name, which all men received at the age of twenty and women at the age of 15.

Even after death, it was taboo to use the personal name of an emperor. Another would be used in its place. For Zhu Yuanzhang, he was known as Hui. Dr. Ulrich Theobald, lecturer at the University of Tübingen writes: "the characters of their names were often also slightly altered so that it seemed as if the word was not written. The surname of the founder of the Ming dynasty, for instance, was written 硃 instead of 朱."[5]

Korean Names

Family name + personal name + generational name

Pak Jang Su or Pak Su Jang

Koreans, like the Chinese, put their family name first, but add a generational name (the position of a personal and generational name is interchangeable). This is given to all children of a similar age within a family. It should be noted that all three components of the Korean name should be taken as a whole. There is no middle name or piece that should be ignored/left off. There are strict social rules about addressing your peers properly, requiring certain honorifics or avoiding referring to them as just their personal + generational name.

The blogger behind *Ask A Korean!* answers some questions about Korean names across multiple responses. He has been answering questions and writing blog posts since 2006, explaining why names are structured this way based on Korean history, why there are so many Kims, and more. If you're curious about any of this, check out the blog's *Korean Names Series*.[6]

HOW DOES THIS APPLY TO MY EPIC FANTASY?

In so many ways. For the sake of argument, let's assume that you're writing a Tolkien-esque masterpiece with complex societies of humans, elves, and dwarves. Each of these (except maybe the humans) brings with them a certain exoticism. Indulge in that.

Perhaps the elves have a powerful militaristic king whose rule is fairly socialist. Everything is for the good of the state, and the highest honor one can bestow upon themselves is joining the armed forces. To introduce an elf as Ailwin Baetris doesn't do this complex society justice. Let the society inform their names. Perhaps, because it is militaristic, ranks are applied as prefixes. After all, the State comes first here. If an elf has no military

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[3] Marozzi, Justin. "The Somali Love of 'Rude' Nicknames." BBC *News*, BBC, 7 Mar. 2014, www.bbc.com/news/magazine-26354143. Accessed 5 June 2019.

[4] "China Re-Think On Names Shortage." BBC *News*, BBC, 12 June 2007, news.bbc.co.uk/2/hi/asia-pacific/6745259.stm. Accessed 5 June 2019.

[5] Theobald, Ulrich. "Names of Persons and Titles of Rulers." China Knowledge, *Ulrich Theobald*, 23 Sept. 2011, www.chinaknowledge.de/ History/Terms/titles.html. Accessed 28 June 2019.

[6] "Korean Names Series Index." Ask A Korean!, *1 Jan. 1970*, askakorean.blogspot.com/1998/02/korean-names-series-index.html. Accessed 20 June 2019.
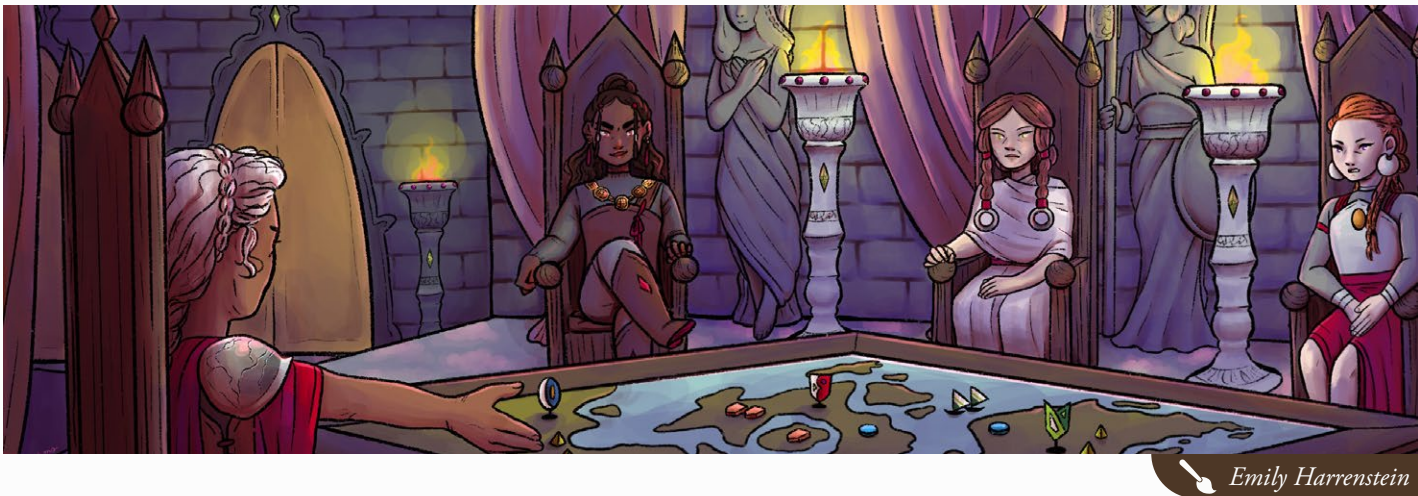
Emily Harrenstein

rank, they are branded as an outsider, and society looks on them less favorably. If they have no rank but are helpful to the military (e.g., a fletcher or blacksmith), we could create a title for that as well. Since the society is for the good of the state and military service is indicative of a good person, maybe rather than a family name they use their father's name. That way, by introducing one's self, people would know right away where you stood and who you were raised by. The latter would be important socially, since somebody raised by a high-ranking soldier might have more expectations on them or find it easier to succeed.

So now we've ended up with an elf named Ad'Ailwin Vamir. Why? Because if we put the state and military before an individual, wouldn't it make sense to put those aforementioned rank prefixes before everything individual to the person? This way, the first thing everyone hears in the elf's name is how much they contribute to society. Ailwin, the personal name, comes next because an individual's achievements (or shames) trump that of their parent's. Even if you were born into a disliked family, you can succeed by your own merits in this elvish society. Up last is Vamir, our elf's father's name. This gives people context of your childhood and parentage. If Ailwin did great things during his life, his children might have better opportunities since they would carry his name. His reputation quite literally is carried into the next generation.

Ad	Ailwin	Vamir
Military rank: "Lieutenant"	Given Name	Father's Personal Name

Let's have a look at the dwarves. We will assume, for the sake of brevity, that they are a rough people living deep in the heart of some mountains. Quite original, yes, but these ones follow a matriarchy. They respect the mothers of their society greatly and are lead by a council made up mostly of elder women. Their faith is also very important to them as they believe prayer to Ülak the Mighty will weigh down their souls and allow them passage into a good afterlife (which is also underground, because dwarves).

In this situation, I might name a dwarf Gustead Knod Naoeralgéstra. If Gustead is a man of faith, who preaches sermons at his chapel, perhaps he also has a special suffix to his middle name. This addition denotes him as a true follower of his religion, which would make him Gustead Knodrü Naoeralgéstra.

Gustead	Knod-rü	Nao-eralgést-ra
Given name	Middle name + honorific for "true follower"	"Son of" + Mother's personal name + honorific for true follower (after gender agreement)

By naming individuals based on different histories and traditions, you are able to echo their cultures. Or, inversely, if you come up with a fun way of naming people within a culture, find out why it works that way! It's easy to come up with a random series of letters that sound neat, or fall into whatever is comfortable. However, when you name people in your world with these ideas in mind, you can create formulas for it and plenty of worldbuilding to explain why those exist. 🪐

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NAMING PLACES AND UNDERSTANDING ETYMOLOGY

by Maximilian Scharffetter

> *"Fear of a name increases fear of the thing itself." —Dumbledore*

Many worldbuilders share the fear of names, although maybe for different reasons. Naming a city, a river, or a whole nation may be among the hardest and most frustrating tasks in creating a world. In some cases, the name could be one of the most important elements of a person or place. It just has to *fit*. The name of an evil empire should strike fear into its enemies by sound alone, and the glorious capital needs a name that everybody knows and respects. In more lyrical words: "*the name that dwells on every tongue, no minstrel needs*" (Jorge Manrique).

Different people have approached the task of naming places in different ways—more or less successfully. To get a good grasp on the topic, we first have to take into consideration how deep we want to dive into the scientific rabbit hole called *etymology*, the study of the origin of words. This article gives an overview of this vast topic. We will take a look at the names of cities, mountains, and rivers in our world, how they came to be, how they changed over time, and what they mean[1]. After that, we will examine three authors and their fantasy works to see how they dealt with naming places in their worldbuilding and what we can maybe learn from them for our own projects.

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TOPONYMY: NAMING OF PLACES

Naming settlements and cities has almost always been done to serve two simple functions: to orient people and to assign property in terms of feudal law. That is why these names often stem from features or characteristics of the prevailing surroundings. If you take a look at a map of Britain, for example, you will easily find cities and towns whose names you will understand or be able to translate. Many are put together by two components, the *prefix* and the *suffix* (*New-castle*, *Blackpool*, *Whitechapel*, *Ox-ford* or *Fair-lands*)[2]. But when you look a bit closer, you will quickly notice that there are many city names that don't fall into the simple prefix+suffix pattern. Many of them may not contain any recognizable words from the location's mother tongue. That is because languages and inhabitants of places change, but their name often remains the same or are adjusted by the new settlers. European capitals are eye-catching illustrations of this phenomenon: *London*, *Berlin*, *Dublin*, *Paris*, *Madrid*, *Vienna*—none of these cities can be translated by just using English, French, German or Spanish. For that, we have to delve deeper into the history and linguistics of these regions.

- *Vienna* (German *Wien*) stems from the Celtic *Vindobona* meaning "white" (vindo) "foundation" (bona).
- *Berlin* probably descends from the old Polabian[3] prefix *berl-/birl-* meaning "swamp."
- *Paris* was named after the Celtic tribe of the Parisii who settled in the region after Lutetia, the former settlement on the Seine-isle, was destroyed.
- *London* presumably shared a similar origin as Paris. It is believed that the Latin name *Londinium* is of Celtic origin and derives from the personal Celtic name *Londinos*, who may have been an important chief or leader.
- *Madrid* most likely developed from the roman settlement *Matrice*, coming from the nearby Manzanares river. Over the centuries it changed to *Mayrit*, combining Arabic *Mayra* ("giver of life") and the Ibero-Roman suffix *-it* ("place"), due to

change in leadership. After the Reconquista, the Mozarabic form *Matrit* pushed through the name developed into its present form.

There are, of course, examples of city names that changed along with their inhabitants. This happened for various reasons, but let's be honest: it's mostly because of conquest. A perfect example of this is the Turkish metropol Istanbul. Istanbul has been through a lot—not only regarding its changing names. The Greeks called their settlement on the Bosporus *Byzántion*, after its founder Byzas. The Romans changed it in honor of emperor Constantinus in 324 C.E. to *Constantinopolis* ("City of Constantinus"). After the conquest of the Ottomans in 1453 C.E., there was no official name for the city. The designation ranged from an Arabic form of *Constantinopolis*—Konstantiniyye—to completely new designs like *Dersaâdet* ("Gate of Felicity"). An official name wasn't given until the early Turkish Republic in 1930 C.E., when the city was officially named *Istanbul* (the Turkish variant of the Greek *Istimbólin*, meaning "in the city"). This denomination was already being used during late antiquity and the Middle Ages because of its sheer size in comparison to other towns and cities in the area.

HYDRONYMY: NAMING OF BODIES OF WATER

The names of European rivers go way back in history. The vast majority of them stem from the Indo-European language family. Their successors nearly exclusively adopted these old names, sometimes just changing them by adapting them to their own native tongue. This phenomenon is also valid for mountains (see below), lakes, bays, or gulfs all over Europe. Hence, some river names sometimes share the same root terminology, even when they flow hundreds or thousands of kilometers apart from each other. This is exemplified by the rivers *Danube* (German Donau), *Don*, *Daugava*, *Dubna* or *Dnieper*, which all share the same Proto-Indo-European root *danu-*, meaning "river". Analysing and interpreting the names and

A RULE OF THUMB: THE OLDER THE SETTLEMENT, THE LESS LIKELY THAT ITS NAME CAN BE TRACED BACK TO THE CURRENT LANGUAGE SPOKEN IN THIS AREA.

their history can therefore be difficult because often there aren't any written sources from these historical periods about these languages. If any exist, they are few in number and difficult to translate.

- The river *Thames* in England most likely derived from *Tamesis*, the Latinized version of the Celtic Tamesas, meaning dark river.
- The name *Rhine*, the second biggest river in Western Europe, goes back thousands of years. Its origin lies in the Celtic-Gaulish Renos, meaning *flowing water*. The Romans and Greeks adopted the name and over the centuries it changed to its current form *Rhine* (German *Rhein*, French *Rhin*, Dutch *Rijn*), influenced by the Greek spelling with an "h" (*Rhenos Ῥῆνος*).
- A short digression to the U.S. shows us a similar pattern: The *Mississippi River*, the one of the biggest river in the country stems from a French adjustment of *Misi-ziibi*, meaning "great river" in Algonquian, the language of the Native Americans living in the area.

ORONYMY: THE STUDY OF MOUNTAIN NAMES

German oronymy deals in large parts with the history of the alpine names. The Alps were first populated by Proto-Indo-European people around 6000 B.C.E. Indo-European settlers from the east took over the region and imposed names based on their languages. When the Romans conquered the region, they adapted the Celtic name *alb/alp*[4] and its meaning, "hill pasture" or "uphill meadow." The present name *Alps* (German: *Alpen*) is basically just the plural form of it. In general, there is a distinction between five categories for mountain names:

1. Location/composition/constitution, like the *Rocky Mountains*, the *Denali*, or the *Mont Blanc* (the highest mountain of the European Union, literally meaning "white mountain").
2. Economic use, like the prior described Alps.
3. Property/possession, like the *Appalachian Mountains*, after a Native American tribe that lived on the southern foothills that located in modern Northern Florida.
4. Culture/mythology/religion, like the *Pyrenees* between Spain and France whose name stems from the mythological story of the virgin princess Pyrene and the hero Hercules; or, the highest Mountain in Spain, the *Teide* in Tenerife, derived from the *Echeyde*, the name given by the native Guachian people to the home of the demon Guayota imprisoned in the mountain.
5. Artistic/scholarly/historical choice, like the previous name of the *Denali*, or *Mount McKinley* after the 25th U.S. President.

As with the etymology of rivers, these derivations are often disputed in science due to a lack of written sources. However, these examples show us two basic principles we can apply to naming places within our own worlds. First, place names stem from basic descriptions of the surroundings, specialties like the wind or weather, mythical stories, or from the people living in it. Second, despite cultural, historical, or linguistic changes over the ages, names often preserve a deeper core of their former titles. Place names often derive from older languages spoken by people who used to live in said places. As we have seen, this practice also applies to mountains and rivers whose names have been adopted and slightly changed by the holders of general hegemonic power over the word. A rule of thumb: the older the settlement, the less likely that its name can be traced back to the current language spoken in this area.

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[1] In this article I will mostly focus on the toponymy of Europe for the sake of simplicity. US-American toponymy, for example, depicts a whole topic on its own, due to the interwoven history of Native Americans and European settlers. To cover both in one article would not do them justice and too much would be possibly neglected.

[2] The same can be said about other European countries (Chateau-roux, Frank-furt, Ben-vento, Salz-burg, Amster-dam, etc.)

[3] Polabian is an extinct West Slavic language that was spoken in nowadays north-eastern Germany.

[4] A word that still can be found today, for example in German successor Alm.

WORLDBUILDING AND TOPONYMY

For writing fantasy or worldbuilding, the sky's the limit. But to create realistic and harmonic names that the reader can read, pronounce, and remember, worldbuilding has to be structured and coherent. Otherwise, one ends up with grotesque creations that the readers will neither remember nor be able to talk about. Examples of this can, of course, be found in real life, especially when looking at language families that you are not familiar with at all. In fantasy literature, however, there are different approaches and solutions for naming cities, rivers, or nations. To keep it simple and comprehensible, we will sample three authors who dealt with the topic in different ways: George R.R. Martin, J.R.R. Tolkien, and Andrzej Sapkowski. These three authors are on different ends on the imagery scale of naming places and therefore perfect examples to show a variety of toponymy in fantasy.

G.R.R MARTIN - A SONG OF ICE AND FIRE

When we look at a map of Westeros, it seems Martin took the easy way of toponymy. He simply uses names and descriptions regarding what the place represents or what characterises it: *King's Landing, Lannisport, Highgarden, The Reach, The Riverlands, Sunspear*; the list could go on and on. It may seem a bit lazy, but it makes sense for basically two reasons. First, Westerosi culture is more or less homogeneous. They share the same language and descend from the same groups and, therefore, also share cultural mutuality[5]. Second, and most importantly, by using English for the Westerosi cities and lands, Martin binds the readers to this part of his world. The readers recognize and understand the Westerosi names and their meanings. The places sound and feel familiar. The regions of *Essos* and *Sothoryos*, on the other hand, form a sharp contrast. These names differ noticeably from their Westerosi counterparts: *Qarth, Asshai, Meereen, Qohor,* or *Vaes Dothrak*. The same can be observed with the names of rivers

or mountains in Westeros and Essos. *Honeywine, Red Fork, Fever River,* and *Weeping Water* lay to the west, while to the east, we can find the *Rhoyne, Skahazadhan, Selhoru* and *Volaena* on the other hand. In naming mountains, Martin stayed consistent by exclusively using English vocabulary[6]. All this underlines a key aspect of his work. Martin draws a fine line with the "home-continent" Westeros, whose names resemble the reader's experience and take influence from European culture and history. The foreign continents of Essos and Sothoryos, on the other hand, are influenced by Chinese, Mongolian, African, and Persian culture. Although in most cases these names don't have a deeper meaning or can be traced back to certain cultural groups[7], the distinction between them and the names of Westerosi places are crucial for Martin's narrative. It is a small detail that shows us the world and story of *A Song of Ice and Fire* through Westerosi lenses.

J.R.R TOLKIEN - THE LORD OF THE RINGS

J.R.R. Tolkien presumably doesn't really need further introduction. His world and stories are among the most read and loved in all of fantasy. Tolkien—often called the father of modern fantasy—was a full-time philologist and fell back on this experience and knowledge whilst building and constructing his world *Arda*. For that, he invented numerous languages, including *Sindarin* and *Quenya* (the languages of the elves) and *Black Speech* (the language of Sauron, Mordor, and the orcs). Most of the toponymies derive from these languages and can be translated back into English. The best examples are the Sindarin names *Gondor* (gond = Stone, dôr = land), *Mordor* (mor = black), *Arnor* (ara- = high/kingly), *Rohan* (an alteration of the Sindarin name *Rochand*, roch = horse) or *Barad-Dur* (barad = tower, dur = dark), the latter also being called *Lugbúrz* (lug = tower, búrz = dark) in Black Speech.

Tolkien uses this same method for naming all places on Middle-earth: the rivers *Anduin* (anda = long, duin = river) or *Baranduin* (baran =

golden-brown) are of Sindarin origin but also have other names in the languages of men or hobbits. The Anduin is also called *Longflood, The Great River,* or *River of Gondor*; the *Baranduin* is called *Branda-nín* ("border river") by the hobbits or *Brandywine* by humans. The mountain Caradhras, whose pass the Fellowship must cross, literally translates to "red horn" in Sindarin (caran = red, ras = horn), which is likewise another name for it. These examples show the vast complexity of Tolkien's work and the key factor of this construction: having Sindarin as the main language of Middle-earth for toponymy (the lingua franca, so to speak)[8]. Creating, using, and not translating these names lay the groundwork for Tolkien's etymological worldbuilding, helping the reader to understand the fantastical elements of his world. Translating them, or rather, using the English terms for *Gondor* or *Mordor* would rob this world of its soul and its character. Tolkien created a whole stand-alone fantasy world of its own, that has its own language, culture, people, and history since the beginning of existence. This makes his world feel alive and real, like it could actually exist somewhere or at sometime.

ANDRZEJ SAPKOWSKI - THE WITCHER

Polish author Andrzej Sapkowski, creator of the *Witcher* series about Geralt of Rivia, used different methods to come up with names for the cities and castles. Given his Polish background, Sapkowski's work is heavily influenced by Slavic culture, and this is shown in his etymology. The biggest northern city *Novigrad* can be translated to "*New City*" and shares its name with a Croatian counterpart. Another Slavic link is the capital of the kingdom of Redania, *Tretogor*, which is common Slavic for "Three Hills." But there are also other influences as well. The famous city *Oxenfurt*, for example, probably doesn't need any further English translation. Furthermore, Sapkowski was influenced by Gaelic languages like Welsh, Scottish, and Irish for the Elder Speech (the language of the elves). A good example is the home of Geralt and the Witcher School of the Wolf, *Kaer Morhen*, and the island *Ard Skellig*. *Caer* is Welsh for "castle" and *Ard* is Scottish for "high." Other examples can be found all over the Northern Kingdoms: *Ban Ard*, a Kaedweni city, literally

translates to "high peak," combining the Scottish "ard" and the Welsh "ban."

Another example for inspiration that Sapkowski took out of our world is the Nilfgaardian province *Beauclair*. The indubitable link to French can't be overlooked. The translation here would be "beautiful" (beau) "clear" (clair). There is even a municipality near the French-Belgian border that shares the name with its fantasy counterpart. Same goes for Beauclair's capital name *Toussaint* that, too, exists in northern France.

When it comes to names, Sapkowiski was probably inspired by Tolkien. He also based the elvish culture and language on the Welsh and Gaelic ones of our world. The clear difference certainly is that Tolkien, as explained above, created his own language system. Sapkowski merely took the already existing languages and used it for his purposes. That does not mean he did a bad job. His method can be seen as a mixture of Martin and Tolkien. He took what was familiar to him (Slavic languages and culture) and created the Northern Kingdoms, achieving the same effect Martin had by using English in Westeros. In addition, he used Gaelic for the Elves because we are already familiar with their resemblance and therefore can build a relation to his work more easily. By using what is familiar, he plays with our expectations—a common theme in Sapkowski's work.

CONCLUSION

There is no blueprint but, rather, a range of possibilities for naming cities, lands, rivers, mountains, and so on. You can use the easier path by sticking to your native language and create names from it. This will make it easy for readers and explorers to learn and remember them. For that, you can follow the basic prefix + suffix formula, e.g. *Redcastle*, *Whiteriver*, or *Pigford*. Observing real world cultures, languages, and especially, their development over time can be quite a useful tool for coming up with names. Adding a bit of variety and creativity by altering the pronunciation simulates the usage of several hundreds of years (e.g. *Jame's town* becoming *Jameston*, *Highguard* changing to *Hygart*, and so on). Remember the rule of thumb:

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[5] There are many examples for this mutuality. The most notable (aside from what is already mentioned) include their almost universally shared religion and politics. This is especially so after Aegon's Conquest.

[6] An exception are the mountains of Krazaaj Zasqa *("White Mountains")* the name the Dothraki are using for the northern part of the Bone Mountains. However, they don't appear in the novels, but rather in The World of Ice and Fire, *a companion volume*.

[7] Or rather, Martin did not imply any particular meaning behind these names.

[8] Besides Sindarin Tolkien uses Old English as source for his toponymy. Isengard, Edoras, or Aldburg are suitable examples for that.

the older a town, the less likely it is that the name resembles a modern word. Another option is to take inspiration from other languages within our world, creating names that originate from these languages. By that, you can play with the expectations of the readers and reinforce associations. For example, basing a culture on medieval Japan and therefore using Japanese vocabulary, so readers will know what to expect or will find it easier to get a grasp of your world. Or, you can go full Tolkien and invent stand-alone languages from which everything else derives. It surely is the hardest but probably the most *fantastical* way. In the end, the choice is up to you and where you want to put the focus on your worldbuilding. But the first step definitely is to abandon the fear of the name itself—or at least of the creation of a name. 🪐

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PROMPTS

- What are some of the most dangerous locations to visit in your world due to treacherous terrains or waters? Why are they so dangerous, and what can one do to prepare should they have to go?

- What are some resources or naturally-occurring items that people value, such as coal or wood? Where can they be accessed? Are there any completely unique to your world?

- Detail one of your worlds' holidays, or make a new one up! How and what do they celebrate?

- What locations have key tactical positions for militaries? Things to consider may include defensible positions like on peninsulas, or places that help move soldiers and goods along a long river.

- How does architecture change based on location? For example, there are a lot of buildings made of wood further north since they don't have to worry about termites. Perhaps some regions in your world have to deal with similar pests or have access to different materials and techniques.

- Earth considers a few notable locations the Seven Wonders of the World—places such as the Great Pyramid at Giza, Egypt, and the Temple of Artemis in present-day Turkey. What are your world's wonders?

- How many of the following geological formations can you find in your world? If the answer is none, are you able to include any? 🪐

- Mountains[1]
  - Dome
  - Fold
  - Fault-Block
  - Plateau
  - Volcanic

- Bodies of Water[2]
  - Bays & Coves
  - Ephemeral & Intermittent Rivers
  - Exotic River (begins in a humid region and flows into a dry one, such as the Nile)
  - Fens & Marshes (Standing Water)
  - Fjords
  - Lakes & Ponds
  - Oceans & Seas
  - River Delta
  - River Rapids
  - Straits
  - Young & Old Rivers

- Islands[3]
  - Atoll/Coral
  - Artificial
  - Barrier
  - Continental
  - Tidal
  - Oceanic/Volcanic

- Forests[4]
  - Boreal/Taiga
  - Temperate
  - Tropical

- Other
  - Canyon
  - Glacier
  - Isthmus
  - Peninsulas
  - Seastacks
  - Spits
  - Valley

If you would like to write a short story based on one of the writing prompts or have a prompt you would like to share with us, please submit it to contact@worldbuildingmagazine.com or on Discord.

Submission Requirements:

Submissions must be no longer than 5,000 words

The submission must include title and author(s) in case of questions.

Dirk Spijkers

[1] https://www.universetoday.com/29771/types-of-mountains/
[2] https://courses.lumenlearning.com/geo/chapter/reading-types-of-streams-and-rivers/ and https://www.popoptiq.com/types-of-rivers/
[3] https://www.geographyandyou.com/science/oceans/island-types-world/
[4] https://www.zmescience.com/other/did-you-know/different-types-forests/

ARTIST SHOWCASE: TANNER STAHELI

Curated by Wynter

INTERVIEW   **CULTURE**

My name is Tanner Staheli. I'm a 20-year-old from Provo, Utah, and I am a fanatic when it comes to creating fictional worlds beyond our imagination. I started drawing by doodling in boring grade school classes; that ball kept rolling and I eventually became the illustrator I am today. I work, specifically with pen and ink crosshatching, with a few drops of red in my artwork to set a nice, consistent tone. I got into worldbuilding by being inspired by fantasy settings such as *Star Wars*, *League of Legends*, and Marvel. It's just so interesting to escape our snooze-fest of a reality into a world where the limits are ours to control. I started illustrating my world in mid-2017 when I was creating character designs, and the world I was building has felt more real every time I finish a drawing. I just can't seem to stop.

The world I have built is called Kudao, it is an Eastern-themed setting incorporating Chinese, Japanese, and Mongolian culture with a mix of fantasy and light sci-fi. It's an alternative Earth, a world so ancient that not even history can keep up with its age. I have demigods based on Chinese zodiac symbols, koi alligators, samurai, demons, warlords, robots, ninjas, you name it. Since my setting is Asian-themed, I borrow a lot from Chinese/Japanese/Mongolian mythology, and I often study their history so I can write lore accurate to the source material. However, I actually have no idea what I want to do with this setting. If it were to become a tv series, video game, or a comic saga, I would be more than happy.

The physical process is rather long for each illustration. I choose to do either an environmental or character illustration on an 11x14 bristol paper. I sketch the entire thing in a light 2H Graphite pencil. Then I start inking—and since I'm cross-hatching, each drawing takes me around ten hours on average to complete. I draw for about 5 hours a

The main conflicts I run into while worldbuilding is the fear of misappropriating Asian culture. My ethnicity group is white American, and as I'm writing this I have never been to the continent of Asia. For example, I have to use Google Translate and other translating programs to create calligraphy and character/location names. I have accidentally had some names that translated to sexual and vulgar meanings or just straight-up nonsense, so I try to do a deep search whenever I come up with new names. I love the culture and I want to respect it as much as I can.

My views on my art are rather black and white. I have redone or removed 'official' artwork for my world for being either a bad representation of Asia or just poor quality. It's one of the reasons why I'm still doing cross-hatching; I feel like if the entire portfolio for Kudao was done in one art style consistently it would make the setting much more alive, so I'm picky on curating it.

I would love for my viewers to get that magical feeling in worldbuilding when they see such a well fleshed-out world that hasn't been seen before and think, "Wow, that's cool." I got those feelings when seeing the fictional worlds that inspired me to create Kudao, and I would love to pass on the magic to someone else. I want my viewers to connect with the characters and see how they interact with their environment. I want my viewers to successfully perceive the tone I'm trying to display. I want my viewers to explore and become invested in my visual storytelling and maybe even solve some mysteries

day so I don't think I've ever completed a drawing in a single sitting. When I'm done inking, I get to digital editing. I always scan my work at my campus library, and I polish the drawing through Photoshop by adjusting the contrast/brightness, fixing errors, and adding color. Most of the time, I add calligraphy art (either Japanese or Chinese depending which faction the drawing is connected with) so my work can resemble actual ancient eastern paintings. I'll also add in a red seal as my signature.

I've planted within. I have drawn 72 environmental illustrations and written 33 characters with personalities, flaws, strengths, and secrets. Getting a fanbase, whether large or small, is an absolute dream of mine. I love what I do. 🪐

EARTH, WIND, & FIRE:
THE IMPACTS OF NATURAL DISASTERS

GEOGRAPHY

NATURE

RESOURCE

by Toombs
Art by Anna Hannon

Natural disasters are a frightening reminder that Mother Earth is not to be messed with. Their sheer power and scale that can destroy populations on a whim is truly terrifying. Natural disasters contort and crack countries, wipe out entire settlements, and decimate everything we know and love, but what impact do they have on the fauna around us?

EARTHQUAKES

Earthquakes are concentrated along tectonic borders (Fig. 1) and, once they begin, can trigger many secondary effects that can disturb an animal's habitat. As such, the ecological effects of earthquakes on wildlife have not been well studied, despite this there are a few examples.

ATITLAN GREBE

The Atitlán/giant grebe of Guatemala is one of them. Primarily, humans were to blame for its extinction by introducing a species of fish that wiped out its food supply but the final blow came from the 1976 Guatemala earthquake which caused a huge fracture in the lakebed where they lived. The water level dropped by 6 meters in the following months, leading to a 60% drop of reed vegetation which they used for nesting and shelter. This was the axe to an already diminished giant grebe population. The species was declared extinct by 1990.

An earthquake that hit New Zealand in December 2017 has put Hutton's shearwater to great risk. Human intrusion via the introduction of dogs and pigs destroyed many of the former breeding sites for this rare seabird, leaving only the most inaccessible areas for the shearwaters to nest. Because of this, Hutton's shearwater now breeds in only two colonies along the slopes of the Kaikoura range on the south island digging burrows and laying only a single egg once a year. This reproductive scarcity ensured that the earthquake which hit shortly after laying season was cataclysmic to the species' population. The seismic activity also caused a series of landslides, one of which buried an entire colony and killed up to 25% of the population. At this time, the International Union for the Conservation of Nature (IUCN) lists the Hutton's shearwater as endangered, and has employed breeding strategies in an attempt to get populations back to what they were.

HURRICANES

Hurricanes and storms are probably the most common disaster that many of us face. These winds vary in how much damage they cause, ranging from irritating to catastrophic, but how do they impact the flora and fauna?

Wind storms can devastate migratory birds such as the piping plover. They have to complete their journey from the southeast coast of North America to the midwest with great precision and their stopping points meant for feeding and rest are pivotal and have little leeway—if a storm knocks them off course by more than a few hours, they could easily tire and fall from the sky exhausted.

Occasionally, hurricane force winds will carry ocean birds far inland, causing widespread confusion for the species involved. Generally, these animals will return to the water once the hurricane passes, though it can be difficult for some, such as albatrosses, to take off without water. Similarly, it's been theorized that some of the species found on the galapagos islands were carried there by rogue winds, the ancestors of Darwin's finches would have been much too small to make a long journey without a strong wind to carry them.
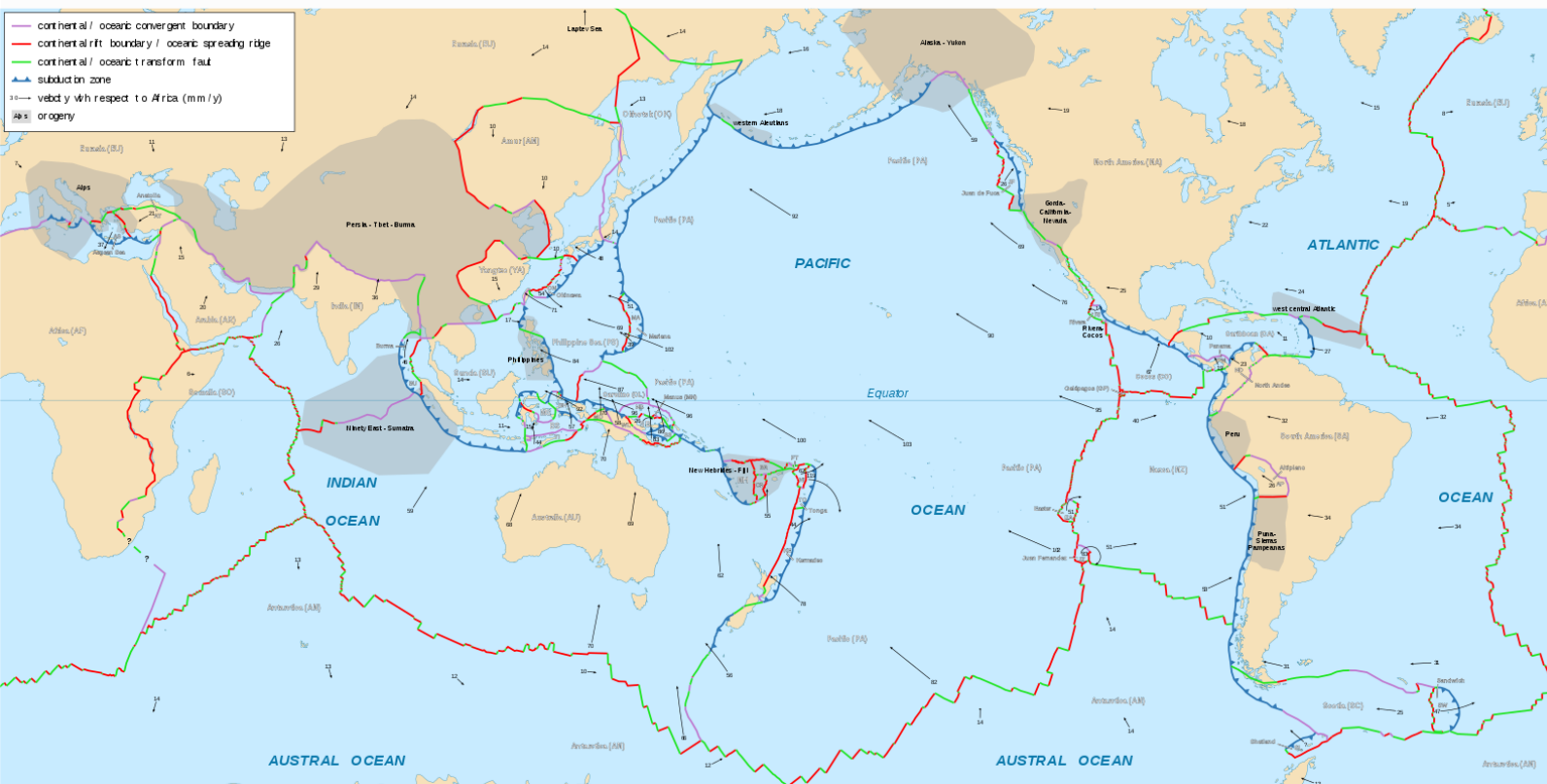
by Eric Gaba on Wikimedia Commons (fig.1)

BLACK TIP REEF SHARK
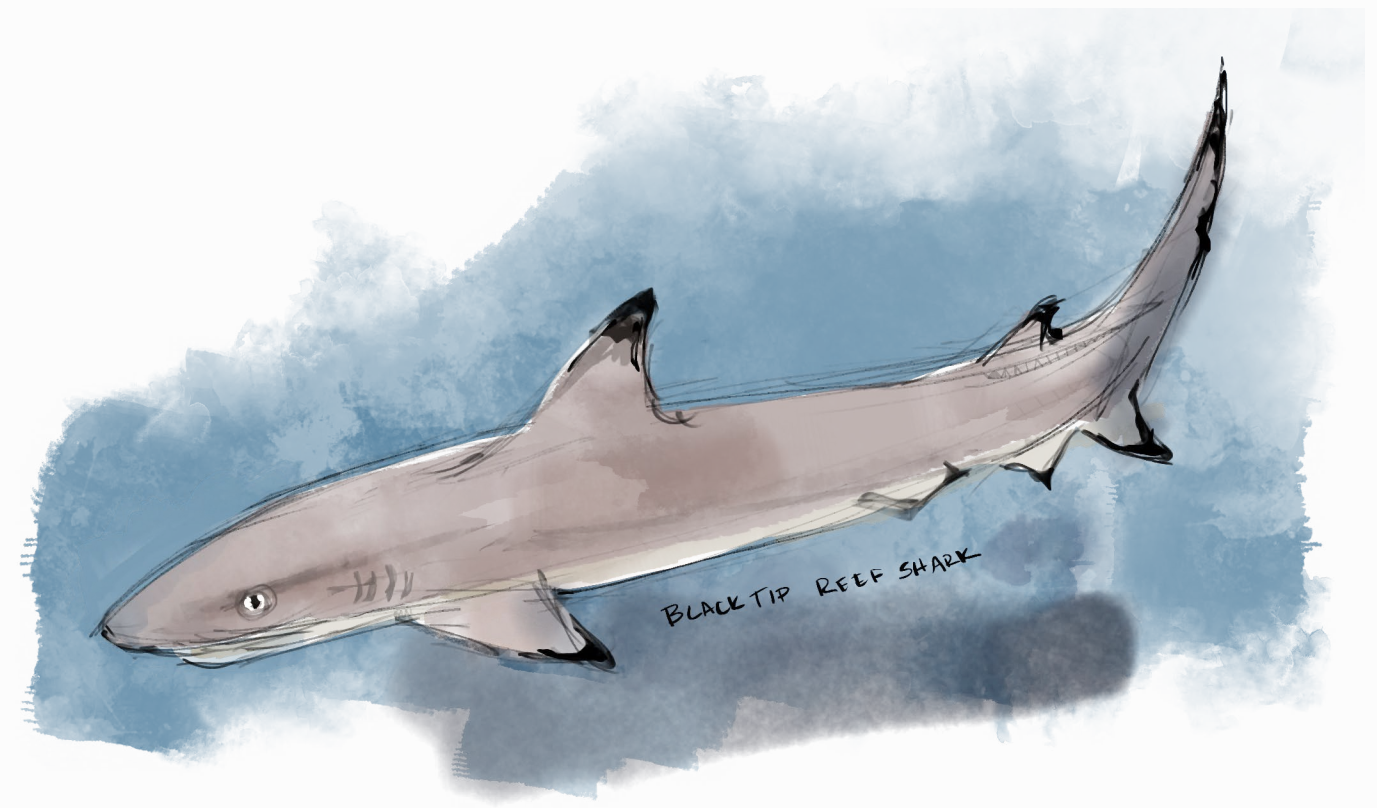
It's not just birds that are affected by storms out at sea, wind and strong waves damage coral, in turn disrupting the oceanic ecosystem. Turbulence from the winds cause further discomfort to fish and other creatures in the photic zone, although some animals manage to steer clear of the chaos entirely. For example, Black tip reef sharks (Carcharhinus melanopterus), normally occupy shallow reefs and bays but flee offshore to the deep and safer waters before the storm hits.

As storms reach the coast, strong wind destabilize the dunes and beaches, ravaging coastal birds and their nests. Sediment and pollution modify coastal habitats not just on a physical level but also altering their chemistry. Freshwater flooding from the heavy rains can occur at any point decreasing the salinity of the coastal environment and exposing the delicate flora and fauna (such as shrimp and oysters) to uninhabitable conditions.

The same is true for fresh bodies of water. Saltwater can enter freshwater ecosystems from the initial storm surge, causing brackish conditions. Many delicate species are killed outright with this change, but even bigger organisms, such as alligators are often drowned or injured by flying debris from the storm.

On land, storms may cause a great deal of destruction. Not only are trees stripped of any nuts, fruit, or leaves; they can also be uprooted and blown away by the winds, taking any nests with them. What animals that have managed to remain are more exposed to predators and further inclement weather as well. In 1989, Hurricane Hugo almost wiped out a large group of red cockaded woodpeckers in the southeast US by destroying the pine trees they depended on—this population of woodpeckers was at one time the largest of them in the world.

It's not all doom and gloom, though. Like the black tip reef shark, some animals are attuned to weather changes. The white-throated sparrow closely monitors barometric pressure and will delay its migrations to avoid hitting any oncoming storms. Larger animals, such as the wild horses of North Carolina, seek refuge in densely vegetated territories as the winds get stronger, then travel to higher ground when the floods come.

As well as this, some animals are able to turn disasters into opportunities. The eastern spadefoot toad loves nothing more than temporary ponds away from predators and they breed rapidly after storms hit, taking advantage of these safe conditions. The same can be said for blue crab which wash into estuaries in great numbers during these types of conditions leading to a huge boost in populations.

FLOODS

As mentioned previously, influxes of freshwater can impact the oceans' ecologies in that during freshwater floods, it is possible for the floodwaters to reach the ocean. The aftereffects of hurricanes Floyd, Dennis, and Irene in 1999 caused a boom in numbers of post-larval crabs although the diluted salinity caused by the freshwater proved a huge problem for their physiology and unfortunately, few survived.

Sediment carried by freshwater floods can also cause issues as its increased presence impacts sessile organisms such as oysters, covering them in piles of sediment from the constant barrage of debris-filled water.

There are numerous effects on avian species, despite their ability to fly. For example, ground-nesting species such as wild turkey may lose their nesting grounds, although most can recover depending on the season and which areas the floods hit. The relocation process can however lead to more problems; competition for suitable habitats, as well as a heightened risk of predators, are all problematic for brooding animals.

Tree-nesting species can also be negatively impacted, but are often able to move to more suitable areas more easily. Many songbird species on the Mississippi River use it as a migratory corridor and breeding ground, and when the river floods they move to adjacent, smaller river systems outside of the impacted area.

In resolution to these problems, some species "dump" nest, (one female cares for numerous clutches of eggs in one nest), this practice however, is both rare and potentially risky for all parties involved. The phrase "all eggs in one basket" springs to mind.

Small fauna, like squirrels and rabbits, experience higher than usual mortality in flooded areas because of their comparative difficulty to escape the waters should they fall in and even those that are capable will be at risk from predators and starvation.

Freshwater fish may also suffer as both natural and artificial contaminants through alien sediments and manmade chemicals can lead waters to have reduced oxygen levels and altered chemistry. Many fish species, especially smaller ones that are more susceptible to change, can be killed quickly by these changes it also leads to issues with reproductive cycles and breeding strategies.

Human interaction and conflicts become much more common in flood circumstances, as the rising waters make animals' habitable zones dwindle. Species that live close to local settlements are forced to share space and resources with humans. For example, floodwaters may have destroyed most of the vegetation that deer need for food and shelter and as they move closer to human settlements, it is possible for an increase of zoonotic disease.

Alligators often flee to higher ground in disasters, sometimes appearing in roadways or gardens, despite public perceptions, alligators are only aggressive when provoked. Snakes such as the cottonmouth do the same and seek temporary refuge in homes and other buildings during natural disasters, usually hiding in debris or seldom used cupboards.

Insects such as the fire ant are also forced from their nests by floodwaters. Luckily they can adapt by forming themselves into large rafts that stay afloat in most conditions remaining in this form until they hit solid ground (Fig. 2).

On the other hand, mosquitoes are a good example of an organism that flourishes in floodwaters because their chosen breeding habitat suddenly encompasses a larger area though this, of course, is a massive problem for us as humans. With more mosquitoes seeking to feed, the transmission of deadly diseases such as yellow fever, encephalitis, and malaria, become increasingly common.

VOLCANOES

An eruption can destroy vegetation and settlements over a wide area of habitats and territories. These eruptions also lead to other lesser known problems, such as pyroclastic flows and ash falls, most fauna can often flee before a lava flow reaches them, but other problems are not so easily escapable.

A destructive mass of hot ash, gas, and lava fragments called a pyroclastic flow can reach speeds of up to 430 mph and race down a volcano's side boiling anything in its way. Similarly, ash falls are detrimental to both fauna and flora, as they dump inches of ash on the ground stretching out for miles killing any plant life lucky enough to still be alive. Even aquatic animals struggle with alterations to water chemistry and quality caused by volcanic debris, leading to similar issues as with flooding and storms. Eruptions can also impact avian species, who often have to change migration routes and feeding activities to survive.

The eruption of Mount St. Helens provides a good example of the negative effects on the natural inhabitants of the area. The Washington Department of Game estimated that 11,000 hares, 6,000 deer, 5,200 elk, 1,400 coyotes, 300 bobcats, 200 black bears, and 15 mountain lions died from the pyroclastic flows following the eruption.

by TheCoz on Wikimedia Commons (fig.2)

It's not all negative though. Volcanic eruptions and all their compounding effects lead to very fertile soils. In time, the eruptions will encourage organisms back into their habitats quicker leading to population booms.

DROUGHT

As water consumption grows, drought becomes an increasingly severe problem in all parts of the world. A BBC article reported on the rapid loss of water in the River Teme where over 500 trout and salmon had to be rescued because of low water levels. Luckily, the Environment Agency carried out a mass capture of these fish and then moved them to oxygenated tanks. Droughts threaten all life, since every creature and plant needs water to survive and due to this, droughts can lead to many unwanted migration and territorial disputes as people and animals contest over limited resources.

Drought can also deteriorate water quality lowering natural currents, diminishing oxygen levels, and reducing the ability to dilute pollutants. Migratory fish like the stickleback are among the most affected and even animals that feed on these fish will therefore struggle to eat adequately.

How, exactly, does competition over these limited resources work? Interestingly, almost 25% of the United States is affected by drought, and the conditions send wildlife further in search of food, water, and shelter. Hungry deer, bears, and raccoons, among others, widen their search for sources of food, causing unwanted interactions with their human neighbours. With fewer berries, seeds, and nuts available because of the poor quality of vegetation, bears and raccoons will eat anything they can get their hands on, garbage and bird seed included. Less grass and vegetation growth also reduces cover for nests of waterfowl and young deer, making these animals much more vulnerable to predators. Deer, elk, and bighorn sheep may forage much closer to roadways than usual, increasing their chances of vehicle collisions and dwindling bodies of water and lower plant growth can also reduce certain populations, such as mosquitoes—a main food source for various species including bats. Overall, crowding in smaller area for access to food, water, and habitat causes further problems through increased predation, occurrence of diseases, and interspecies competition.

WILDFIRES

Wildfires are another devastating example of an uncontrollable and occasionally unpredictable disaster not initially beneficial to wildlife. They are chaotic and damaging, and can often be caused by droughts or human negligence, or a combination of factors. Naturally, wildfires usually occur in the dry season when it takes little effort to get started in an environment devoid of moisture. The fires burn extremely hot once they get going, often destroying all in their wake but It's not just the vegetation burned to cinders. Animals are often injured and killed (though some quicker or larger ones may escape) and smaller fauna, such as squirrels and snakes cannot always outrun the flames. Birds that fly away often leave their eggs and nests to be destroyed, greatly reducing the population of the next generation.

Even the animals that do survive are often burned, dehydrated, and malnourished as they struggle to find sustenance in their charred home. They suffer substantial losses due to the destruction, often having to re-establish territories as well as travel farther for shelter, food, and water and this migration can, once again, lead to more competition for food between members of the same species and other rival populations.

According to ecosystem ecologist Mazeika Sullivan, animals that live in these regions "have a long-standing relationship with fire" as this is a natural part of the landscape. Many organisms have some ability to escape the flames: birds fly, mammals run, and amphibians and other small creatures burrow into the ground or take cover under debris. Other animals, like large elk, take refuge in streams and lakes.

Fires can benefit predators who target these fleeing animals, though. Bears, raccoons, and birds of prey, for instance, feast on exhausted and terrified prey as they reach relative safety. It has been suggested that several bird species in Australia including the black kite may even help spread fires to further flush out small animals for them to eat. A moderate level of fire can create a wider variety of microhabitats in certain areas, ranging from open meadows to regrown forests. Having such a diverse series of biomes supports multiple species and the ecosystem in general.

CONCLUSION

Disasters are natural forces that we cannot, for the most part, control and in some cases, human intervention can only make them worse. Regardless, disasters can both destroy and carve pathways for new life and their impact can be felt from one corner of the world to the next. For some interesting ideas, disasters give a good excuse to change up animal physiology or behaviours as well as give additional cause for human interaction with fauna.

Creatures living where storms are common would need to have a few physiological and behavioural characteristics to make them more believable. Some aquatic species may be able to adapt to changes in water quality and chemistry, such as changes in salinity levels and avian or flying species must be able to navigate their way through storms or have other options to survive. Think about the available food sources, too. Land animals will need to be able to escape high winds and floods adequately. In floods especially, fish, small mammals, and ground-nesting birds are often the most negatively affected because they have more difficulty escaping rising water levels. If an area in your fantasy world often experiences frequent flooding, then consider this information to make your own flood prone fauna more believable.

Real world examples of animals that have adapted to volcanic activity are few and far between but that isn't to say that you can't come up with something interesting in your world. Fauna living in or near volcanic conditions would need to be able to either escape the fast moving pyroclastic and lava flows quickly or somehow withstand extreme temperatures whilst exploiting the unique minerals present. Similarly, droughts are punishing to organisms' behaviours and anatomies, it is, however, important to acknowledge that most of these species have adapted to high temperature environments over a long time. Otherwise, animals that adapted to live in an environment plagued by wildfires would need at least one of the following qualities: fast enough to escape from fires, or be heat resistant in some way. Of course, these ideas don't account for your world containing completely different elements or your fauna being made of sterner stuff than the ones seen on earth. Even if your species may be less "delicate" than the ones present in real life, the basic idea of adaptation remains the same.

Animal interactions with the natural world can often be overlooked in fiction. By taking some time to contemplate the impact of disasters, you can create extreme environments and species which may help them survive in your world.

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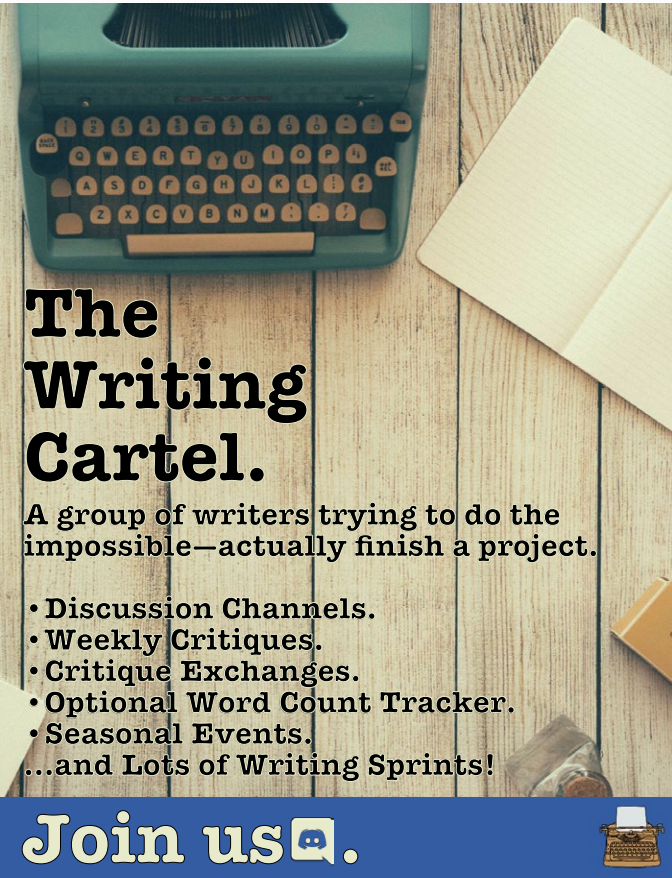
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WORLD SHOWCASE:
MEDWEDIANPRESIDENT'S MEDWEDIA

Interviewed by Aaryan Balu
   Art by MedwedianPresident

*M*edwedianPresident is writing and mapping the Medwedian Democratic Federation, a totalitarian dictatorship made of anthropomorphized animals in an alternate Earth. Here's how he describes himself and his work.

I am a young man still in education. I live in Europe and do various things in my free time—including, but not limited, to playing games, reading science fiction, listening to classical music, studying mathematics, and worldbuilding.

The Medwedian Democratic Federation is sort of a corrupted childhood fantasy. When I was small, I owned a lot of teddy bears. My parents bought me new ones every two or three weeks. I started off by giving them names and determining family relations. I think this was, at that point, still fairly in the "normal" range. But eventually, after watching cartoons in which animals form advanced societies, I asked myself: why not make a country for them? "Medwedia," then, comes from the Russian word for bear, medved.

What did this early worldbuilding look like?

At first, it was nothing but one or two nonsensical, poorly-drawn maps. I was small, and I struggled with creating landmasses and such. But after my dad bought me my first PC, I discovered Google Earth. It was a very primitive program back then, but it already allowed you to place markers on the virtual globe. And as such, I began placing Medwedian cities, towns, and villages in northern Russia, Norway, all the way into Alaska. Mashing up words from languages I knew at that time with the names of my teddy bears.

So basically, the capital Medwed was born then. It was at that point, and still is, located where Ukhta sits in real life. As implied, the Medwedian Democratic Federation lies on a planet with minimal geographic

The Medwedian flag.
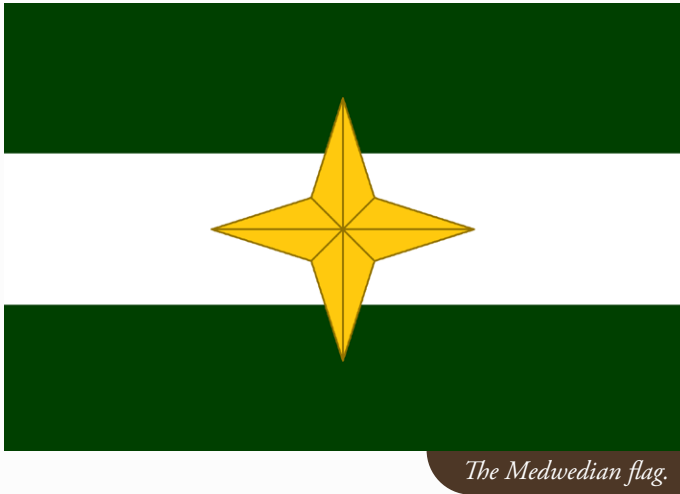
differences in respect to reality. The main difference is the fact that it is not evolved apes but evolved, humanoid bears who are the dominant and intelligent race. They walk on two legs. They speak like humans. They wear clothes. Men can even grow mustaches and beards on top of their facial fur. It was clear from the beginning that I want to place a new country into a real, slightly altered world. As such, countries and cultures except for Medwedia are broadly the same as in real life. There is a Russia, an England, a Germany, a United States, etc.

What's the in-world origin story for these people?

I did a bit of historical research to create a viable origin story for the Medwedians, so I looked at the origin story of the Russian people. As you might know, Russia was, according to the legend, created by three Varyag (Viking) brothers: Ruyrik, Truvor, and Sineus.

Ruyrik is the most famous one; he founded the Kievan Rus. Medwedia basically stems from the speculation "what would one of the other two have done." I chose Sineus, who reportedly went to Lake Ladoga. I made him go further east with a band of Viking settlers until arriving on a magnificent river

Dark green: core Medwedian territory. Light green: Colonies and possessions.
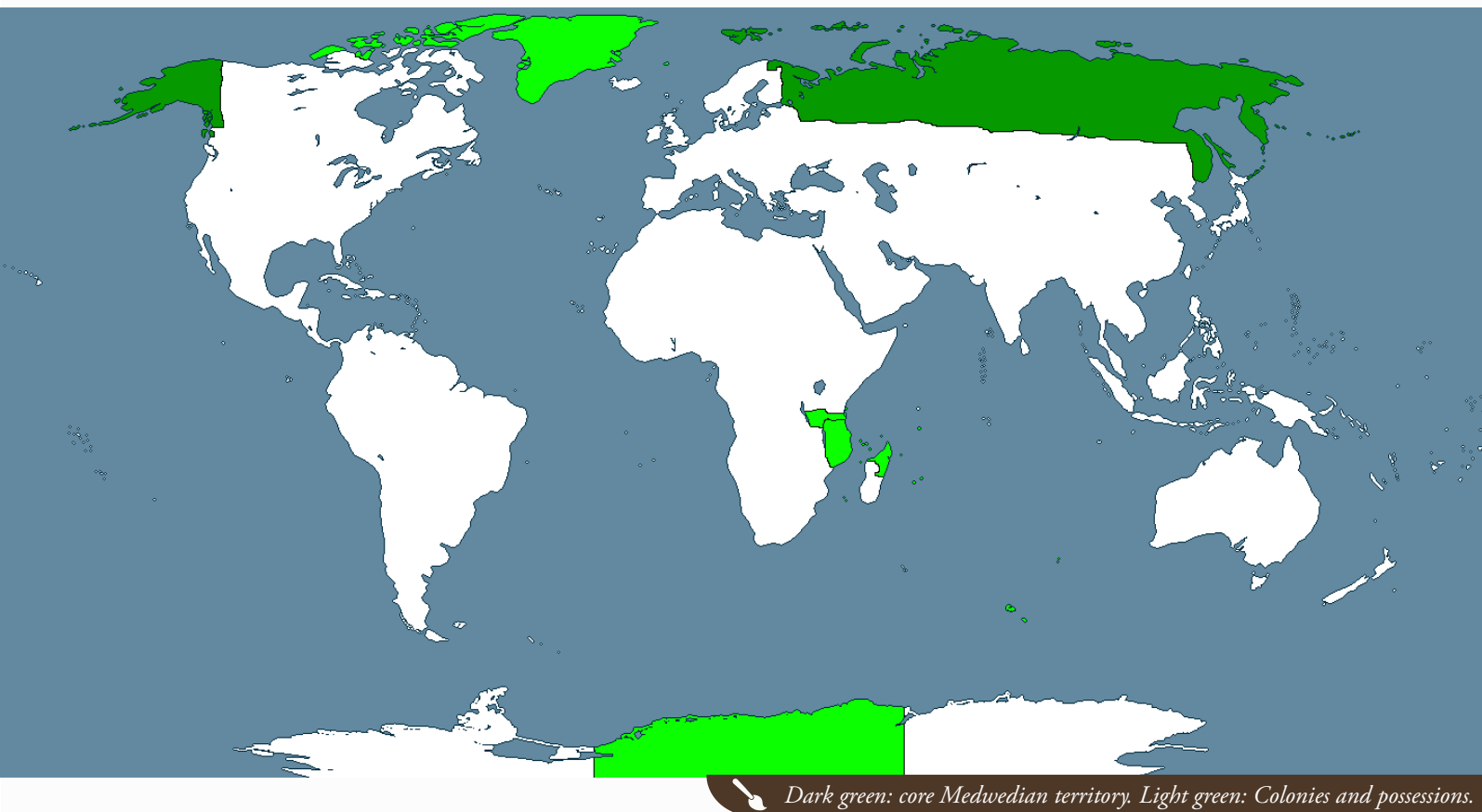
in a beautiful northern landscape that is in the real life Komi Republic. He stopped at a wide river, where he built a fort. The surrounding Komi people saw Vikings for the first time then. It was the first Viking settlement in future Medwedia. "Medwed" is related to the Komi words for "first, ancient." Over time, the settlement of Sineus grew and became the City of Medwed, soon found within the Duchy of Medwedland, which soon saw Scandinavian settlers pouring into the area.

Note that the climate in my world is, in these parts of Earth, a bit more comfortable, allowing for intensive agriculture much further north. The Duchy of Medwedland began competing with Muscovy, the Novogorod Republic, and another duchy lying to its west called Bjarmland. Wars were fought, and eventually, the Volga River (it has a slightly different course in my world) was selected as a boundary between the Norse and the Russian areas of interest.

More and more petty states appeared. They began expanding to the east, crossing the Urals. The Medwedians began fighting the Siberian Tatars along with Russians. More and more petty duchies

appeared and disappeared again until the 18th century. The most important Medwedian states of that time—the Duchy of Medwedland, the Duchy of Waidawiek, and the Tsardom of Tullemark—started yet another war. After 40 years of fighting, when resources were getting scarcer and scarcer and already-united Russia and Sweden were looking for an opportunity to invade the weakened Medwedian lands, several major generals and ministers deposed the royal families and declared peace.

The generals formed a military junta. They promised to modernize the country, as Tsar Peter had done with Russia, but they never did it. They kept feudalism in place. If anything changed for the commonfolk, it became worse. After numerous coups, civil and not-so-civil wars, Medwedia became what it is known today.

The Medwedian Democratic Federation is Orwell's worst nightmare. It's as totalitarian as a dictatorship can get. 75% of all Medwedians are peasants, serfs, and slave workers who toil either in labor camps, "private estates" (essentially labor camps privately owned by Party members), or polluted factories in

the cities. They rarely live beyond 30 or 40. Those who can't work anymore are simply shot. 15-20% are soldiers. Mostly cannon meat. Modern levies armed with pitchforks and 19th-century rifles. Then there is a small amount of what can loosely be identified as the "middle/upper-middle" class: doctors, teachers, foremen, skilled workers, and tradesmen, mid-grade officers, and such. The top 1% are the elite of the Medwedisk Folksparti, the "Medwedian People's Party." They de facto own the country and rule it from the comfort of their lavish mansions and palaces, sending their money and children to Switzerland.

The current dictator (who rules Medwedia with an iron fist and likes to pick out random names from the phone book to be sent to work camps or be executed) is His Excellency, the Glorious and Honourable President of the Medwedian Democratic Federation, Beloved Leader of the Medwedian People, High Marshal Theodor Lynden Frankenstein.

What's your favorite part of this world?

My favorite part of the world is designing the road network. I love motorways, and I draw out fictional motorways, complete with signage and everything.

What's the biggest worldbuilding challenge you've faced?

The worldbuilding challenges I face mainly concern the maps I make: How do I make everything align? How do I make sure that the distances between the cities are right? As Medwedia is a really big country, I can only draw high-detail maps of small areas at a time. But after finding the map editor JOSM, I think that my problem is solved. JOSM can be used to digitally create fictional maps and allows for a true top-down approach in which I can design rough features and then detail them without having to fear inconsistencies or distance problems.

A variant of Medwedia is on the site OpenGeoFiction. It is incorrectly labeled Konsiat (I need to rename it). As you can see, OGF is a cooperative platform where people design a planet

together—a fictional planet. Therefore, I had to transpose the landscape and provincial setup of Medwedia onto a different shape.

Can you sign us out in the Medwedian language?

I don't have a comprehensive grammar yet, but Medwedian is largely mutually intelligible with Swedish and Norwegian in its written form. The pronunciation is very different. I infuse a Norse substrate with various Slavic influences and also German words. As such, a greeting:

Gudsål fyr ljesning! Sei De skår i Medwedia, den Verdens entige Land hvere Præsident er udvalgt med 120% fra alle Stjemmer!

Translation: Thank you for reading! See you soon in Medwedia, the world's only country where the president is elected with 120 percent of all votes! 🪐

This interview was edited for Worldbuilding Magazine.

Special thanks to MedwedianPresident for taking the time to speak with us and share a bit about Medwedia. If you have a world of your own that you would like to share, apply for one of our future world showcases for a chance to appear in Worldbuilding Magazine.

HABITABLE PLANETS:
EXOPLANET RESEARCH FOR WORLDBUILDING

by Tina Hunter
art by Adam Bassett

Building a world from scratch is no small feat for any worldbuilder. From culture to characters and everything in between, the geology of the planet your story lives on can sometimes feel secondary. That shouldn't be the case, however, as your geology can add a new layer to your world and story building. Almost like another character, your planet can be full of flaws, benefits, and dangers that enhance your story. I've found that the easiest place to start building a whole planet is to look at the strange and wonderful planets already out there being studied: exoplanets.

2019 marks a strange phase for the study of exoplanets. So far we have already discovered 49 potentially habitable planets, and scientists have extrapolated that we could have 40 billion in our galaxy alone. These discoveries are thanks to the deep space Kepler and K2 telescopes. Unfortunately, these telescopes have recently retired. Our new space telescopes, TESS (which launched last year) and JWST (which launches in 2021), find exoplanets using transit photometry, meaning they wait for a planet to cross in front of its star and take measurements from the dip in light. Therefore, if any of these planets have an orbit similar to Earth's, we'll be waiting at least a year or two before we have a confirmed find.

So what is an exoplanet enthusiast supposed to do in the meantime? Many of them have been combing through the data we already have to create better guides and models for the types of habitable planets we might find out there. This is perfect information for a fictional planet builder.

While no one has come out with an actual guide yet, Sarah Rugheimer, an astronomer and astrobiologist at the University of St Andrews in Scotland, and her colleague Lisa Kaltenegge are pretty close. They took the data from different geological epochs in earth's history (as well as surface features, cloud cover, and star type) to come up with different kinds of planets we might find out there.

There is also the climate model created by Max Popp, an associate research scholar at Princeton University in New Jersey, and Siegfried Eggl, a Caltech postdoctoral scholar at NASA's Jet Propulsion Laboratory in California. They studied how the placement of a planet inside the habitable zone can dramatically influence its climate.

It took me a while to sift through the data, but I did my best to break down just the human habitable planets. These exclude all the planets without a breathable atmosphere even though in a science fiction novel they could be terraformed.

FROM THE STUDIES

STAR TYPES

First, let's talk about star types. The modern classification system for stars is the Morgan–Keenan (MK) classification with a luminosity class attached. This breaks down the star into a spectral class based on color & heat (O, B, A, F, G, K, M, and D) and then a numerical value to break down the heat in each class (0-9 with 0 being the hottest). This resulting letter and number form the star's spectral type. We can't forget about the size of the star, which we can denote using the Roman numerals 0 through VII. Zero would give us a hypergiant and VII a white dwarf.

For example, our sun's full classification is G2V.

G (Spectral Class) + 2 (Heat) + V (Roman numeral for 5, Star Size)

So why is this important? Well, the type of star can have a big influence on the climate of the planets that orbit it because each star type heats planetary atmospheres differently. This causes different concentrations of gases like water, oxygen, methane, and ozone. Considering we humans require around 20% oxygen to breathe, this is an important statistic to nail down. Plus, oxygen is a key factor in determining if plant life is present since it's unlikely for a planet to have free oxygen without life.

Thankfully, this study only focused on FGKM stars (white, yellow, orange, and red stars) as they are the most common and most likely to produce habitable planets, so I will do the same.

GEOLOGICAL HISTORY

The study from Rugheimer and Kaltenegge looked at four points in Earth's geological history: before microbes (3.9 billion years ago), after microbes and the first rise of oxygen (2 billion years ago), during the second rise of oxygen (800 million years ago), and Earth as it is today. However, since there wasn't enough oxygen for humans to breathe in the first two epochs, I removed them from my data below.

Rugheimer and Kaltenegge's data showed that earlier epochs have weaker atmospheres than our modern Earth because of lower ozone concentrations. Without the higher ozone in these early epochs, planets around hotter stars would have less water and methane, causing these atmospheres to be cooler. This is the opposite for the modern

epoch where the hotter the star, the hotter the planet. Water and ozone are also present in higher concentrations around cooler stars even in earlier epochs.

They also gave points of comparison for reflectivity because oceans, continents, and clouds all change the amount of light bouncing off a planet. Since an exoplanet will be tiny in the telescope, its reflectivity can tell future astronomers what kind of planet they are looking at. For us, it gives us a better picture of what the surface of the planet might look like.

In their 2017 study, Rugheimer and Kaltenegge write, "due to the increased stellar flux at shorter wavelengths for an F or G type star, Rayleigh scattering is much more pronounced for F and G stars than for K and M stars". Rayleigh scattering

affects how light is scattered by particles which gives us our blue skies at short wavelengths, and red-orange sunsets at long wavelengths. This could mean mean that hotter stars are more likely to have deep blue skies, and this tendency shifts towards light blue, green, and yellow (possibly even orange) as the sun in question becomes cooler.

THE GOLDILOCKS ZONE

Also known as the "habitable zone", each star has an ideal range of orbital distances where a terrestrial planet is most likely to have liquid water on its surface. Having liquid water is the key there. Earth sits closer to the inner edge of our sun's habitable zone, with Venus sitting outside the zone and Mars on the outer edge of it.

When a habitable planet is closer to the star, the global surface temperatures stay almost constant. This is thanks to the amount of water vapor that would stay in the atmosphere, acting as a regulator to keep the climate comfortable. When a habitable planet is further from the star, it would have a lot more variation in its average surface temperatures over a year, due to the decreased amount of regulating water vapor.

Even star clusters—two or more stars that orbit each other closely—have a habitable zone. In that case, the habitable zone depends on the distance from the center of mass that both stars are orbiting. To make things even more complicated, a planet around two stars would not travel in a circle; instead, its orbit would wobble because of the gravitational tug-of-war between the two or more stars.

Overall, a planet's position in the habitable zone will affect the amount of atmospheric water it has, which helps determine the temperature and climate. For ease, I've broken the habitable zone into two sections—Inner and Outer—which results in high and low atmospheric water levels, respectively.

BUT WHAT ABOUT...?

If you are an avid reader, or just have an excellent imagination, you may notice there are a few planets from fiction and elsewhere missing from the above list. Does that mean they aren't possible? Of course not. This was just one interpretation of the data I had. Even though the data is from two reputable studies, with 40 billion possible habitable planets in our galaxy, there are sure to be some planets that don't fit neatly into these rules we're just now deciphering.

Fictional Habitability Index

	White Star — Navy Blue Sky		Yellow Star — Blue Sky		Orange Star — Seafom Green Sky		Red Star — Green Sky	
The four major star groups thought to host habitable planets and their respective sky color based on Rayleigh scattering.								
Typical Surface Water Percentage.	<30%	>80%	30 - 50%	50 - 80%	50 - 80%	30 - 50%	>80%	<30%
Based on two earth-historical epochs: **A)** 15%-20% O_2 with diverse marine life but primitive life on land. **B)** 20%-25% O_2 with a thriving and evolved biosphere.	1A	1B	2A	2B	3A	3B	4A	4B
Habitable Zone — **Inner** (Even global temperature. Predictable seasons. Positive water cycle.) **Outer** (Fluctuating global temperature. More frequent Ice ages. Inconsistent seasons.)	**Desert Planet** With large lifeless deserts and slow plate tectonics, this is a planet of cold nights and blistering days. What little land life exists will be close to the small oceans/sea basins and grow no taller than a meter.	**Island Planet** This planet is largely submerged, meaning the only land are micro-continents and island chains. The oceans are shallow and warm, resulting in a tropical climate and an advanced underwater ecosystem.	**Swamp Planet** This planet has low surface features, giving us extensive swamplands and high amounts of global precipitation. Solid ground would be mostly lifeless, and glaciers would cover the polar regions.	**Earth Analog** Just like Earth, this planet will have a wide variety of climatic conditions caused by continental plates, a richly diverse biosphere, and a moderate planetary climate.	**Wet Planet** This planet is made up of shallow seas and low topography on its large continents. The primitive vegetation here is widespread, and has high amounts of global precipitation.	**Jungle Planet** With features like extensive swamplands, rain forests, jungles, and island chains, this planet has extensive vegetation, a thriving ecosystem, and no glaciers in polar regions.	**Ice Planet** Large polar caps, glaciers, and ice-covered oceans dominate this planet. Glacial carving has made vast mountain ranges, and life will mostly be underwater and / or adapted to the cold.	**Extreme Planet** With vast inland dust deserts and small green oceans, this is a planet of extreme temperatures. Highly specialized and adaptable life will be widespread and thriving.

For example, while the moons of gas giants that sit in the habitable zone would have similar classifications to their standalone planet counterparts, there would be unique features to consider as well. Such as possibly having tidal pressures from being tidally locked, the gas giant's potential magnetic effect on the planet, what kind of day and year cycles they have. There may also be planets out there that are close to Earth-like with early biospheres or decaying ones but would require the aid of technology to be habitable for humans. There could be planets with uninhabitable surfaces that have extensive cave systems allowing a thriving underground biosphere to emerge. Or water worlds, where the surface is covered entirely by a single ocean that could be hundreds to thousands of kilometers deep. Tidally locked planets have multiple variations as well, ranging from a scalded side facing the star with water on the other side to frozen on the side facing away from the star and water on the side closer to it. For these planetary types, where they sit in the habitable zone can have an even greater impact on their potential climate and geology. The most important thing to remember is that for a planet to be deemed habitable, only a tiny portion of it is required to support life.

The types of habitable planets listed in the index are a great starting point for you to build your fictional world, and it may also offer up new options you might not have considered. Will you build an ice planet with green skies, or maybe a jungle planet with green-blue skies? What kind of plants and animals will thrive there? What kind of culture would develop? What kind of story will emerge? Building solid geology for your story means there are so many more obstacles you can pit your characters against and places to invoke awe and wonder in your reader. 🪐

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Deificat, Branco Stancevic

WORLDBUILDING MAGAZINE

Deep below the earth lie, undisturbed, the secret denizens of the underearth, entering into their lightless lairs through the holes in the ground. We above-earth people call this lair of horror and secrets the deep below. Much of the dark monstrous beasts that plague our lands emerge hungry and menacing from the darkness. Few of us have travelled there and fewer have ever returned.

—An Introduction to the Deep Below by Atticus Zhin, Chief Geographer of the Earth Guild of House Zworren

CAVE FORMATIONS:
THE NATURAL & SUPERNATURAL

by A. Edwards
Art by Anna Hannon

RESOURCE

NATURE

The strange locations, events, and exotic dwellers that exist below the earth, though hidden, are often a powerful catalyst for events above. Caves, the deep darknesses beneath, provide a number of boons to civilizations willing to exploit the gifts that sit hidden there, be they great riches or valuable resources. Yet, the costs may be high. Hidden below may lay all manner of ferocious creatures, evil curses, forgotten plagues, and hungry cities, or merely the dangers that come along with greed itself. All are able to tip a civilization into collapse or ascendance.

Commonly, safety is one of the underground's most useful gifts; without it civilizations are mere prey to their neighbours. Below ground is a well suited place to hide, fight, or wait out a siege. Without a last redoubt little may be left of a civilization when it falls prey to the avarice of its neighbours.

Each cave and chasm is influenced largely by its formation. Below, I have listed the ways in which they form, as well as what uses and features they may provide.

NATURAL CAVE FORMATION

ACIDIC SOILS

The vast majority of the accessible caves on our planet are formed by the erosion of limestone, eaten away by water turned acidic by soil. This process then carves the soft rock over immense spans of time, often tens of thousands of years, forever changing and growing as the years go by. Ultimately creating the grand and chaotic shapes common to the entropic nature of earth's geological processes.

Though most are made of limestone, some stunning examples exist of caves wrought from marble (Marble Caves, Patagonia), dolomite (Bozkov, Krkonoše foothills, Czech Reb.), and the otherworldly crystalline formations of gypsum (Cave of Crystals, Chihuahua, Mexico). Also, on rare occasions, acidic gases float up, burning away the soft rock that sits above it (Lechuguilla Cave, New Mexico, US).

This slow process leads to long, thin, and horribly tight tunnels, but under the right conditions, huge caverns are created which entire cities could be hidden within. Underground rivers are a common sight, wearing their own path through the rock. Often these are a safe nursery for young fish, which in turn feed all manner of strange fungi and other basic life forms that are able to live without light. Stalactites and stalagmites are most often found here, created from the slow, undisturbed collection of mineral deposits over immense spans of time. Eventually, large ones stretch back to the roof, resulting in giant columns. Old caves could well be patterned from head to toe in these lumpy yet smooth sediment.

On occasion, where the surrounding rock is not strong enough, the roof can collapse. The resulting depression lets in light, leading to unique biomes. Given enough time, they become home to unique species taking advantage of the safety of being cut off from the wider environment.

MINING

Humanity's hunger for resources often results in some immense feats of geographic adjustment. Huge coal mines may snake for miles underground follow the erratic lines of coal and other treasured resources through the deep rock. Humans have searched below for all manner of prized minerals, which if carve-able like salt, the miners may leave behind stunningly crafted works of art and beauty. (Wieliczka Salt Mine, Poland).

Being human built, these tunnels are likely an accessible size, and often contain long straight hallways dotted with functional equipment like hooks for lamps, wooden arches, rails, or discarded tools. One might find rotten old bridges spanning deep chasms. Ropes may lead down holes where light from a torch cannot penetrate. Much could be gleaned regarding the inhabitants life and culture, from what remains. Skeletons might denote a violent end, while rotten meals on tables could indicate a hasty retreat. Even old markings that speak of dangers down some of the many branching hallways may warn of ancient legends and feared places.

LAVA

As lava flow oozes along its path, its outer layer cools, but its inner layer continues on, leaving behind it a tubular formation known as a *primary cave* (Manjanggul, Jeju City, South Korea). These can run for miles, threading a secret path all the way to its volcano of birth.

This formation results in very tubular and often plain caves. Though simple, they can run for miles and provide an excellent hidden route to a dormant volcano. These artifacts of great cataclysm might inspire a spiritual and fearful civilization; tunnels that lead back to the source of a god's almighty anger and spite would be given great meaning, and possibly offered sacrifice and other gifts to please the erratic intents of higher beings.

WAVES

The power of the tide carves many dark, haunting, and well-hidden caves. Sitting unseen from the shore, they are a great boon to any smuggler or ne'er-do-well hoping for a nice spot to lay low with easy access to the sea. Many of these opportune hidey-holes dot the Cornish coast in the United Kingdom with legends of those crooks's deeds peppered in folklore.

These cave formations tend to produce crisscrossing caves that snake around sections of harder rock, leaving a number of small hiding places, and sometimes mini-beaches. Where the tunnels delve further into the sea wall, they come close to the land above. This grants their secretive users a chance to dig hidden exits to the sea, sitting below seemingly ordinary buildings. Many sea creatures find these caves as useful resting and hiding spots, or a populous hunting ground. Such dens may provide opportunity for glory if these creatures be large, dangerous, and unfriendly.

In here we shall never be found. The dastardly coast guard can stick it, them and their damned customs agents! Spice will flow freely from these caves. Even from the sea, our boats remain hidden, stashed in the deeper hollows. The bugs in here remain a nuisance. Only Egren complains, he says he can hear scratching at night. Probably just another itchy smuggler.
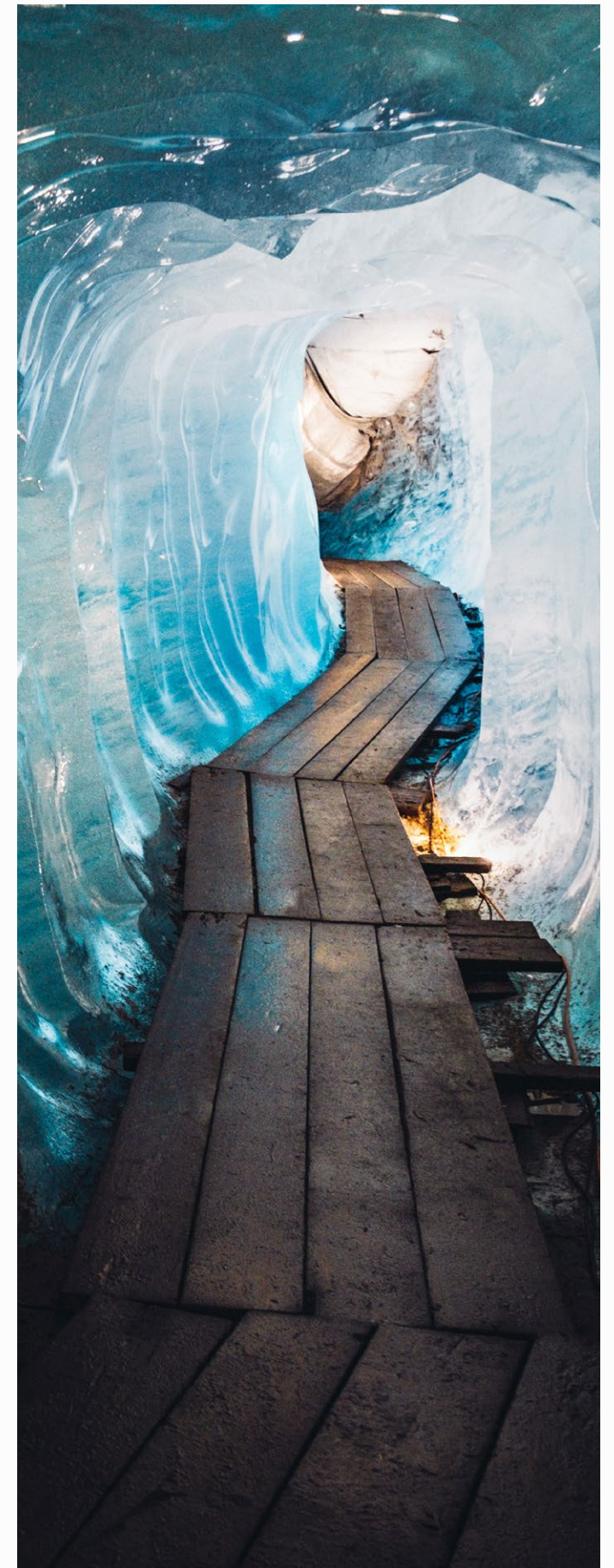
Unknown Smugglers Journal - Washed up on Lyme Rock Bay

Photo by Patrick Robert Doyle on Unsplash

GLACIERS

Hidden below these goliaths of ice, lie the temporary and glistening glacier caves. Formed by the warmed melted water that slips under, and widened by warm summer air, they come and go with the weather. Running for many a mile, these tunnels are surrounded by the wonderful patterns created by the slowly shifting ice. As wondrous as they are temporal, able to disappear completely, just as entirely new caves form elsewhere below.

These caves are cold and curious. Capturing the light, they refract it producing wonders of illumination and form. Ripples left by melting ice then layer the walls with delicate and intricate patterns, and the ice's transparency allows light to pool and catch shapes in a myriad of brilliant contours. Stalactites form here quickly and easily. Huge columns can be made and destroyed even before someone has a chance to admire their beauty. Hidden within the ice itself, strange frozen forms appear in crystal clear blocks of wondrous bubbles, whirls, and even creatures trapped in a sombre final moment.

Too unstable to call home, their most popular use by sapient beings is to provide a place to hide, or, if open at both ends, a secret path known only to the most adventurous.

SUPERNATURAL CAVE FORMATION

There are limited ways in which caves have appeared on Earth, but we are unaware of how the underground may be opened and exploited on stranger planes. Below I have listed a few possible ways such caverns may come into being through more supernatural means.

BEASTS

The gnashing of teeth, the slow scraping of hooves, the natural acidity of leaked fluids, the wild and strange beasts of other worlds have a number of ways to produce tunnels of their own making. Just as termites and ants build great homes out of dirt, many larger beasts prefer building their homes below the earth.

These caves are functional to the beasts that made jagged sides and branching paths following where the soil is softest. There would be many rooms and signs of living: dung, bedding, and the remains of lunch that had been dragged home. The smells of life would be pungent, and the floors discolored from use. Other species may find a use for their functional but uncomfortable holes, should their makers be of big enough size, but the likelihood for there being trouble expelling them may be somewhat high.

These great caves of Ictul are the work of horrific beast—the largest Rock Eater Worm we have ever recorded. This giant monstrosity has eaten small towns and bored miles below the surface. It has snuck to places where even we cannot hope to catch him, but dare it rise again, it shall find the Guild ready!

—A letter to the councillor of beastly dangers, Atticus Zhin

PLANT LIFE

The fauna that covers the surface of planets have their own methods of tunnelling below. Fungi live mostly beneath the ground, only surfacing to spawn, but an acidic mycelium (a mushroom's 'roots') that carves its way through rock would leave behind a living, wild network of tunnels behind it.

Imagine tunnels that drop down quickly, following the most nutritious veins of stone all decorated with the fauna itself. Sprouting flowers and seeds litter the floor. These mycelium tunnels are tubular and circular, the walls patterned by the spreading, writhing tendrils. The air itself is powerful, pungent, and likely sprinkled with a dangerously intoxicating chemical. Destructive concoctions might very well wreck the mind of any wandering soul, or any creature foolish enough to investigate the fresh young spores waiting there.

EARTHQUAKES

Although a natural force, quakes are not known for producing caves—that, or they are yet to be found. However if an underground passage were to peel apart at the tectonic boundaries, secret places may come to light. The power of the plates grinding and smashing against one another can produce all manner of shardlike gaps, gaping chasms, and dangerous falls. These likely are not permanent and shift with the jostling of the earth, but for a time, they might harbour a level of safety for those seeking refuge.

The speed at which these hidden chasms come and go mean they would likely be devoid of any organic life. Their unguessable locations and giant caverns provide treasured places of secrecy in which whole cities could develop. If these cracks break through rivers, water would quickly pool inside creating

Photo by Vruyr Martirosyan on Unsplash

giant undisturbed freshwater lakes filled with the fauna stolen from the rivers above.

EXTREME WEATHER

Weather on our earth rarely contains enough power and time to create great formations below the soil, but on other planes these forces could hold power so great they would be chilling to consider.

Monstrous tornadoes whip up sand or water. Over time they can erode rock, sanding it away under conditions that would leave cities in ruins. Such unusually powerful forces could leave behind huge plummeting holes that spiral ever downwards. A consistent torrent of acid rain over time could mimic that of acidic soil, burning huge cave systems into areas where very little soil or life are found. Rare arrivals of cloud, travelling to drier planes, might hide lakes beneath the most arid of deserts. Powerful lightning storms could vaporize enough underlying rock to leave behind a jagged formation somewhat like an ant's nest of immense size.

The formations left by such tremendous events of natural force would likely be craggy and warped. Walls crystallize under immense levels of energy.

MAGIC

The work of mages, or possibly heavily advanced technology of which we can only imagine, could craft and alter many of the world's natural wonders. In a bid for secrecy, a magical cult might use their powers to delve into the earth. Powerful magic allows the building of hidden places of remarkable form and shape.

Many forms of magic contain enough power to remove soil, break rock, and mould stone. Its control and inhuman power mean the places it carves are entirely to the taste of its creator. An academically trained mage would likely create great halls that echoed the stone buildings of his training, perhaps grandiose and intimidating walls textured with symbolic detail. A wild outcast however, might make a shifting fractal layer of paths, a puzzling web of illusions spun from the influence of natures organic form.

Some users of magic tend to be more restrained in their aesthetic, others more adventurous. One might make bright crystals that illuminate giant passages, perfectly smooth arches that run along carefully sloping floors. Others may tend to images of accomplishments and secrets of knowledge sitting as frescoes upon ceilings. While exploring, one might notice strange smells of myrrh and boiled newts. Traps might lead to dark plunging holes where curiosity pays its price.

We have dug too far and too deep. The gods have cursed us, for our greed has been too great. The endless tide of these biting gnashing beasts is too much to bear. Are we lost? I fear so. Let this record remind those that we left behind, leave the caverns of Elmont be. Its treasures command too high a price!

—A journal found at the last hold in Elmont Cavern - Terin Minerson

CONCLUSION

Caves and the weird places of the underground are a thrilling and curious secret. Below us might be all manner of unexplored wonders, more so in stranger worlds. Each time a person follows a tunnel, there is a strong chance a story may begin to take form. Adventures are born from our desire to explore and few places offer so many untapped secrets than the underground.

I wish you all the best in exploring the secrets that are still to be revealed.

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ASK US ANYTHING

By B.H. Pierce
Art by Ahmed Elgharabawy

This Ask Us Anything is presented by a senior member of the Amalgamated Order of Interdimensional Persons, Percival Aluminius Illumnius, Adjunct Professor of Gateways, 3423 WestNorth Street, Dunny-on-the-Spire.

Goldenarchangel: When designing an alien species, how do I make them truly "Alien" rather than just humans with a certain trait exaggerated?

To avoid a debilitating case of the dreaded rubber-forehead syndrome, know that 'Alien-ness' comes from two places: the form of a creature and the mind of a creature. We'll start with form as it is the simpler of the two. Humans are used to seeing solid, carbon-based creatures walking on four or two legs and communicating by vibrating the air with muscles in their throats. To make a creature seem alien, change these aspects up. Perhaps your creatures don't see at all but use senses that humans do not have access to. They may have an entirely different way of ingesting nutrients, making mealtimes an interesting experience. A completely alien creature may not even be made out of solid matter but gas or liquid. Altering the way a creature moves or breathes or communicates is a quick and effective way of invoking 'Alien-ness.'

A far more difficult way is to make said creature very different from a human mentally. This is challenging because human experience is limited to...human experience. Instructive examples to draw from are cats and dogs. No, really. Think of how different the minds of these two creatures are. The mind of a cat is built to be that of a solitary hunter, to ambush and capture its prey. Whereas the dog is a

social hunter, mentally primed to work with others on long hunts. How these animals interact with humans and humans with them can be the base to build your own alien species. What did they evolve to do? What is their speciality? What behaviors were rewarded by evolution, and which were weeded out? Go back to the very beginning of the species' history and move forward if you want to make a truly alien mind.

Pharaoh: When I have a well-planned out timeline of my world's past and future, how would I know which point in time is best to start, from a reader's point of view?

The most important thing to remember when deciding this is that your world is a backdrop to your story, not the story itself. Find out what sort of story you want to tell and then scour the well-detailed and thoroughly cataloged history of your world for a time and place that would be conducive to it. If you want to tell a story of war and the rise and fall of nations, then you would naturally pick a period of great upheaval. If you want to weave a romantic tale about the life and times of professors (we are a passionate, fascinating people), then you would need to focus on an area and time where there are large academic institutions. When you put your story in what can be called a plot-rich environment, it will make your job as an author all the easier, and knowing what you want to say is vital to doing that well.

Celestial_Blu3: How do you create a sense of interconnectedness in your world?

The first and foremost way to give the scattered parts of your world a feeling that they are part of one whole is to give them a shared history. Over the course of time, empires rise, consolidate, and break apart; perhaps the different parts of your world were once all part of the same empire, giving them a

common heritage they can harken back to. Consider ancient Greece and Rome, and how scholars and kings centuries later would emulate the forms and styles of those long-gone civilizations. How many nations, both fictional and nonfictional, have had a Senate? How many times have you seen Greek columns used as iconography for wealth and power?

A widespread and far-flung religion is another way to bind disparate parts together. If the myriad people of your world worship under the same symbol and offer prayers to the same deity, a reader can't help but feel all the pieces are part of one whole. A word of caution on that advice, however: do not make the practices and forms identical in all places. The architecture of temples on a windswept coast in the arctic will naturally be different than that in an earthquake-prone desert. Make certain there are local variations in this faith, but also be sure to keep certain core aspects of it identical everywhere. That will assuredly give you the sense of interconnectedness you seek.

But suppose you can't follow either of these marvelous pieces of advice. Fine. It's your world and you want to do without continent-spanning empires or a single religion. There is one option left to you, and if you can't use it, you're on your own.[1] People trade and engage in commerce in all eras of history and most dimensions. Having rare goods bartered and sold across vast distances shows that, while your characters and lore may only focus on one location, the world is a bigger and more dynamic place than that. All in all, a world may be interconnected by its very nature. These are just a few of the best ways of showing that. 🪐

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[1] Disclaimer: I'm required to inform you that there are possibly other options to solve the issue of interconnectedness in your world(s), but these are the three I have come up with, so really they're the only ones that matter.

MEET THE STAFF: BK BASS

Curated by WithBestIntentions

Please introduce yourself! What is your role for the magazine? What do you hope to do going forward?

I'm B.K. Bass, author of fantasy, science fiction, and horror. I've published six books so far and have two more being released by the end of the year. I'm also the acquisitions director for Kyanite Publishing, the editor-in-chief of the Kyanite Press journal of speculative fiction, and a staff writer for *Worldbuilding Magazine*.

I love working on all of these, and going forward, I hope to keep doing what I'm doing now!

Do you have any advice to worldbuilders or writers who are just starting out?

Don't spend too much time in books or behind the keyboard. Get out and experience life. Pay attention to everything; it's all research. I noticed my own writing evolve drastically as I grew more seasoned. I think that having spent time working in the service industry made the biggest difference for me, as I had the opportunity to study a staggering variety of different personalities.

I can use that experience now to write more believable characters. I also believe that one must experience love, success, hardships, and tragedy themselves to fully understand how to express the characters' reactions to such things.

Tell us about your world!

That's a loaded question! I have several worlds already among my published works. Seahaven is a dark/flintlock fantasy setting centered on the eponymous port city. Understone is a kingdom of dwarves in a traditional high fantasy setting that's yet to be explored further. New Angeles is the setting of my cyberpunk noir books *The Night Trilogy*.

I have a large project on World Anvil called *Istaria* which is to be the setting of a large epic fantasy saga I have brewing. So far I have about 70,000 words of notes on there, and it's still growing.

I have a few others, but they're all in the early stages of development.

Anything else to share?

Parting The Veil is coming out on August 9th. This short novel is the first in a series of cosmic horror alternative history adventures set during World War II.

What Once Was Home is coming on October 25th. It's a post-apocalyptic military sci-fi novel about a man in the Appalachians learning to become a man and a leader. He struggles to maintain his moral compass in the aftermath of an alien invasion.

Stop by bkbass.com for more about these and all my other projects, and visit kyanitepublishing.com to learn more about the Kyanite Press and our other books from almost two dozen amazing authors.

BUILD SOMETHING NEW WITH US.

Worldbuilding Magazine is always seeking writers, editors, artists, and other passionate worldbuilders!

Our Writers help by providing content for the magazine Editors refine it and provide invaluable feedback. The Artists breathe life into the magazine and our Layout Artists arrange everything into the final products you see. Last but not least, the Meta department assist with organization and the community. If you are interested in helping with our next issues? Email, or find us on Discord.

✎ *Alexander Andrews, Adam Bassett*

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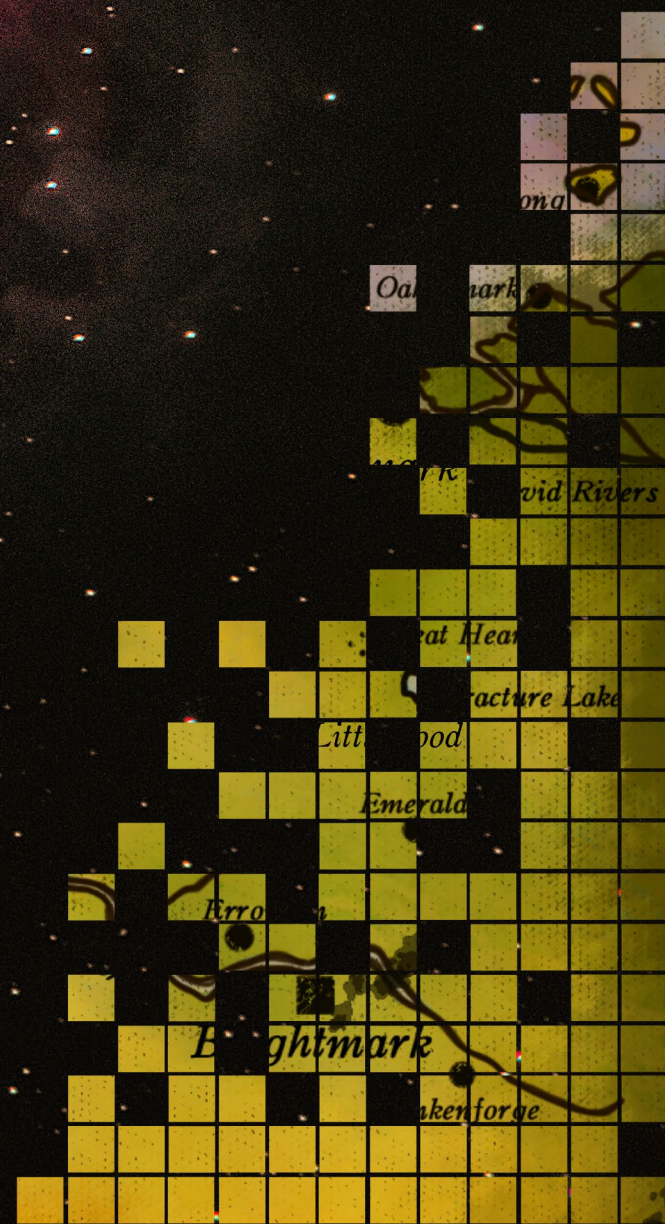
LETTER FROM THE EDITOR

Hey, worldbuilders!

We hope that you enjoyed reading this issue of *Worldbuilding Magazine* as much as we enjoyed making it. There's something special about getting to do *literal* worldbuilding, and the *Geography* issue allowed us to do just that. The team really rocked it this time. The writers dug deep for their articles, and I think the quality shows. The editors then laid their signature coat of sanding and polishing on top, and the artists inlaid some wonderful jewels of artwork to bring the whole thing to life. I'm really proud of this team and the work they do every time. I would also be remiss to not mention our more behind-the-scenes team members that help organize, facilitate, and manage both the magazine production and our very active Discord community.

Speaking of, we'd love for you to join us there. We have several creative channels for artists, writers, worldbuilders, linguists, and more to collaborate and brainstorm. There's also a recurring RPG "Test Kitchen" where we encourage new and experienced gamemasters alike to experiment in community one-shots. There's a resource channel with an extensive list of all kinds of worldbuilding-related resources that you may find helpful. We also have, of course, our collaborative worldbuilding project which you read about on page 4.

If you'd like to get involved with the magazine itself, we'd love to hear from you. There are always new topics to explore and new points of view to learn from, so feel free to share your expertise. This magazine is not only for the community, it's by the community. So if you're an editor, artist, writer, organizer, or wanting to pitch in any way you can, just stop by our Discord server or send us an email at contact@worldbuildingmagazine.com. We look forward to meeting you!

Our next issue, coming out in October, will be themed around *Economics*, and we've got something special planned for it. We'll be working with some old friends of ours to tackle a specific topic within that theme. Look out for more details on that in the coming weeks. In December, we'll coverbe covering *Trades & Occupations*, looking at the professions that make your world go 'round. If you'd like to write an article for either of these issues, the deadline for *Economics* is August 9th, and the deadline for *Trades & Occupations* is October 11th. I'm looking forward to both of these topics, and Volume 4 starts in 2020.

Happy worldbuilding!

LieutenantDebug, Editor-in-Chief

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