TREE STORIES

Bridget DeFranco

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Rhode Island School of Design

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Thank you

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mom and dad

and Br(◔◡◔)ks

Tree Stories

A thesis presented in partial fulfillment of the requirements for the degree Master of Fine Arts in Digital + Media in the Department of Digital + Media of the Rhode Island School of Design, Providence, Rhode Island

by

Bridget DeFranco
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Nicholas O'Brien, Independent Artist, Guest Critic

Vincent van Gogh, *Two Rats*, 1884

Tandemaus from *Pokémon Generation IX, 2022*

Abstract

This book is a companion to my MFA thesis project. The project, also titled Tree Stories, is a generative landscape that functions kind of like a drawing program. The project is accompanied by found-text narrative that details the stories of an ancient sea dweller, a wayward bird, a disappearing fish, and two highly debated dolphins.

Together, these stories tell of the many strange ways humans relate to other animal species. The narrative is included in this book and is accompanied by a research paper that delves more specifically into the uncertain worlds of nonhuman animals and the worlds we build to describe them. These constructed worlds, particularly classification systems and trees of life, exist in a feedback loop with the technologies we use to create them. They are akin to a worldbuilding practice, one that perpetuates itself continually deeper into the realm of representation.

Representations of the nonhuman world are similar to screen-based representations in that everything is a placeholder or symbol pointing to something else. The final section of the book provides some notes on how this relates to my own use of 3D software, both in modeling and in game systems. What would it look like to build a digital habitat that fits within the logic of the screen rather than being displaced into it or recreated for it?

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Louise Bourgeois, *Nature Study (Velvet Eyes)*, 1984

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Note to Reader

This book was created with Bindery.JS using HTML and CSS. The → icons scattered throughout were links that helped me navigate through the book as I was making it. The ✳ icons provided spatial cues. I've decided to include both in the final manuscript as remnants of the development process.

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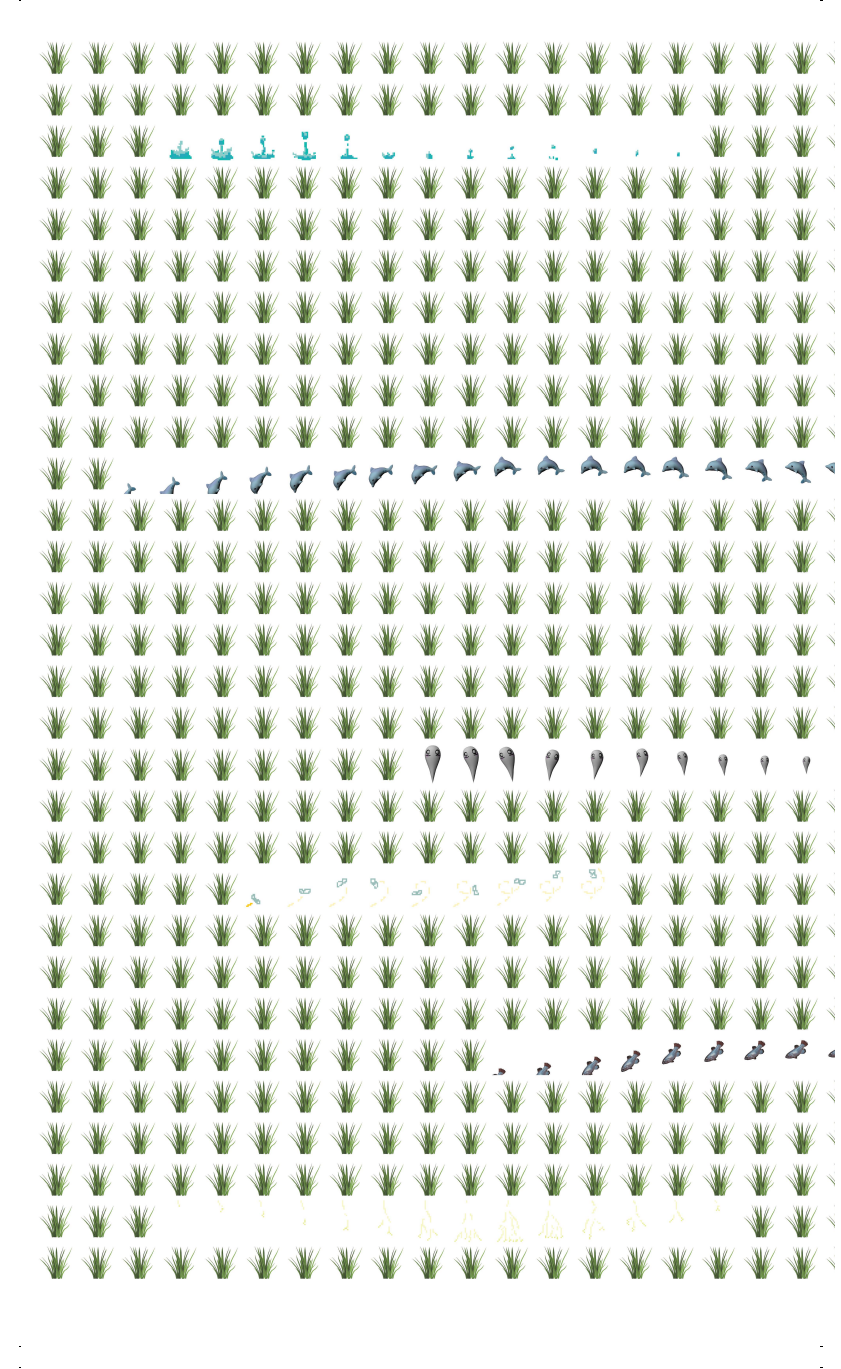

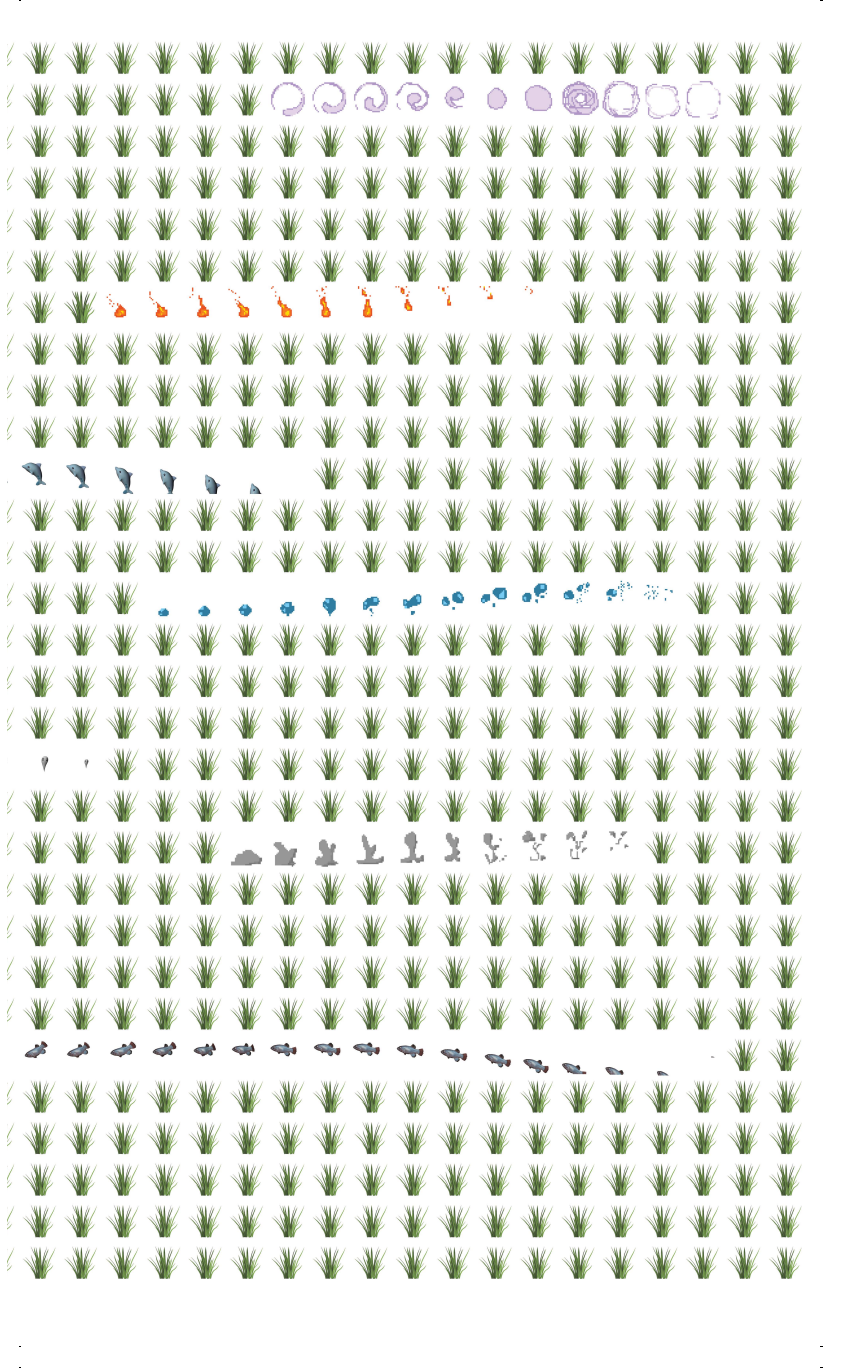

Tree stories

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On a dewy morning in 1938, the coelacanth, thought to have gone extinct 66 million years ago, was rediscovered off the coast of South Africa. The discovery was made by a museum curator, whose job included inspecting any catches thought by local fishermen to be out of the ordinary. In the pile of fish, she spotted a fin.

🕐

I picked away at the layer of slime to reveal the most beautiful fish I had ever seen. In addition to its iridescent silver-blue green sheen, this enormous fish possessed four limb-like fins and a strange puppy-dog tail. I stood as if stricken to stone. Yes, there was not a shadow of a doubt, scale by scale, bone by bone, fin by fin, it was a true coelacanth.

🕐

Today, we find that humans are employing some of the best technology to tell the story of creation to large, general audiences. The artist is involved at several levels of participation, including the design, color, choreography, and editing of the visual.

🕐

These narrations provide a social function that is similar to mythological art of the past. They describe any widely held belief that cannot be proven, including the belief in superhuman aliens, as well as the story of creation.

🕐

Pictures of the ivory-billed woodpecker look like pictures of bigfoot you might have seen online.

It's a beautiful bird and no one wants it extinct, but we need evidence. The United States Fish and Wildlife Service defines the objective evidence needed to verify the continued existence of the species as "clear photographs, feathers of demonstrated recent origin, or specimens." One group offered a $12,000 dollar reward.

They've extended the deadline to make a final decision on the bird's fate by six months, including one month for public comment. It could be anything, he wrote in an email. The landing sequence… made me almost shout "ivory-bill". One ornithologist called the footage laughable. Although my sighting only lasted 9.8 seconds, it was unmistakable.

The disputants, I ween, rail on in utter ignorance on what each other mean; And prate about an elephant not one of them has seen!

Finding a needle in a haystack is a challenge, but counting elephants from space sounds like science fiction. The images come from an Earth-observation satellite, allowing up to 5,000 square kilometers of elephant habitat to be surveyed on a single cloud free day. All the laborious elephant counting is done via machine learning. This research can shine like the North Star.

🕐

Elephants, it turns out, can be detected in satellite imagery with accuracy almost as high as human detection capabilities. This type of work has been done before with whales, but of course the ocean is all blue, so it's a lot less challenging.

🕐

In zoology, technology can move quite slowly, so being able to use cutting-edge techniques for animal conservation is just really nice.

It occurred to me that if the retail industry can use a few numbers to distinguish between a box of tissues and a can of green beans, why can't we look at DNA the same way? Eventually, it might even be possible to embed the technology into an inexpensive handheld device, an iPod-like species reader. When that happens, it will do for biodiversity what the printing press did for literacy. It would enable anyone to identify what bit of biodiversity is biting them.

It would, like the satellite, end nature in the conventional sense, as though tortoises became mayflies.

The Devil's Hole pupfish is small, blue and incredibly endangered, a tiny ghostlike creature with eyeballs shimmering like mirrors. They live in the smallest habitat of any known vertebrate, with oxygen levels so low that most other fish would die immediately. They may also be the most inbred creature on Earth. But the good news is that human interventions and accidents haven't really made the population worse than it was... I don't think they're doomed.

🕐

In what has come to be known as the pupfish crisis of 2004, empty fish traps stacked on dry land were sent tumbling into the water by a flash flood. Researchers later discovered 80 expired pupfish caught in the jars, roughly one-third of the population at the time.

🕐

A mile down the road, in the warm aquamarine water of a 4.5 million dollar 100,000-gallon concrete and fiberglass tank, scientists are trying to establish a captive colony of pupfish. Cameras monitor the pupfish's every move as they paddle through the water. Eventually, the captured fish may not be the Devil's Hole pupfish anymore.

🕐

I spit in the ocean. So what?

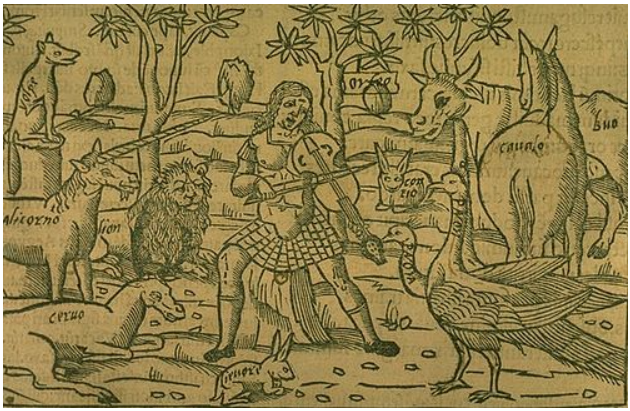
Within two weeks they were recaptured because the National Marine Fisheries Service considered it an illegal release which it technically was. As soon as they were released it looked like - do you know what it reminded me of? When you see a hound being chased through the forest and you see these guys in red coats with dogs, it was just like that and they started feeding them dead fish right away. I have pictures of this. They sabotaged it.

Now bear in mind, if you want to capture dolphins and send them to a shopping center, no problem. Sell them to a discotheque in Switzerland, no problem. You want to release two? We're worried about those two. Here's the answer I got: Prove to us that dolphins are capable of breeding in the wild and that predators are not going to attack them.

Things that you can't possibly prove.

One frame in the scenario of a caterpillar does not foretell the later scenario event of its transformation into a butterfly.

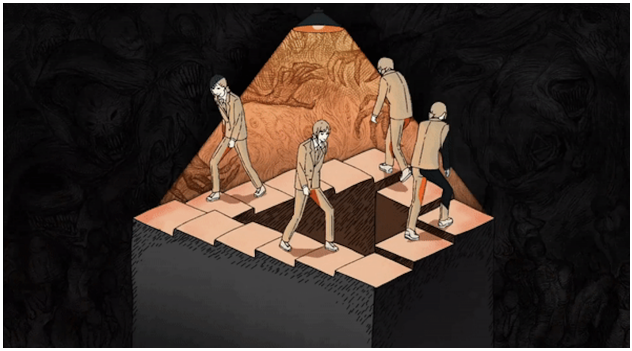
One frame of a butterfly cannot tell you that the butterfly flies.



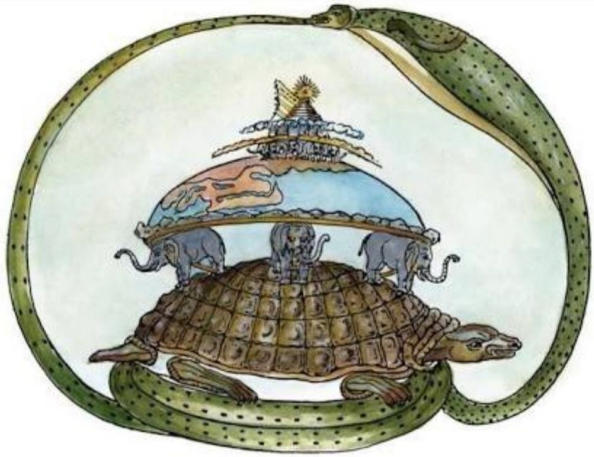
From Wikipedia: Orpheus's music and singing could charm the birds, fish and wild beasts, coax the trees and rocks into dance, and divert the course of rivers.

From Wikipedia: According to Chinese legend, when the tyrant King Zhou of Shang ruled the land more than 3,000 years ago, a horse, a donkey, an ox and a deer went into a cave in the forest to meditate and on the day the King executed his minister Bigan, the animals awoke from their meditation and turned into humans. They entered society, learned of the King's heinous acts and wanted to take recourse against the King. So they transformed themselves into one creature that combined the speed of the horse, the strength of the ox, the donkey's keen sense of direction and the nimble agility of the deer. The sage Jiang Ziya, who was battling the King, rode the creature to victory and helped found the Zhou Dynasty. After fulfilling its vow, the milu settled in the lower reaches of the Yangtze River. The animal became a symbol of good fortune and was sought by later emperors who believed eating the meat of the milu would lead to everlasting life.

The Perception-Representation Loop



Still of the Escherian Stairs in the intro sequence of *Chainsaw Man*, 2022



From Wikipedia: All the birds and animals who live in the great cloud sea are panicked. The Duck asks, "Where can it rest?" The Beaver replies, "Only the oeh-dah (transl. earth) from the bottom of our great sea can hold it. I will get some." The Beaver dives down but never returns. Then, the Duck tries, but its dead body floats to the surface. Many of the other birds and animals try and fail.

Finally, the Muskrat returns with some Oeh-dah in his paws. He says, "It's heavy. Who can support it?" The Turtle volunteers and the oeh-dah is placed on top of his shell. The birds fly up and carry Awëöha'i' on their wings to the Turtle's back. This is how Hah-nu-nah, the Turtle, came to be the earth bearer. When he moves, the sea gets rough and the earth shakes.

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Sub-sections

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Trees of Life

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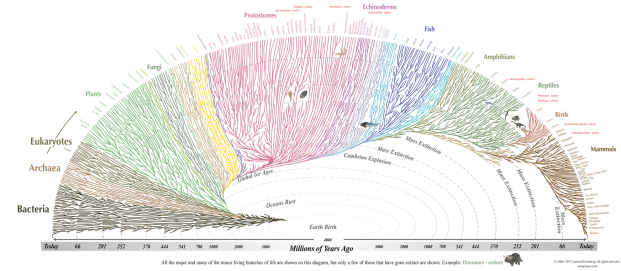
In the beginning, there was a turtle's back and around it a coiled snake and on it three elephants and then the world. In another world, there was a flood, and an ark set sail with 70 thousand creatures in tow. In yet another world, a single-celled organism began eating carbon in the ocean. Millions of years and millions of mutations later, it became human.

These worlds ground themselves in the relationship between humans and other animal species, a relationship that holds uncertainty at its core. Who wandered the earth's surface first? Where, or who, do humans come from? How can we learn from and about species we can't communicate with? What happens in their worlds? And is their world the same as ours?

This essay is concerned primarily with this term: world, both the uncertain worlds of nonhuman animals and the worlds, or stories, we build to describe them. These stories, fed by uncertainty, drive the construction of narratives, mythologies, and theories, each of which is grounded in human perception.

Scientific visualization artist, Donna Cox, describes the connection between scientific and mythological trees of life, specifying that “like images of mythologies of the past, modern scientific models are painting a new view of the universe and providing a modern creation myth.” [3] She goes on to describe how branching, tree-like forms have provided a common structure through which to conceptualize the world.



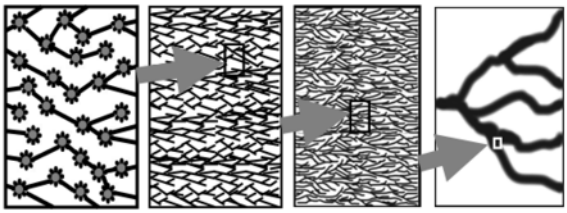
The Evogeneao Phylogenetic tree describes evolutionary relationship between major species groups

Scientific “trees” come in many forms. Some are organized around evolutionary relationships, others around observable traits. They vary in size and specificity. Many focus on major species groups—it would be wholly impractical to organize the approximately 1.7 million known species together in a single diagram. Thus, subtrees pop out of the tree, like asterisks, outlining relationships within specific species groups. For instance, bees branch from 1 order to 7 families to 4,000 genera to over 20,000 species.

Gorilla gorilla gorilla

Gorilla taxonomy

Further, reconceptualizations of the tree are ever emerging. Charles Darwin proposed the “coral of life.” He considered coral a better metaphor by way of its geometric structure, which allows for infinite zooming and panning for more or less detail.[1] Fritjof Capra conceptualized the “web of life,” a way of describing ecology as a network of interspecies energy transfers.[2] Capra’s web has gained much traction in recent years as a diagram that complicates the rigidity of the tree and more accurately represents the entanglement of life on earth.



Geometric structure of coral allows for infinite zooming

These diagrams, no matter their visualizing structure or criteria for organization, serve as a form through which to imagine and understand the world. Together, the trees, corals, and webs might be thought of as a sort of forest. This forest is the amalgamation of systemic representations that take on any structure, no matter how entangled.

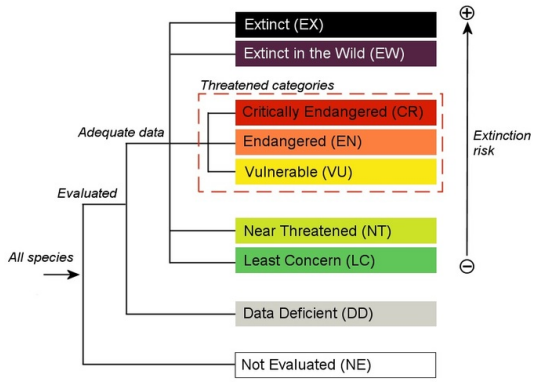
The forest as a metaphor through which to gather "trees of life," rather than focusing on the particulars of any single shape. In the forest, the distinctions between structures are secondary; a tree is a web, and a web is a coral. I am interested not in the structure of organization, but in how structures, no matter their shape, build stories.

The forest is not a single, fixed diagram, but an ever-changing view of all species on the evolutionary timeline. This timeline spans from about 3,500 million years ago to today. "Today" is on the outer branches of the forest; with each new day comes newly discovered species and newly declared extinctions. The forest is in a constant flux at its edges, expanding and rearranging with new information.

Meme from stills of *Donnie Darko*, 2001, origin unknown

New information comes to light not only at the edges of the forest, but also below the canopy and deep within the roots. For species no longer living on earth, new information is constantly emerging from fossil records. Thus, new species appear in the depths of the forest, and interrelationships between species shuffle accordingly. Though I am focused primarily with species currently living on earth and the technology we use to learn about them, the ever-changing nature of the entire forest is an important framework through which to consider our classification systems.

The Red List, run by the International Union for the Conservation of Nature (IUCN), defines the extinction risk of any given species. It begins with “least concern” and ends with “extinct” and holds “near threatened,” “vulnerable,” “endangered,” and “critically endangered” in between. The Red List also includes outlier categories: “not evaluated,” “data deficient,” and “extinct in the wild.”



International Union for the Conservation of Nature (IUCN) Red List of Threatened Species classification system categories

These categories are used to guide conservation efforts, as well as to generally assess the state of biodiversity. These categories have practical uses, no doubt. But some also hold vastly higher levels of subjectivity than others, and together they exist not on a sliding scale, but as a series of discrete categories. Each classification is organized, contained, and labeled.

This rigidity lends an illusion of certainty, but the forest has many barren patches. It omits reference to millions of species that left no fossil trace—invisible and inaccessible—and it also omits reference to the millions of currently living species that have not yet been perceived by humans or our technology (estimated at 86% of land-dwelling species and 91% of ocean-dwelling species). These holes, extremely large in resolution, serve as the backdrop against which the story of nonhuman animals is told.

Perception

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In the early 20th century, biologist Jakob von Uexkull coined the term umwelt. Uexkull describes umwelt as a “bubble around each creature to represent its own world, filled with the perception which it alone knows.”[4] It is a world that is not only uncertain, but strange, mysterious, and quite simply unknowable to others. Umwelt can be summarized as “the self-world,” a world that cannot be breached but through the first-person.

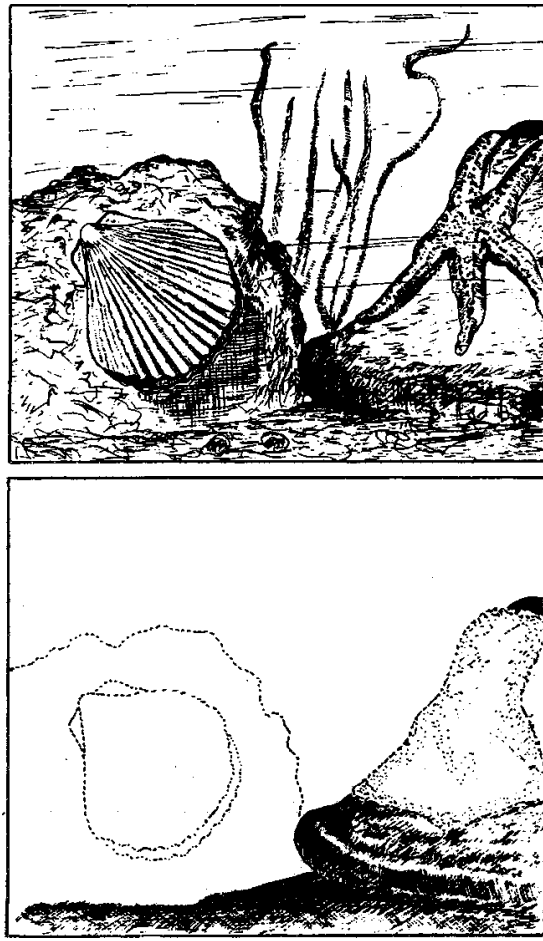


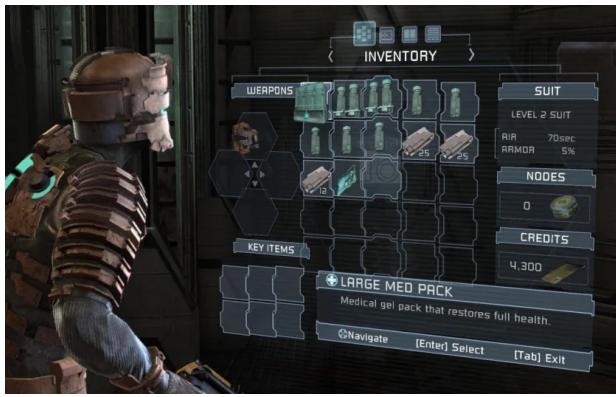
Illustration highlighting distinction between how we see the environment of the scallop and how the scallop might exist within its environment. Jakob von Uexkull, Stroll Through the Worlds of Animals and Men, 1957

Scientific diagrams reach around the umwelt of the species they outline. They are not what one species sees, but how we see all the species collectively. More than anything they reveal the human umwelt, our perceptual experience and our modes of storytelling.

Anthropomorphized starfish

Another framework through which we might consider how humans relate to the nonhuman is the concept of diegesis, a term borrowed from narrative and cinematic technique. Diegesis describes the interior story-world as distinct from the exterior view of the audience. It is what the character experiences in comparison with what the audience sees.

The common example is sound: if a character can hear the same music as the audience, then it is diegetic, part of the characters' world, and audible only by proxy to the audience. If, instead, the music plays as an "overlay," and does not exist in the world of the character, then it is non-diegetic. It is for the audience, not part of the story-world itself. As such, scientific diagrams might be thought of as a form of non-diegetic storytelling. They are neither experienced by nor known to the species they diagram.



Diegetic UI in *Dead Space*, 2008

Through the framework of umwelt and diegesis, I distinguish between two worlds: the perceived world and the lived world. The perceived world refers to the non-diegetic story, a representation told through the human umwelt. It is the outside-looking-in, mediated by human perception.

The lived world, on the other hand, refers to both the nonhuman umwelts as well as the diegetic, lived experience of nonhuman animals. It is the first-person perceptual and actual experience of nonhuman animals. But is it also the third-person observable experience of nonhuman animals, the diegetic part of the story that is distilled into non-diegetic information—classifications, dates, evolutionary relationships.

Information

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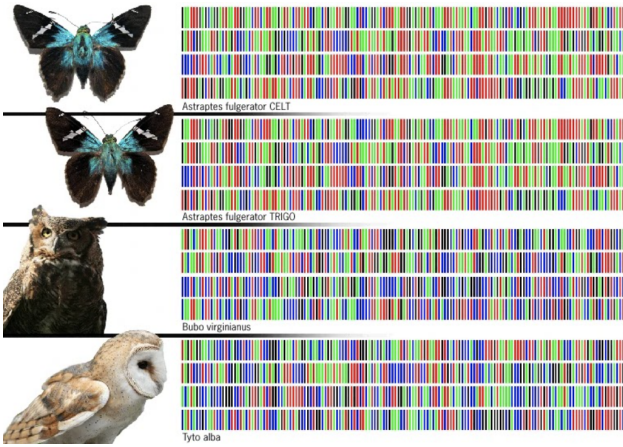
Human perception is (increasingly) mediated by technology: a world seen through a hand-held camera is different from a world observed via a satellite. Every technology available to us serves as a possible extension of our umwelt. The lenses through which we interact with the world mediate our interactions with it.

Science fiction author Ursula Le Guin describes the terms of this mediation in her essay, “The Carrier Bag Theory of Fiction.”[5] She asserts that the first technology to mediate human interaction with the world was a basket, not a stone tool, like an axe, hammer, knife, or arrow, as is most commonly considered. This distinction demonstrates how a particular tool affects its user’s interaction with the world. The device held in one's hand changes how one perceives the world, and the possibilities for interacting with the world change according to that perception.

The first widely distributed image of Earth in its entirety. Apollo 17 crew, “The Blue Marble,” 1972

As our technologies change and become more distributed in time and space, so too does our perception of the world. Increasingly, the human umwelt extends far beyond our innate ability to perceive in both time and space. These extensions change the terms of knowledge. Marshall McLuhan once asserted, for example, that the satellite “ended nature in the conventional sense.”[6] What we know and how we know it embeds itself in the way we perceive the world, and in turn construct a representation of it.

The DNA sequencer is one such tool that extends our umwelt. The sequencer distills the DNA of any given species into data, and represents that data in the form of a barcode.[7] So far, there are 35,000 species with barcode representations. These representations enable scientists to distinguish between different, but similar looking species, as well as draw evolutionary connections between them.



DNA barcode comparison distinguishes between similar looking species. Suz Bateson, University of Guelph

Traditionally, the process of speciation involves inspecting for distinct morphological characteristics, both in outward appearance as well as internal anatomy. Morphological inspection, though, becomes secondary in the face of readily comparable DNA barcode data. Thus, the terms of speciation change with the DNA sequencer, as do the terms of our relationship to those species.

The DNA sequencer is currently in the process of being developed into a hand-held device, much like the Star Trek tricorder, a portable sensor that instantly spits out information about anything in the environment. Scientist Dan Janzen asserts that a handheld DNA sequencer will “do for biodiversity what the printing press did for literacy.”[8]

Underlying both this assertion and the tricorder comparison is a drive towards the future through the realization of a preconceived vision of future technology. It represents an excitement for discovery and more importantly an acceleration into the world of representation.

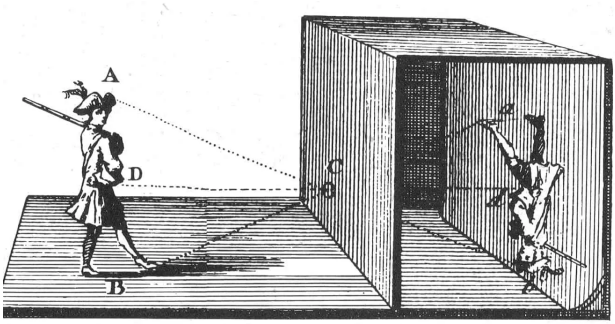
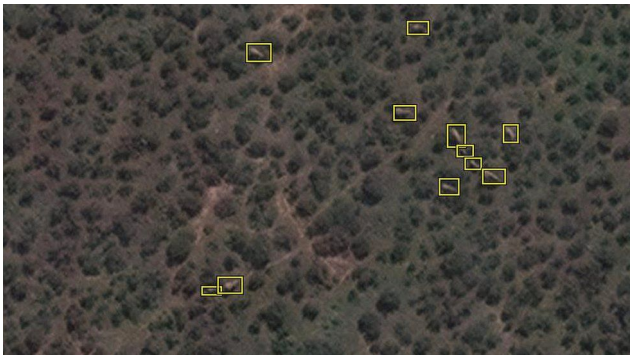


Diagram of the camera obscura

This acceleration, enabled by readily organizable information, incentivizes the production of more readily organizable information. It is akin to a feedback loop that perpetuates the value of information that, like the DNA barcode, can be easily organized, compared, and placed. Thus the directional transformation, from perception to representation, loops back on itself; perception becomes a representation, and the representation defines the terms of perception. It is a recursive process that drives a search for quantifiable information.

Quantifiable information is especially significant for disappearing species. It comes in the form of a headcount, and the process of obtaining this information is, like speciation, undergoing a similar methodological digitization. For example, elephants in southern Africa are traditionally surveyed through aerial counts, which consist of people in helicopters literally counting the number of elephants they see. Recently, satellites have been employed instead.

A satellite captures a 5,000 square kilometer image, which is then fed into a machine learning algorithm. The algorithm is trained to distinguish and count the number of elephants in the image.[9] The satellite looks at the elephant, and the algorithm looks at the image made by the satellite looking at the elephant. Only then does the human see, not the elephants, but a number that represents the elephants. This number is used to produce information over time on the trajectory of the elephants' population, a significant factor in their Red List classification.



Elephants as detected by machine learning algorithm, Maxar Technologies

As with the sequencer, the more technically mediated method lends itself to the possibility of increased accuracy, but with this accuracy comes greater distance between human perception and representation. In this case, the algorithm sits between perception and representation, creating not only greater distance, but also an opaque division.

Extinction

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In 2021, the Epactoides giganteus became a newly described species of dung beetle. This beetle was not discovered in its habitat; rather, it was found in the collection at the French National Museum of Natural History and identified as a distinctive species based on newly noticed unique morphological characteristics as well as its unusual geographic origin. Thus, it came to be added to the list of 7,000 other dung beetle species. The scientific journal that published the beetle's discovery was titled "Extinct before discovered?"[10] This title aptly points to the gap between the lived and the perceived world; they have different timelines, different terms of existence, and different moments of significance.

Darwin's experiments included measuring the speed with which stones slowly settle into the earth.

From *The Formation of Vegetable Mould Through the Action of Worms*
Wikipedia page

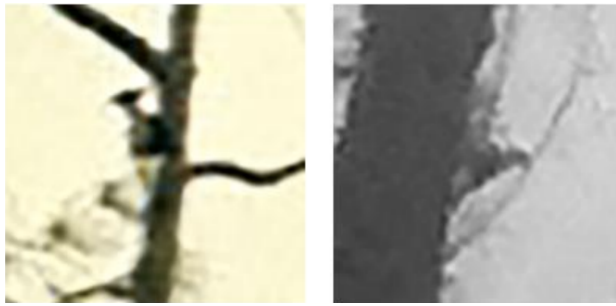
This gap is further illustrated by the fluidity of extinction. For example, the Latimeria chalumnae, commonly known as the coelacanth, was thought to have gone extinct 66 million years ago. In 1938, it was rediscovered off the coast of South Africa.[11] In a less extreme example, of the twenty species declared extinct in 2021, three had previously been classified as “extinct,” only to be seen again, reclassified, and later reclassified again.

Recent photograph of a coelacanth seen with human for scale. Laurant Ballesta, Expeditions Gombessa Photography, 2013

Extinction is not a state of being, but a state of understanding, and passing in and out of extinction is so common that there is a special taxonomy for these species: the so-called “Lazarus taxon.” This taxon is named after Lazarus, the Biblical figure who dies only to be restored to life four days later. While the name symbolizes rebirth, the taxon represents the ambiguity and inaccuracy of classification.

This inaccuracy stems from the near impossibility of proving that an elusive species still exists. The ivory-billed woodpecker is one evolving example of this challenge. Since its officially recognized “last seen” date of 1948, there have been over 200 reported sightings of the bird. But despite these reports, the United States Fish and Wildlife Service (USFWS) placed the bird on a list of species that were planned to be classified “extinct” in 2021. The USFWS has dismissed the reported sightings as inaccurate identifications and has gone so far as to stipulate the objective evidence needed to verify the continued existence of the species (“clear photographs, feathers of demonstrated recent origin, [or] specimens”).[12]

In response to these demanding stipulations, scientists have deployed a slew of trail cameras and drones in the habitat of the ivory-billed woodpecker in Louisiana, collecting 428,000 camera hours of activity and 864 hours of video.[13] The footage, however, has only thus far produced admittedly blurry images and video of what scientists believe to be the ivory-billed woodpecker. The low quality of these images is attributable to the fact that the imaging devices are designed primarily for large ground-dwelling species.



Project Principalis, apparent ivory-billed woodpecker, 2021

By requiring proof in the form of hard evidence, the USFWS is dismissing the unquantifiable and unverifiable nature of human sight, including that of an ornithologist at the USFWS itself. What was meant to extend our ability to see is instead superseding it, pointing to an imbalance in the feedback loop. In the face of uncertainty, the terms of representation overpower the terms of perception.

The extinction risk of an individual species, serves as a building block through which to cumulatively measure mass extinction. Measuring mass extinction, though, is just as ambiguous as measuring the extinction of a particular species. Not only are the building blocks unstable, but there is also a temporal disparity between the million-year timescale of mass extinction and the yearly calendar through which it is measured. This disparity points to a temporal contradiction between new information and the very structure onto which it is imposed. For example, the USFWS has granted the ivory-bill a six-month reprieve from its planned extinction. Six-months, though, is a blink of evolutionary time.

Some scientists estimate that the current mass extinction is unfolding at a rate 100 to 100,000 times higher than any of the previous five mass extinction events. This comparison implies the availability of adequate data on the total number of species on earth at any given time and the number of extinctions that occur over a specified period of time. This data is fragmented at best, both now and especially in the fossil record.

Despite this, the drive to formulate a representation overpowers and overlooks the limits of human perception. These limits recall Timothy Morton's idea of a hyperobject, "an entity so far beyond our temporal or spatial understanding that it breaks our ability to understand it in the first place."[14]

Containment

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As of 2022, there are 38 species that exist, as far as we know, solely in captivity. These species are “extinct in the wild,” a kind of physical containment motivated by a drive to protect. This containment, though, freezes evolutionary time within the human temporal experience. These species exist neither in the lived nor the perceived world. Their world is a preserved world. It exists outside of but parallel to the ever-changing environment. They are frozen in the moment of their own containment, kind of like an image.

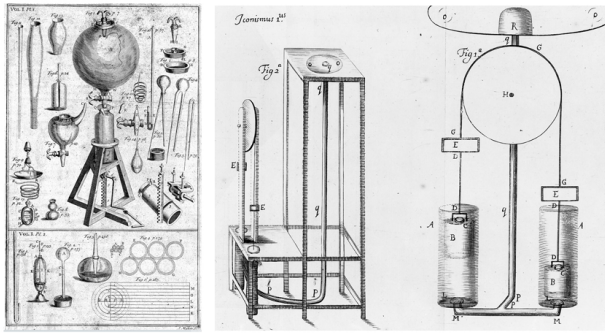
The Devil's Hole pupfish, one of the rarest fish in the world, is on the road to being "extinct in the wild". The United States National Park Service (USNPS) have surrounded the entrance to the pupfish's habitat, a small water-filled cavern, with barbed-wire fences and security cameras.[15] Bi-yearly since 1972, scuba divers have conducted population counts. As their population fluctuates, a full-scale replica of their habitat is being developed about a mile down the road from their habitat. This replica is not a temporary breeding ground in an attempt to raise the wild population of the fish, but an alternative world meant to protect a refugee population.

Regulatory system for captive pupfish near Devils Hole, CBS Sunday Morning, 2016

As a regulated system with fixed inputs and outputs, this contained “alternative” habitat recalls the 1960s vision of the environment as a cybernetic system.[16] Cybernetics is “the science of communications and automatic control systems in both machines and living things.”[17] The comparison between the environment and cybernetic systems has proved, despite multiple attempts to demonstrate a correlation, to be nothing more than an enticing idea. Study after study, researchers found that the environment is adaptive and ever-emerging, rather than a perfect system of balance.[18]

Where the cybernetic comparison fails as an analogy to the real environment, it applies well to contained ecosystems. The fewer factors in an environment, the more predictable the behavior; and while species kept in captivity may technically continue to evolve, they remain isolated from their evolutionary timeline, frozen in something like a self-regulating loop. The contained habitat is not so much a replica as it is a simulacra; it resembles the real, but is removed from the entangled ecology of the earth.

The separation of the contained ecosystem from the environment evokes the air-pump debate of the 16th century.[19] The debate was centered around Charles Hobbes' air-pump device, a device that simulated a vacuum environment inside a glass orb. Hobbes' experiments consisted of placing various living creatures inside his glass orb to observe how they responded to being in a vacuum.



Drawings of Robert Boyle's air pump device, archived by Columbia University

While the ethics of these experiments are dubious at best, the issue at the time was the relevancy of the simulated environment. Some argued that performing experiments in conditions completely unrelated to the lived world was a scientific waste of time. While this argument is not so relevant to modern science, it is applicable to the relationship between the lived world and our representation of it. Like the contained ecosystem, our representation is trapped in a self-regulating loop.

Representation

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The limits of human perception are well described by Plato's cave, a space where people see but a shadow of reality. Rebecca Solnit further describes the cave as "a condition in which people live entirely in representation and interior space, in a universe constructed by humans, ultimately inside the imaginations of those who came before, an operation that suggests nesting Russian dolls and a certain crampedness of the imagination."[20]

The cave is the perceived world: the world of nonhuman animals as seen and conceptualized by human animals. Our perception is our umwelt, our classification systems, and our temporal experience. Through perception, we construct a representation of the world, but despite its all-encompassing size, it remains within the cave walls; each uncertainty, each disproven null hypothesis, and each inherent fallacy propels our representation deeper into the cave, taking refuge in an attempt to understand.

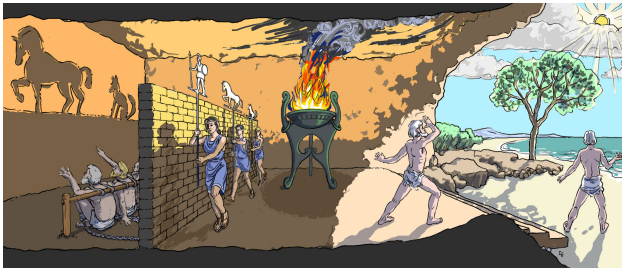

Illustration diagramming the allegory of Plato's Cave

In a way, the walls of the cave are what wraps the feedback loop between perception and representation. Perception constructs a representation, and the terms of representation—quantified, organized, and categorized—in turn, serve as our lens. We see through the terms of our previous representations. The more information gathered, the more rigid and homogeneous the terms of information become. Reality disappears behind predetermined methods of observation.

The cycles of the loop rely on the separation of reality and representation as described by Harold Cohen, a pioneer of generative and computer-based art. Cohen considers the representational nature of images in his essay, “What is an image?” He asserts that a representation will never stand in for the real, arguing that “life follows its laws, [and] representations follow theirs.”[21]

An image of an elephant will never be mistaken for a real elephant. Though this may seem a given, his assertion eliminates space for overlap: the lived world and the perceived world are discrete, each abiding to their own laws. Accordingly, a representation is distinct from the thing it represents, and more disconnected than it likely appears.

As our representations turn in on themselves, we might consider the succinct words of science and technology scholar Donna Haraway: “It matters what worlds world worlds.”[22] Representation can be taken as a world in and of itself, and it matters how the terms of representation embed themselves in the way we perceive the world.

Scientific diagrams are a practice in worldbuilding, the construction of “an imaginary setting with coherent qualities such as history, geography, and ecology.”[23] These qualities are clean and organized, each abiding to particular precedents, each following the laws of representation. But despite this rigidity, the “tree of life” remains a knowingly porous modern mythology.

In the closing paragraph of his book Mythologies, theorist Roland Barthes states: “We constantly drift between the object and its demystification, powerless to render its wholeness. For if we penetrate the object, we liberate it but we destroy it; and if we acknowledge its full weight, we respect it, but we restore it to a state which is still mystified.”[24] In the face of this powerlessness, our modern mythology seems to have found a way around. It neither destroys nor respects what it represents. Instead, it runs away with its own uncertainty, ever deeper into the world of representation.

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Marcel Broodthaers, *La souris ecrit Rate (a compte d'auteur)*, 1974

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Notes on 3D

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I finished my thesis writing, The Perception-Representation Loop, in December of 2022. Since then, my interest in the relationship between perception and representation has drifted from its ecological angle. Now, and especially through the process of developing my project, I have begun to consider representation more specifically through the affordances of 3D software. The following provides some notes on my current musings, how they trace back to what I was interested in a while ago, and how they might develop as I go.

In my 3D modeling practice, I most enjoy making models of plant life. This habit made me wonder about the draw of bringing nature behind the screen, and how the screen's tempo seems somewhat at odds with that more commonly associated with nature.

I wrote at one point: "Landscapes' connection with slowness is drawn, in part, from its ongoing stability relative to human perception. This stability or slowness gives way to a lack of perceived change and narrative."

Landscapes are often used as screensavers or Desktop images for our computers. A screensaver is a resting state, and a Desktop image is sort of like a placeholder. They fit right in with a lack of perceived change. In *Bliss*, the popular Windows XP wallpaper, the empty pasture appears stable and unmoving. We might, though, imagine ants crawling through the grass.

Charles O'Rear, *Bliss*, originally titled Bucolic Green Hills, 1996

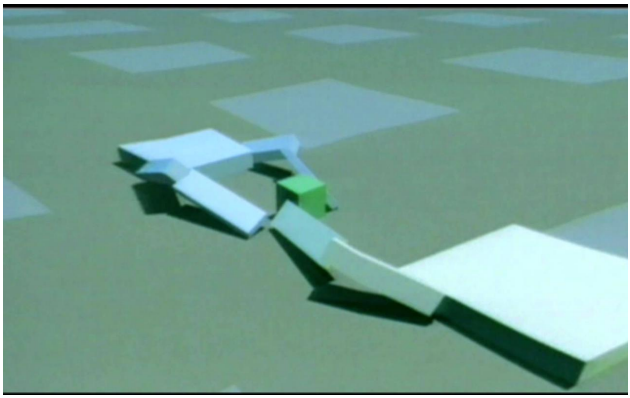
Live stream of hawk nest outside Bobst Library, NYU

I'm also interested in recreations and simulacra of landscapes, things that don't exist but represent something familiar or stand as a symbol of a broad category... like a farm.

Still from *Stardew Valley*, 2016

What would it look like to build a digital habitat that fits within the logic of the screen rather than being displaced into it or recreated for it?

I used to frame the term mutation as "mutations in digital space" aka a 3D model as a mutation of the image it came from. Now, mutation doesn't quite stick in my mind as a synonym for recreation. Framing slow animation as mutation, though, seems newly interesting to me. It could be generative, like real mutation, based on randomness... maybe I'll return.



Karl Sims, *Evolved Virtual Creatures*, 1994

Most of the time, and increasingly, I start from images I find online. I use these images as references for creating the shapes of my 3D models. Then, I apply the image onto the model as a texture. In an analog comparison, it's like molding clay on top of an image and then paper macheing the image onto the clay model once the shape is done.

Dirk Koy, *Shape Study 12*, 2020

The more complex the object I want to model, the more reference images I will use. If I'm making a model of a mushroom, I might use two: one for the mushroom stem and one for the mushroom top. If I'm making a model of a lily flower, I might use three: one for the petals, one for the stem and leaves, and one for the stamen. Basically, each section of the model needs a reference image that supplies a clear orthographic view of each of its parts. The outcome will appear as one lily, but really it's a composite lily, a sort of Frankenstein of reference images.

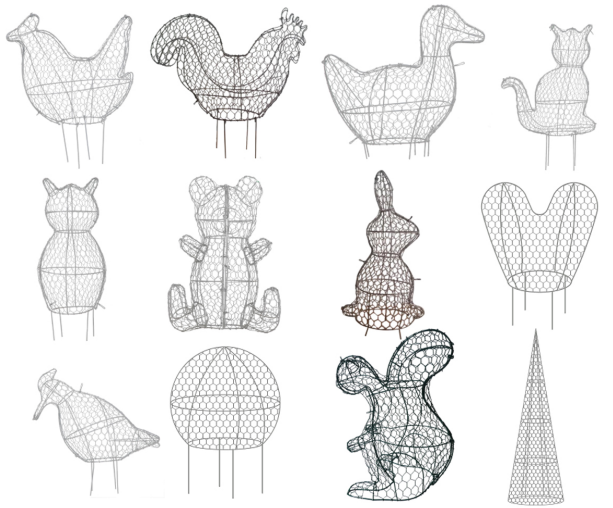
The reference image is a representation in its own right. It is a rescaled, recolored, dislocated and flattened version of something that exists or once existed at some point in some real place on Earth.

As an image circulated online, it is lost in time--does the caterpillar in the image still exist or is it long dead? And, to some extent, it is also lost in space, though I think it holds onto remnants of its history in its background. These remnants enable the thing in the image, whatever it is--mushroom, lily, caterpillar--to resist becoming a passive object. They ground the thing, keeping it from being abstracted into something else.

The process from image to model, though, relies on the loss of the image background. The leaf is distilled from the image, cut out and brought forward while the rest of the image information gets discarded.

This discarded information holds valuable context. It provides, even if to a limited extent, some hint of where this leaf comes from. It allows the image viewer to extrapolate beyond the frame and, with some imagination, picture in their mind's-eye the object’s history and place of origin.

Once the background of an image is discarded, it is free of its history and contained only within itself. Like a png or a sticker, it can go anywhere. And as a pure object, it stands in for all of its kind. Like the lily stitched from multiple reference images, one stands for multiple. It is, in its containment, ripe for abstraction. It can become anything, maybe a cartoon or a stuffed animal.



Topiary frames

In alchemy, one object can become another through transmutation. This process is kept in check by the law of equivalent exchange: to create something new you must trade in something of equal value. This holds true for images and models alike. A representation is created in exchange for its information. On the path from real to image, the object loses its temporal history. On the path from image to model, the object loses its spatial history. It becomes an empty vessel.

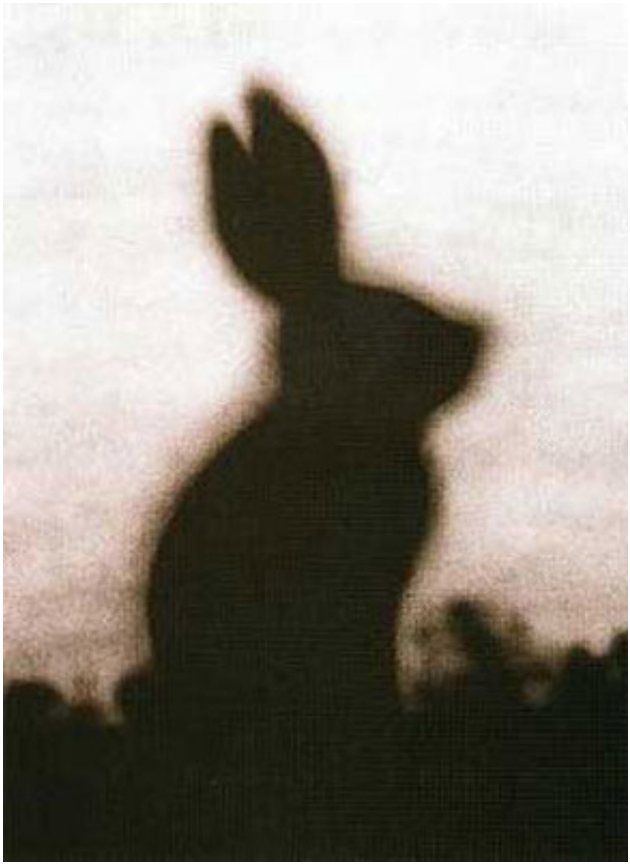
Still from *Fullmetal Alchemist: Brotherhood*, 2009

Abstraction is a form of transmutation. When an object becomes another version of itself, it exchanges what it was for what it can stand for.

Nina Katchadourian, *Barnacle Mixer*, 2002

Albrecht Durer, *Young Hare*, 1502

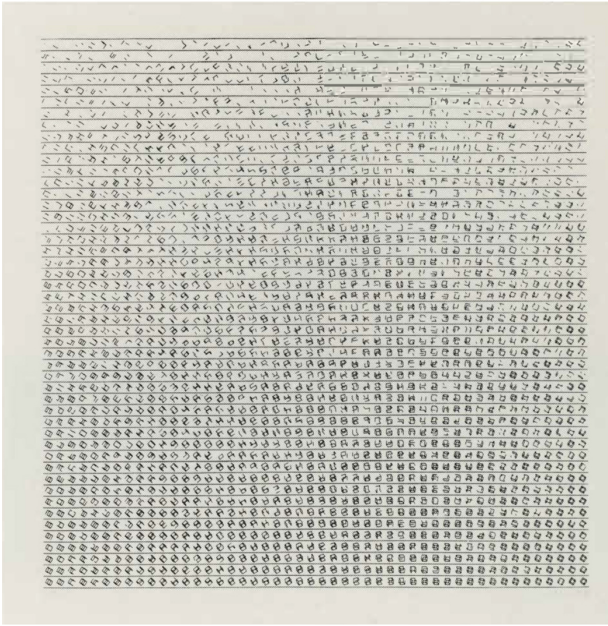
Beatrix Potter, illustration of Peter Rabbit, 1901



Ed Ruscha, *Rabbit*, 1986

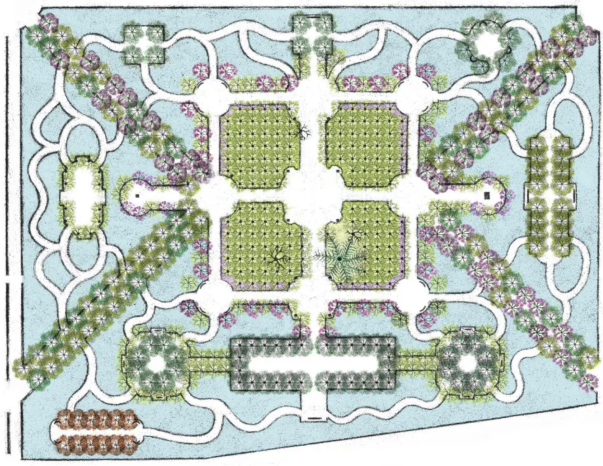
Eduardo Kac, *GFP Bunny*, 2000

My models are almost never situated in space. They remain groundless, and if they get a ground, it's invisible. I have a tendency towards a black background. For a while, I tried to fight this tendency. Then I learned the reasons for the tendency in the first place. With the black background, I'm maintaining the object-y-ness of my objects. This groundlessness prevents the objects from relinquishing their containment. They cannot be re-attached. My grass finds no new ground.



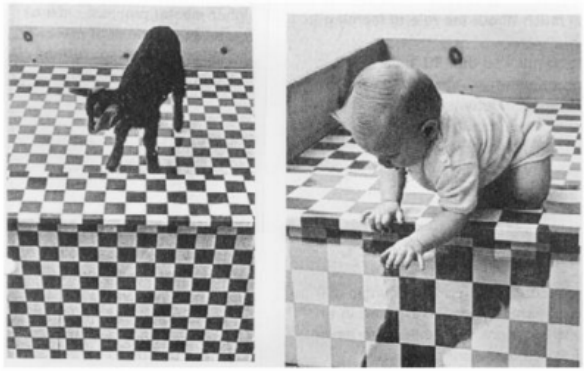
Manfred Mohr, *Cubic Limit*, 1973-1976

3D software encourages users, by design, to situate objects in space. The idea, usually, is to create a setting that mimics human perception of space and how it's meant to be moved through. There is a forward, an up, a down and a backward. One joystick brings you about, like legs, the other lets you tilt your perspective, like a head.



Map of Versaille Gardens

Trajan's Column built in AD 107-113.

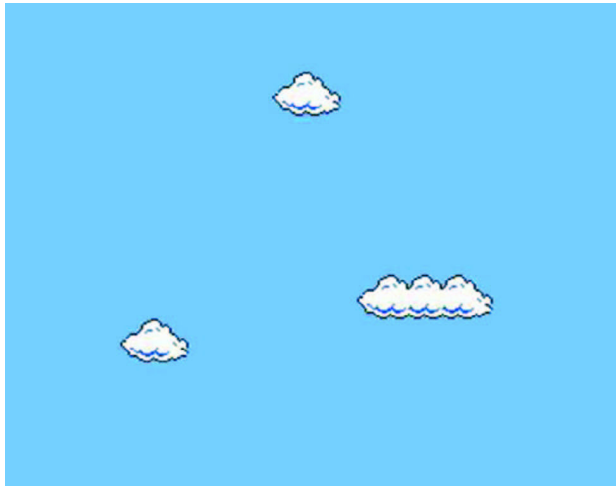


Photograph illustrating JJ Gibson's Theory of Direct Perception

These software function on the assumption that 3D space is a given, but there are many ways to flip things around. The most basic might be removing context through the illusion of flatness in between objects. This is the black background. Or creating the illusion of flatness, and then breaking it. Or simulating dimensions within a flat space, parallax style. In painting, dimension and flatness have a rich history. Maybe there's more to be seen for the moving image.

In the game software Unity, 3D models are designated as GameObjects. GameObject is an umbrella term for effectively everything in the software: characters, environmental assets, lights, cameras, user interface components, and so on. As the term object implies, GameObjects are to be acted upon. They are empty vessels, no strings attached, ready to take on any role. They wait for certain traits and behaviors to be assigned.

Often, a GameObject is duplicated many times: many of the same tree, many of the same non-player character, many of the same cloud in the sky. This duplication is like a sort of acknowledgement of the GameObject's role as a representation of a thing, not the thing itself. By using the same cloud for every cloud, the cloud says: I am not a cloud, I stand for "cloud".



Cory Archangel, *Super Mario Clouds*, 2002

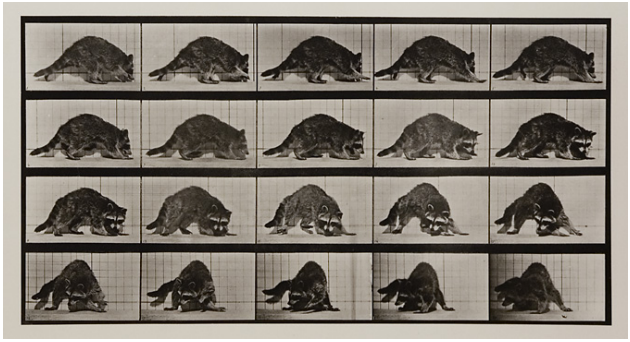
Procedural generation seems to work against this. It rejects the containment of the GameObject, instead using tweaks and turns to make things seem unique.

Walk cycles are similar. A walk cycle is an animation that seamlessly loops into itself. It allows a character to walk very long distances and an animator to only animate two steps. They come in many shapes and sizes. For the most part, walk cycle references can be found for biped and quadruped species and/or character tropes, but you may be very hard pressed to find references for other kinds of species.

Walking animal balloons

Walk cycles, like images and models, are representations. They stand, no pun intended, in for what is otherwise an extremely complex set of actions, distilling movement to the bare minimum necessary for creating a convincing illusion.

Giacomo Balla, *Dynamism of a Dog on a Leash*, 1912



Eadweard Muybridge, *Raccoon walking and turning around* from Animal Locomotion series, 1887

Artavazd Pelechain, Still from *Les habitants*, 1970

The traits and behaviors for how each GameObject exists are designated by the developer. They define the specific role of each GameObject and determine the specific behavior of that object in relation to other objects. These interrelations are the basis of worldbuilding.

Nam June Paik, *WATCHDOG*, 1996

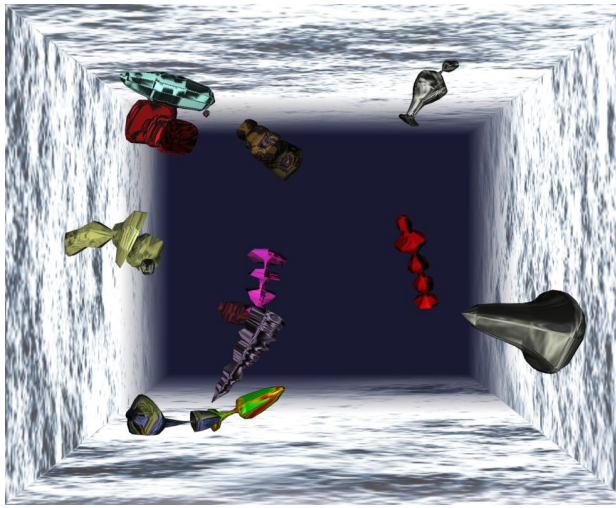
Ian Cheng is an artist, and he's also kind of like a worldbuilding spokesman. He describes worlds: "We could say a World is something like a gated garden. A World has borders. A World has laws… A World is a container for all the possible stories of itself."

Oliver Laric, *threedscans.com*, 2015

A world is not a place, but a set of relationships. These relationships, though, are often hidden within a place. The place might be a setting, like a castle, that holds some association to the rules of the world. It could be a place, like a foreign planet, that justifies the creation of unfamiliar, “other-worldly” rules.

Still of The Unknown Planet from *Hey! Pikmin*, 2017

Place could also be the screen space. One of my rules is that if the object reaches the edge of the screen, then it comes out on the other side. From left to right, bottom to top, or vice-versa. My world is contained by the periphery of the screen.



Christa Sommerer and Laurent Mignonneau, *A-Volve*, 1994 - 1995

If you remove the place, you are left only with relationships. In games, these relationships are often described through interaction and the development of a story over time. Without interaction and without narrative, where do these relationships take hold?

One of my ongoing questions is perceptibility. How opaque are the relationships of my worlds? My work is not goal oriented, and doesn't attach to a traditional narrative arc. Usually, it is without interaction or interaction has no long term effect on the rules of the world, only on how the player experiences it. Maybe that can be a place for transparency.

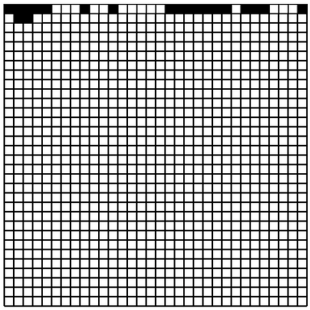
I usually make my world's relationships collision-based. That is, if two objects physically overlap in space, then some action occurs. For the most part, the resulting action is based in physics simulations aka how the object acts in space. This is usually a moment to create conflicting spatial relationships. For example, before the collision, the object exists in 2D space. After the collision, the object reveals itself as 3D.

If a world is a container for possible relationships and interactions, then how these relationships unfold is kind of like probability. If there are 100 pieces of candy in the bowl...

Agnes Varda, Still from *The Gleaners and I*, 2000

Agnes Varda, Still from *The Gleaners and I*, 2000

Every Icon



Given:
An icon described by a 32 X 32 grid.

Allowed:
Any element of the grid to be colored black or white.

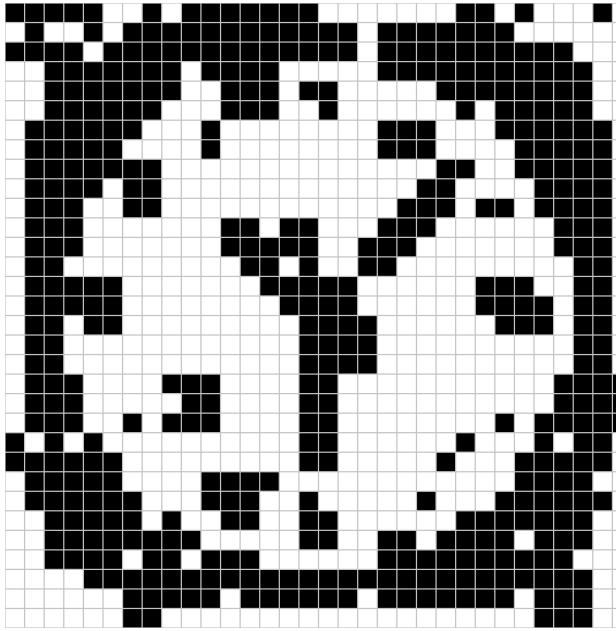
Shown:
Every icon.

Owner:
John F Simon Jr

Edition Number:
Artist's Proof

Starting Date:
January 14, 1997, 9:00:00 pm

John Simon Jr, *Every Icon*, 1997



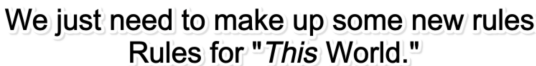
Clock produced by *Every Icon*

I wrote in the past: “What is the role of coincidence if the possibility of something happening is built into its program? In other words, can chance be encoded? It seems that the algorithm creates causal relationships rather than coincidental ones, even if the occurrence is based on simulated, pseudo-randomness.”

Maybe a key characteristic is that if the occurrence happened outside a simulated system, it would be without immediate or perceptible cause.

For example, over an indefinite period of time, a dragonfly may never land on a given windowsill. In a simulation programmed to have a dragonfly land on a given windowsill once in an indefinite period of time, the dragonfly will eventually and with certainty land on the given windowsill.

The act of witnessing the simulated dragonfly land on the simulated windowsill is coincidental, but the moment of occurrence itself is based on probability, not pure chance. It feels both with and without cause. It is one in the set of possible outcomes. And with enough time, it is inevitable.



Caption still from *Sonny Boy*, Episode 1, 2021

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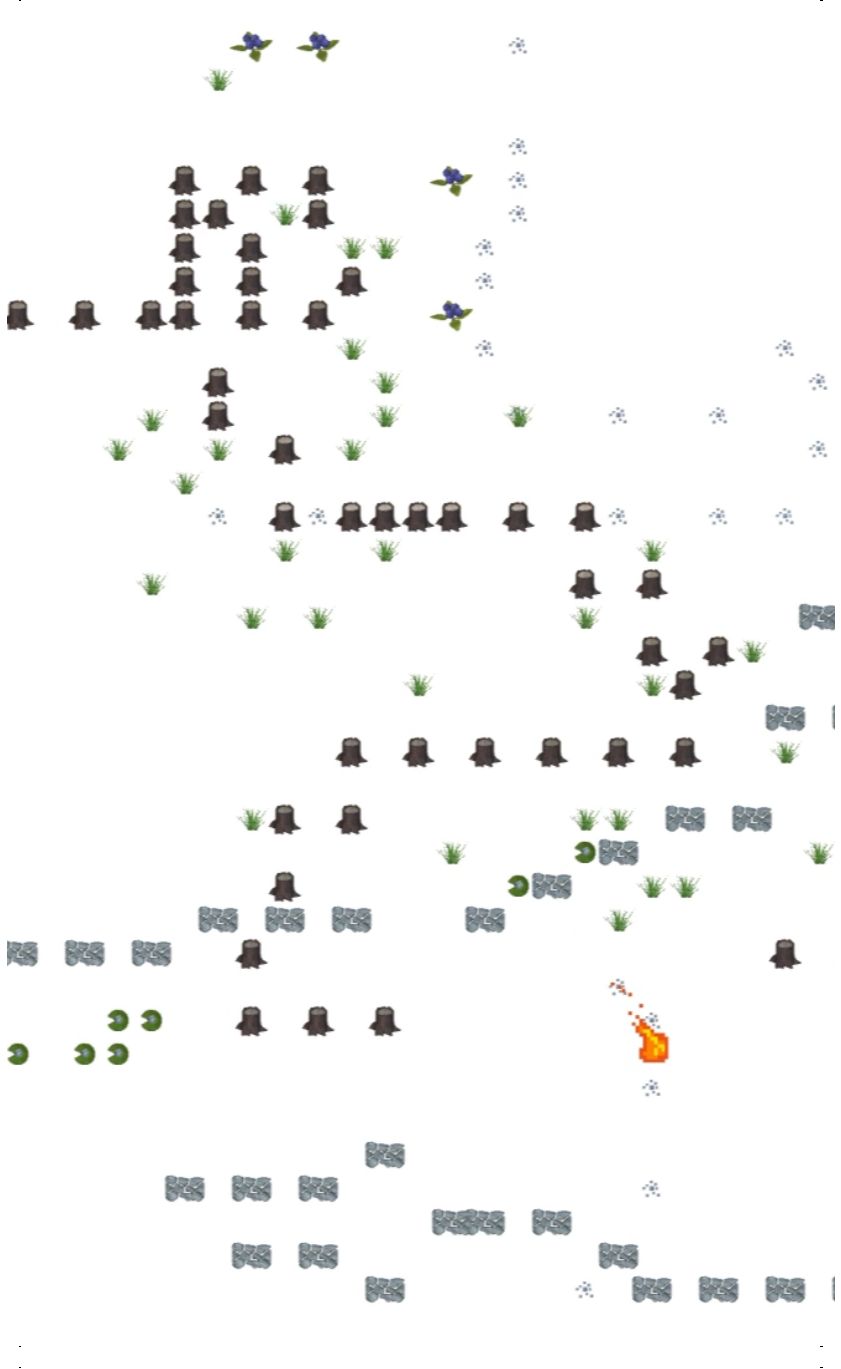
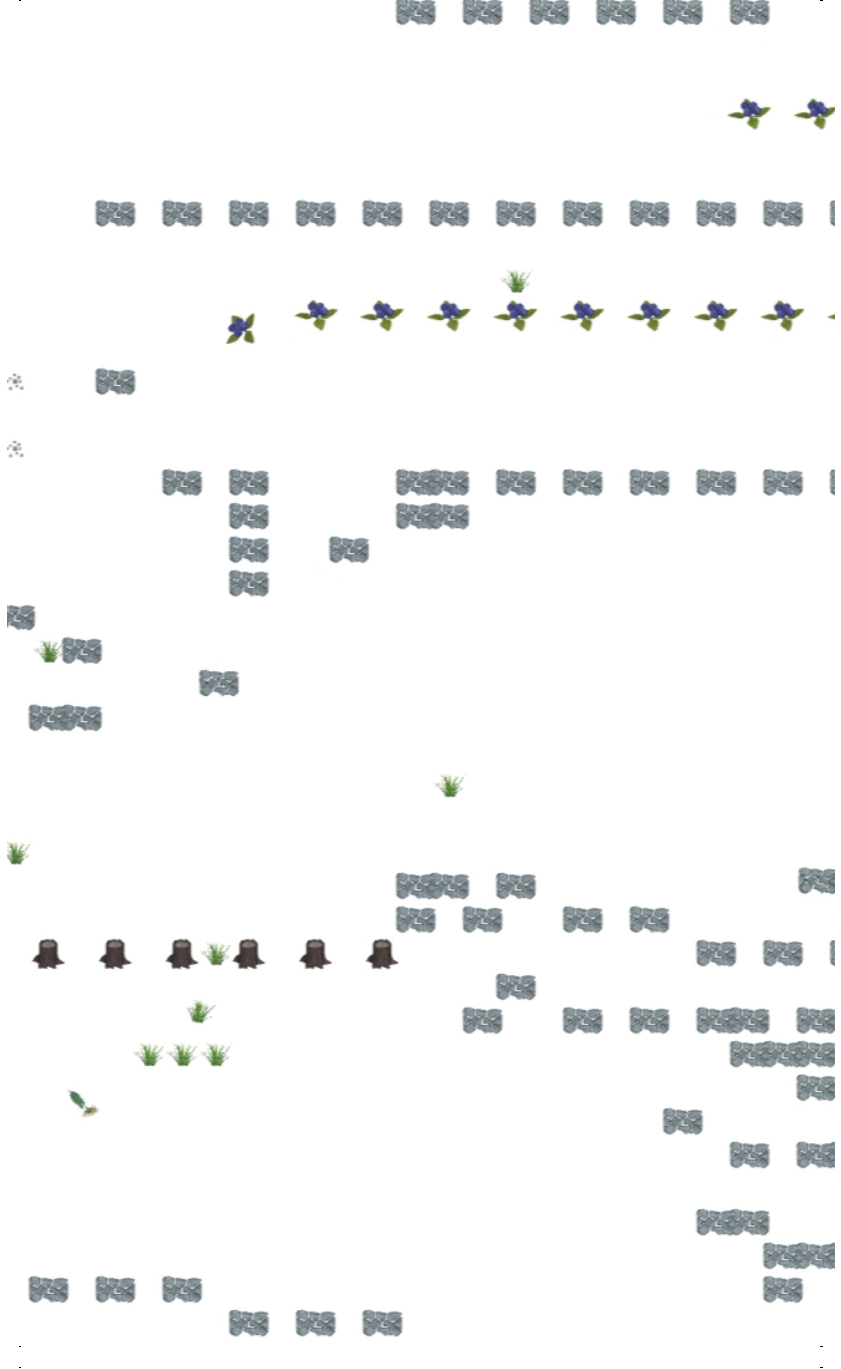
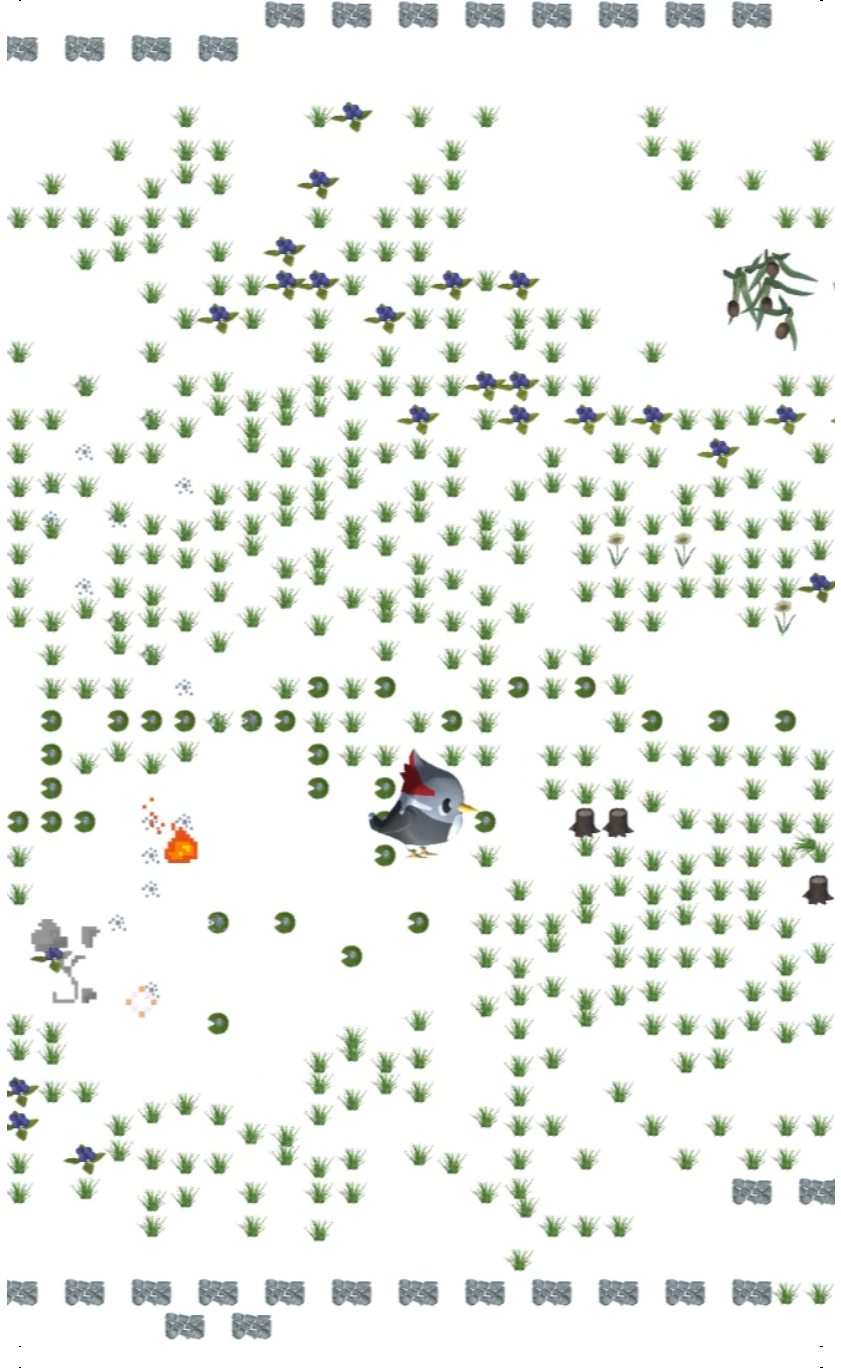
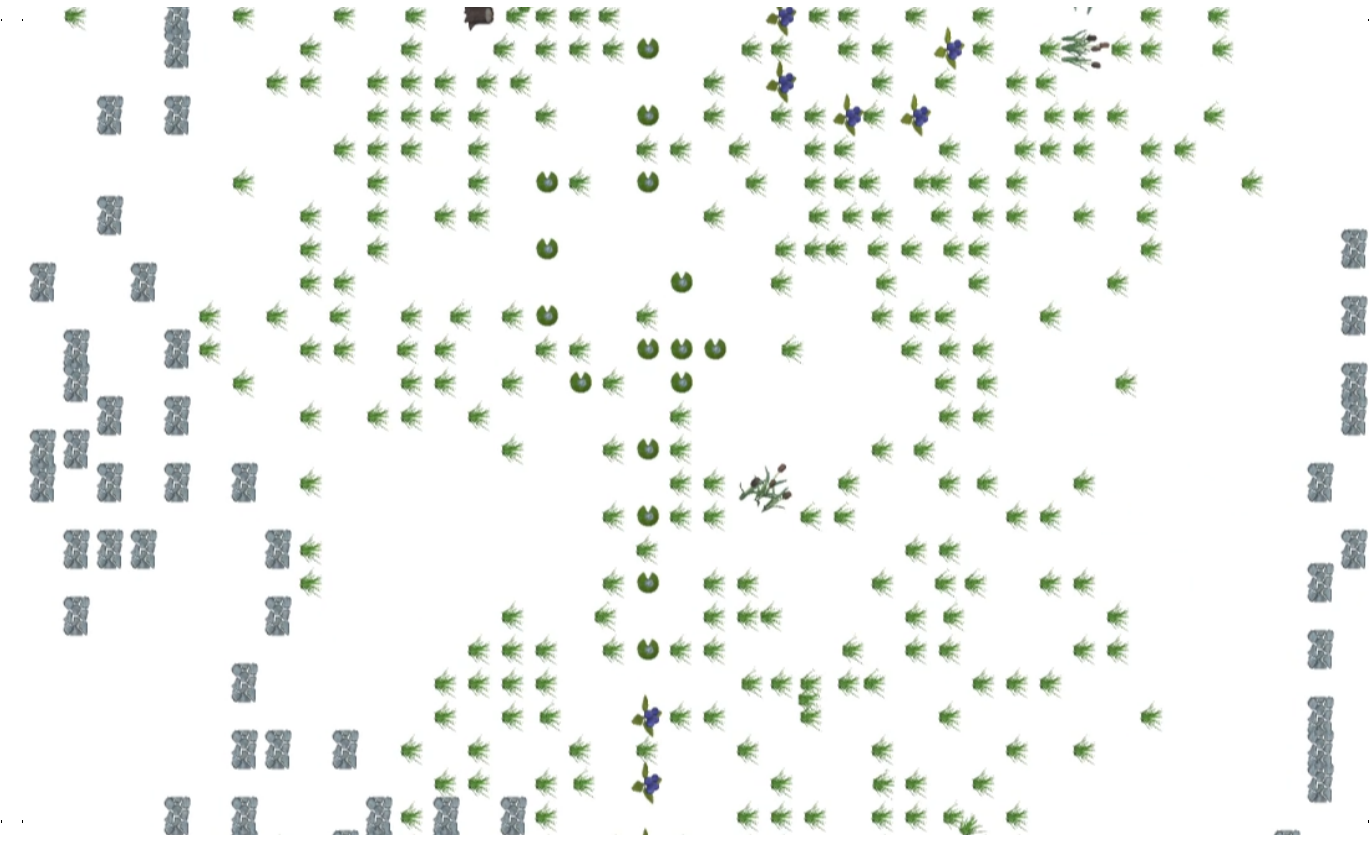
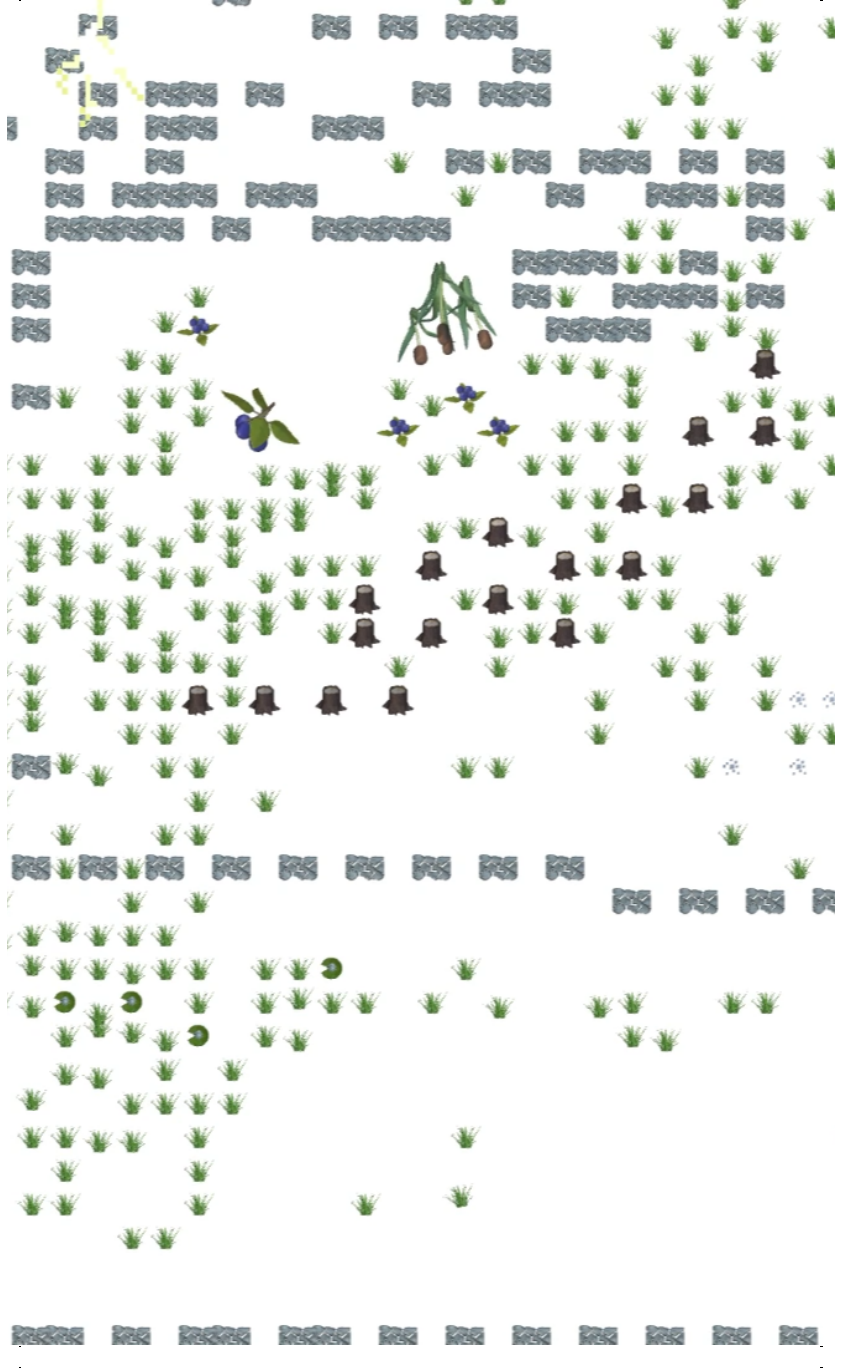
Project Documentation

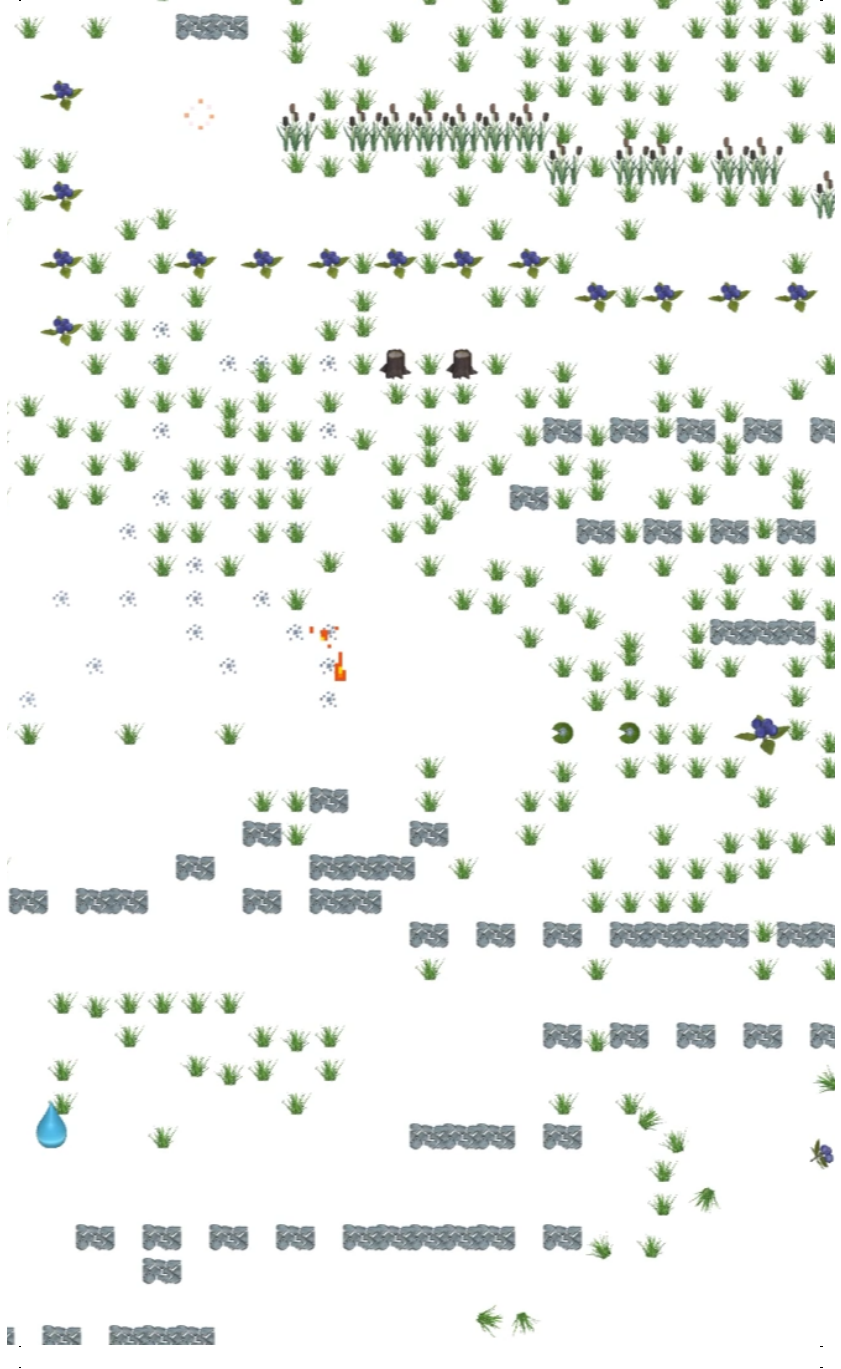


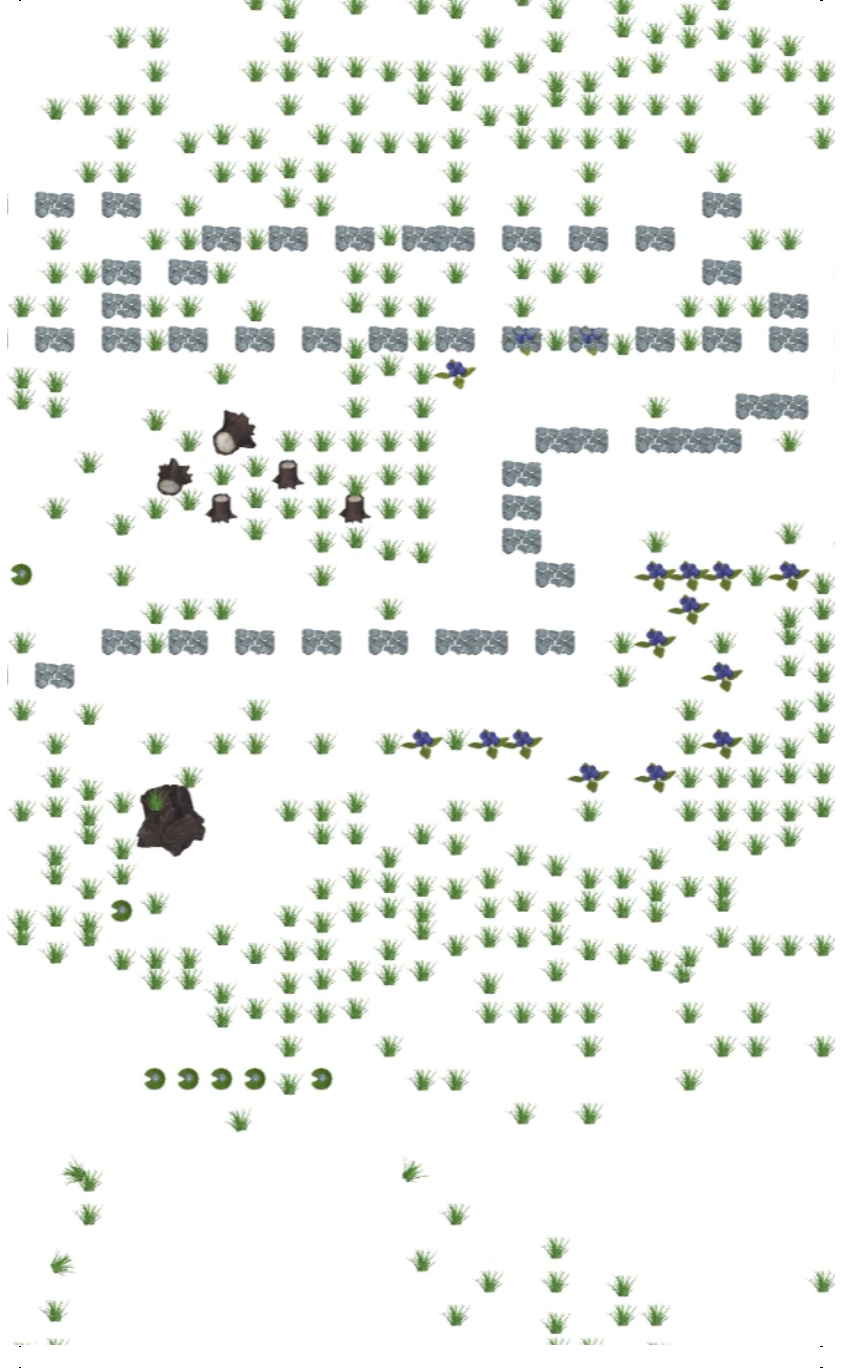


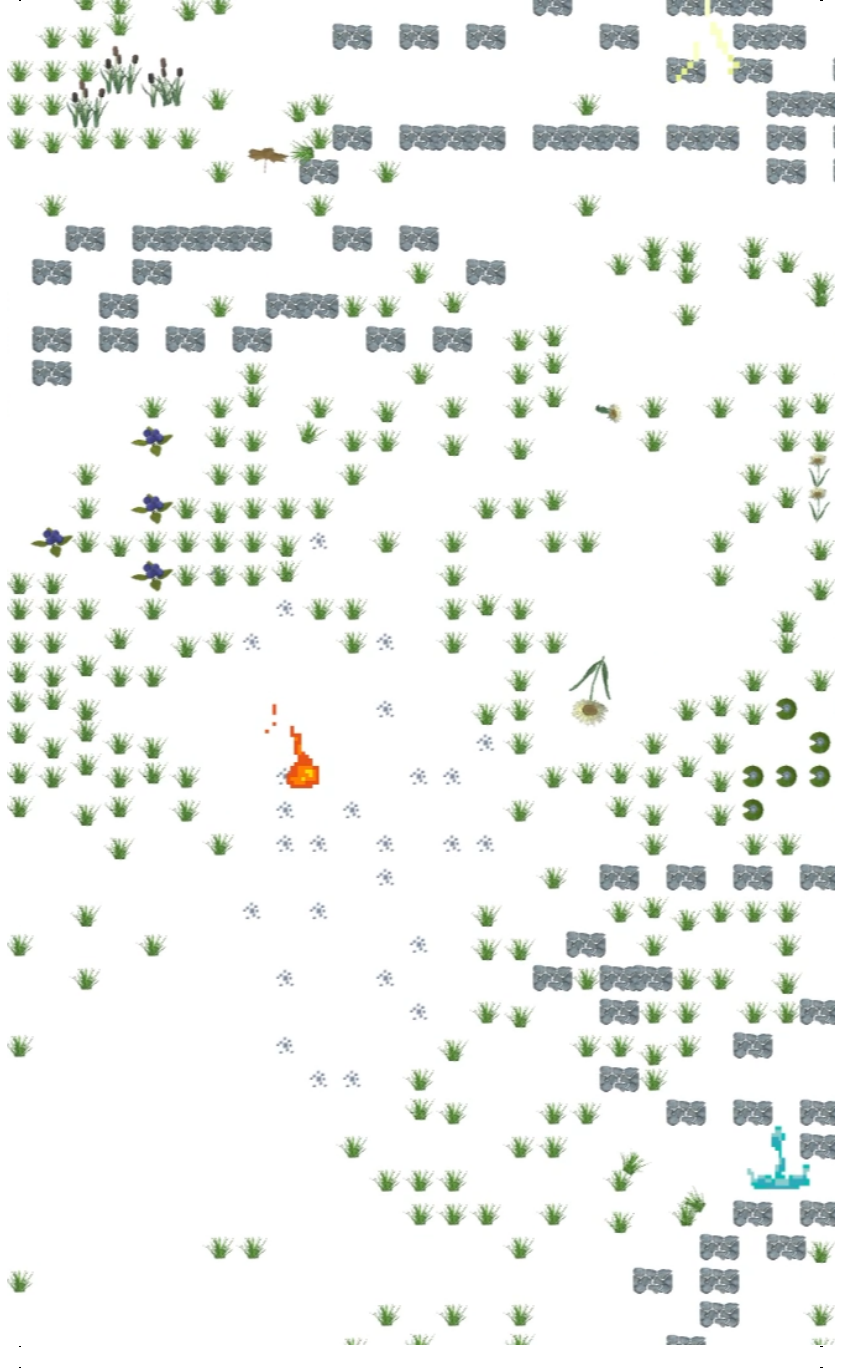


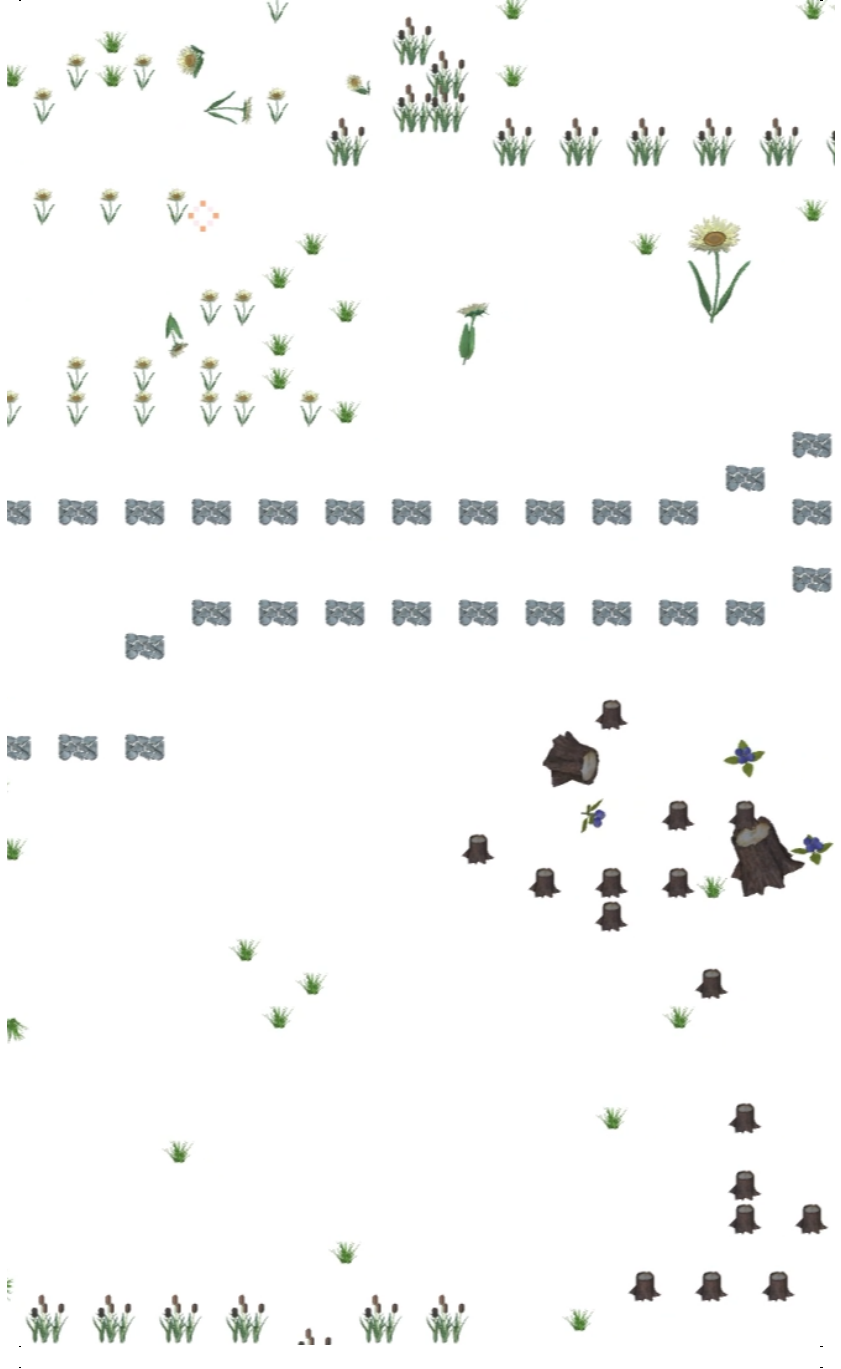


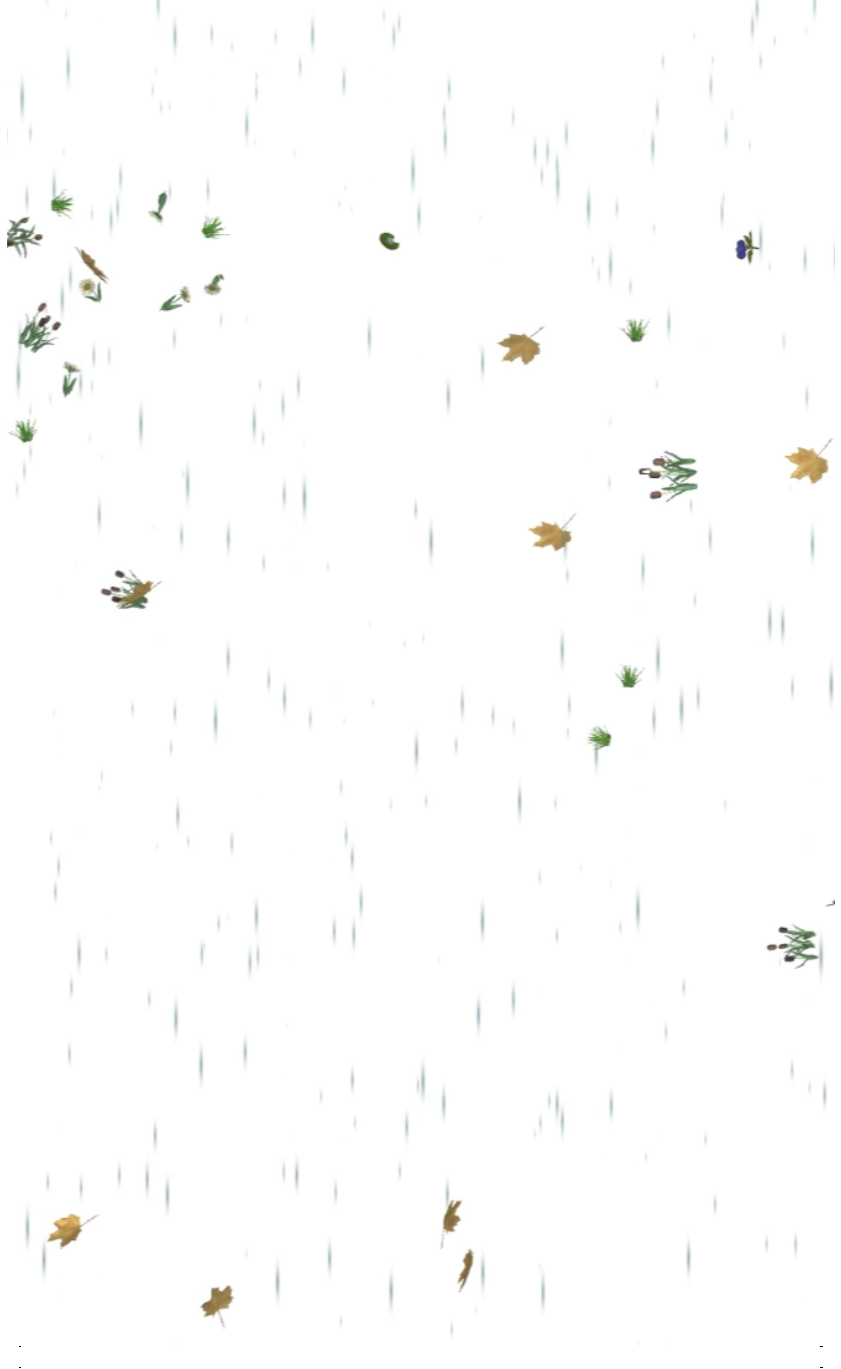


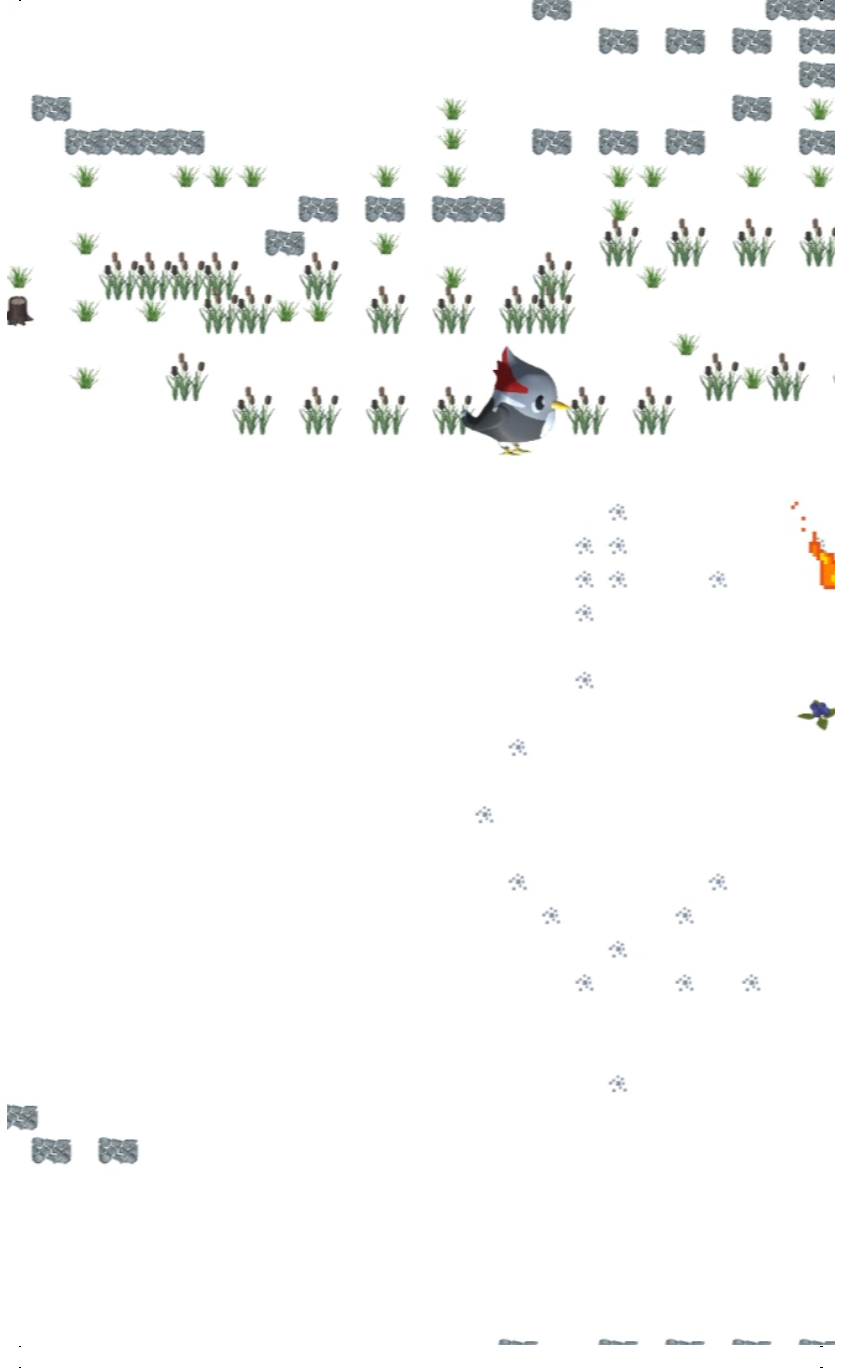


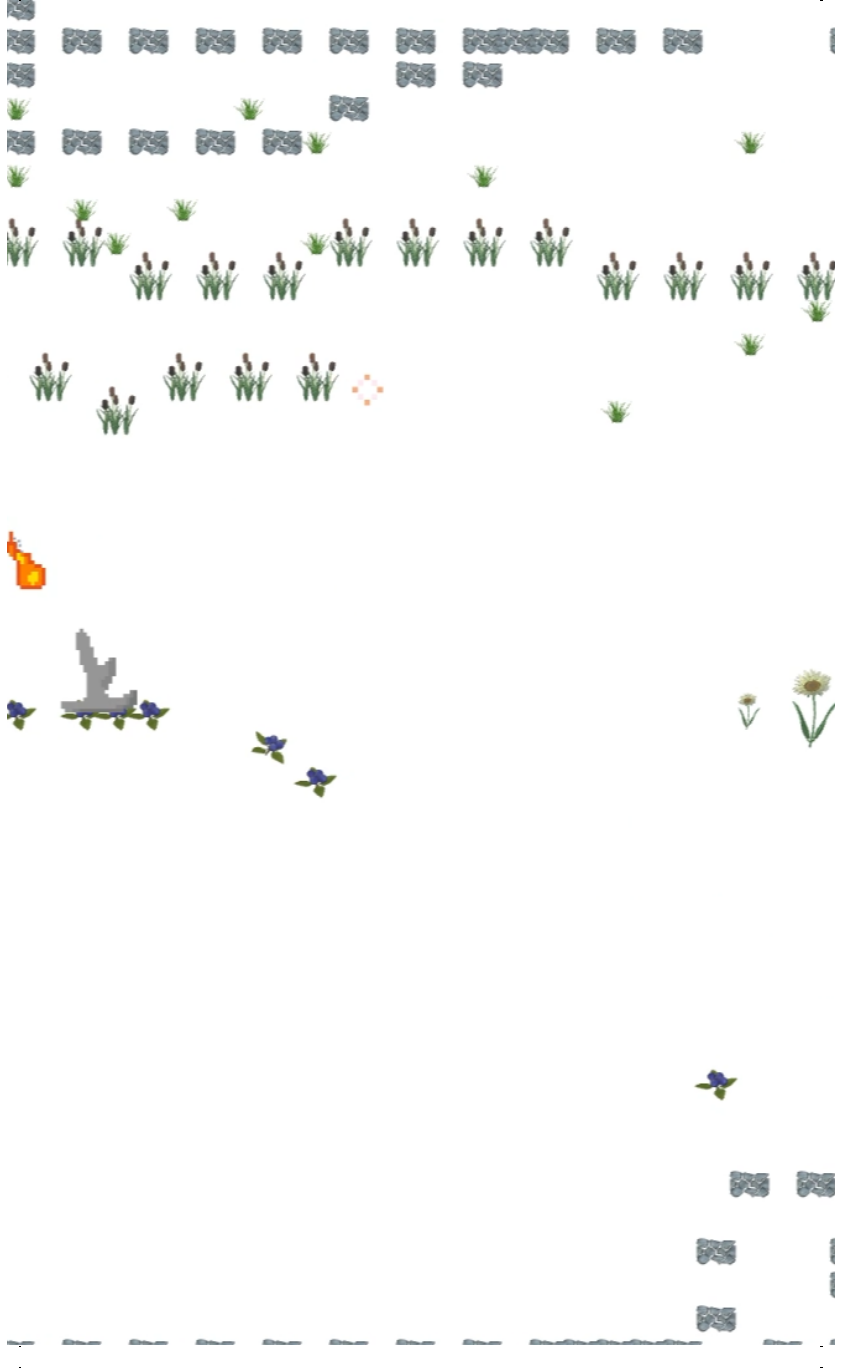


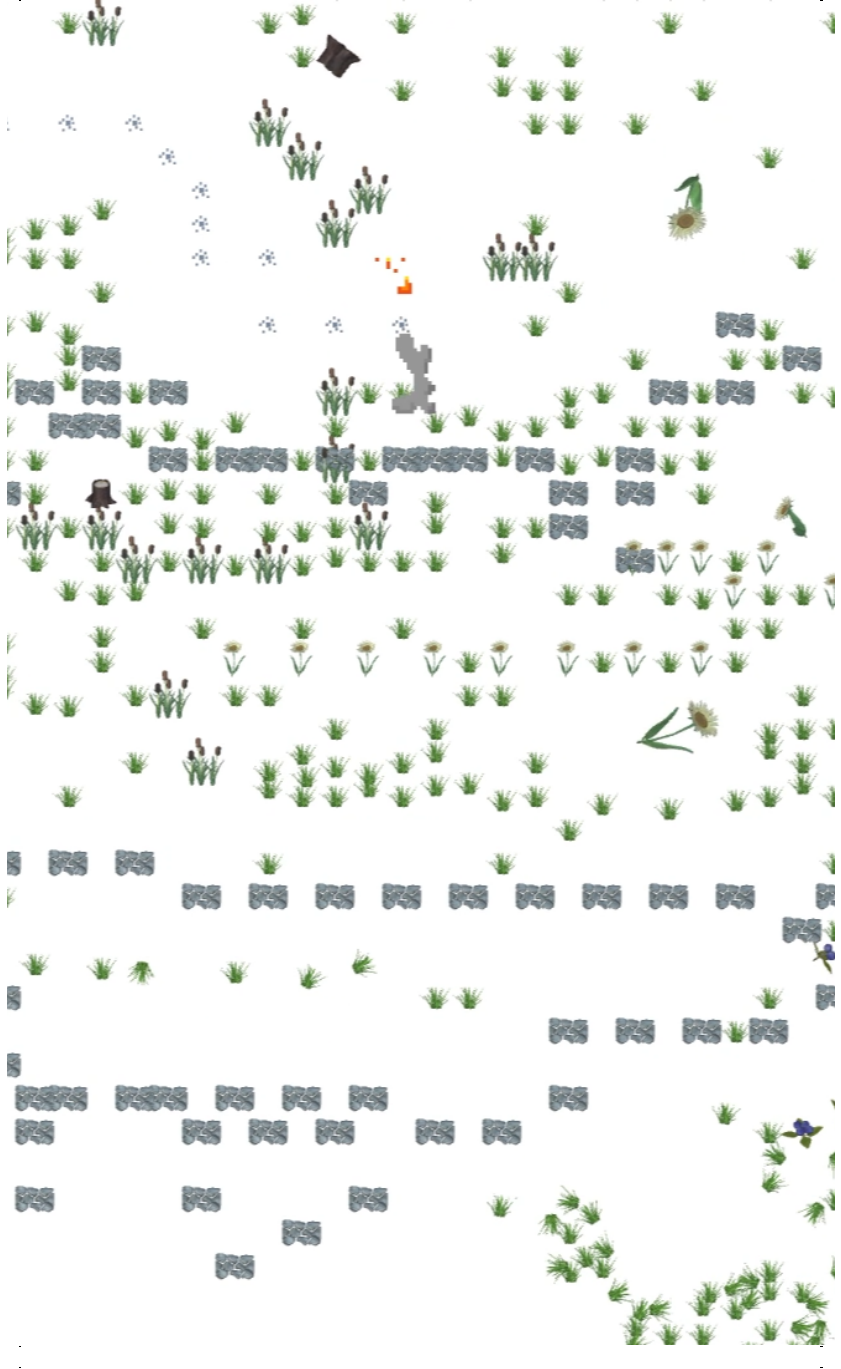


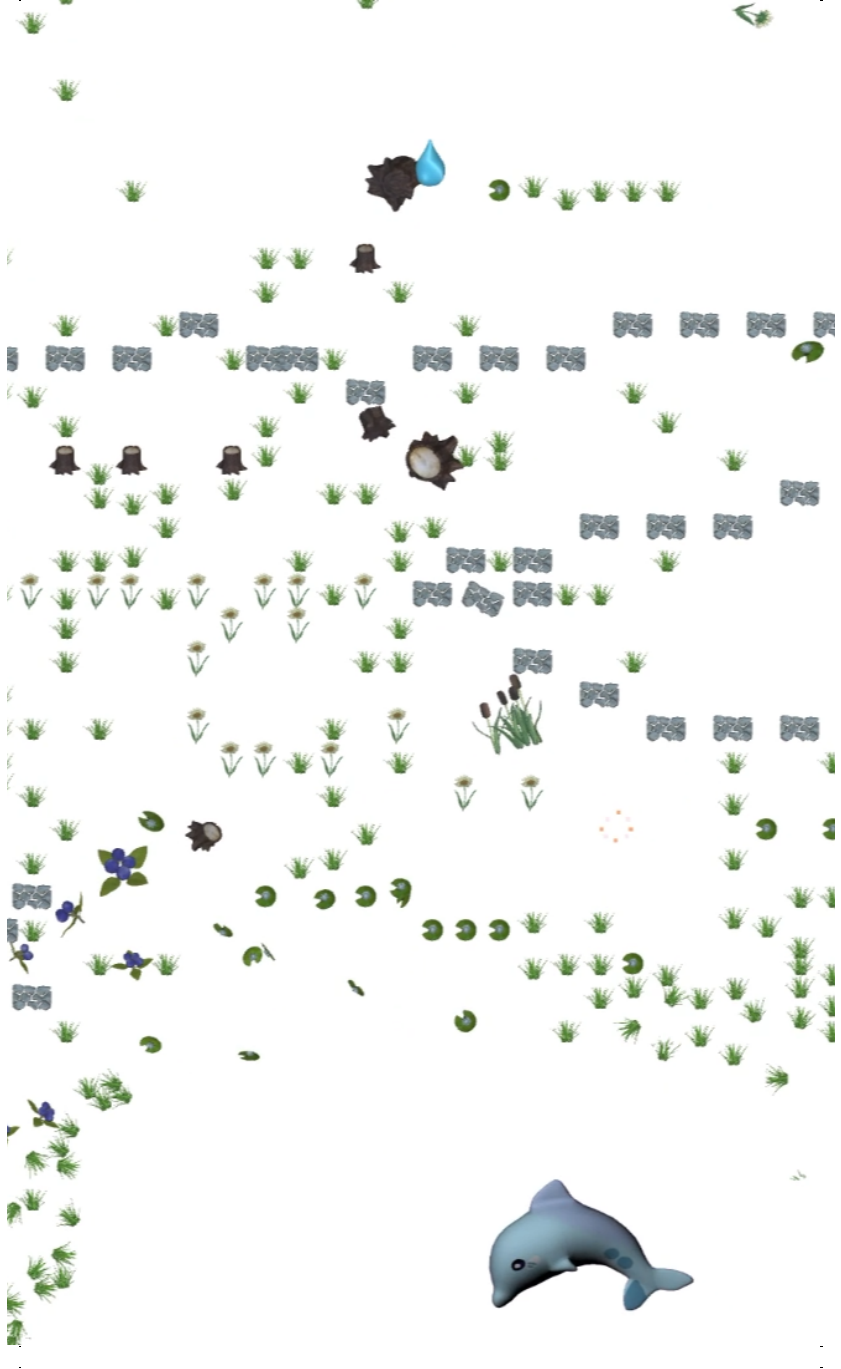


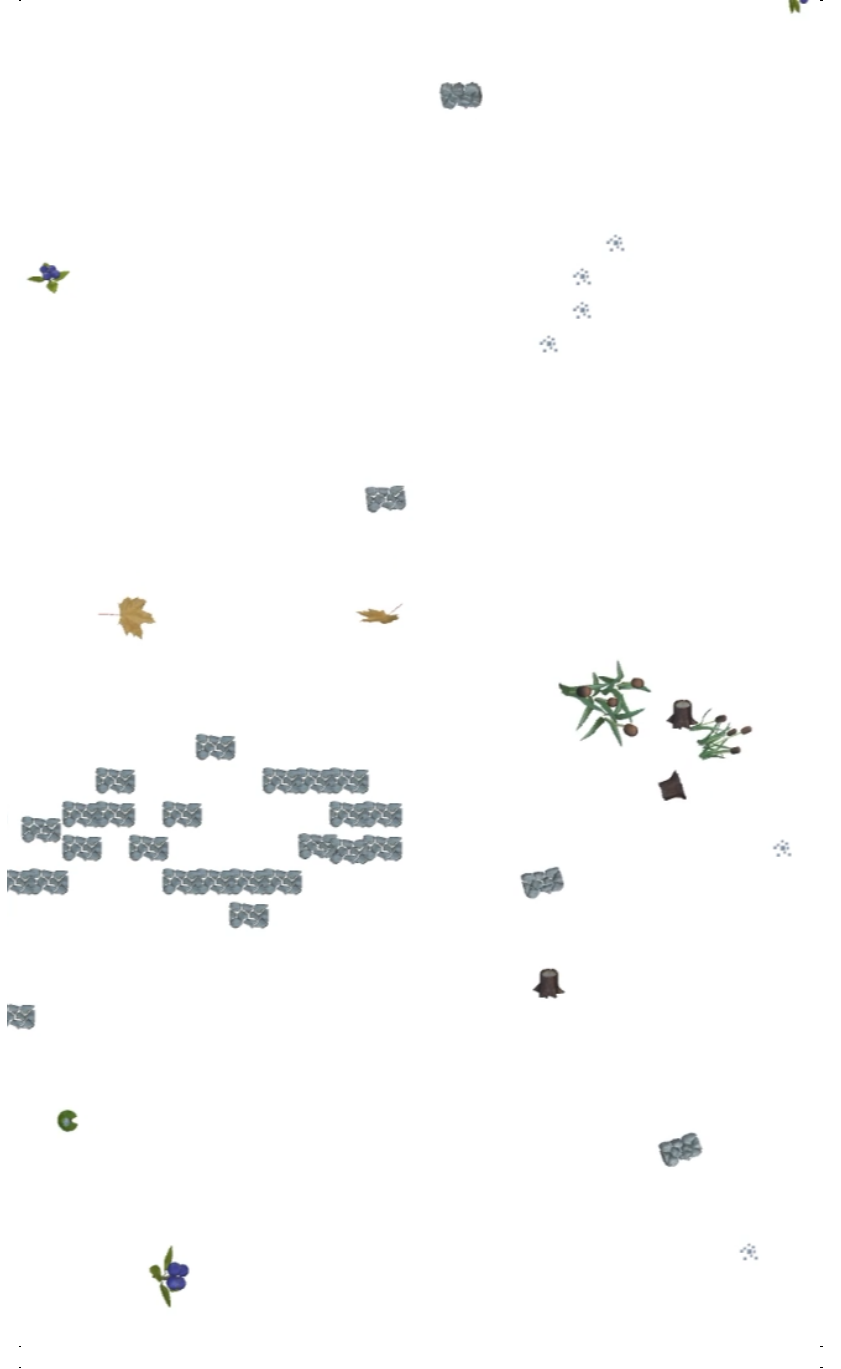


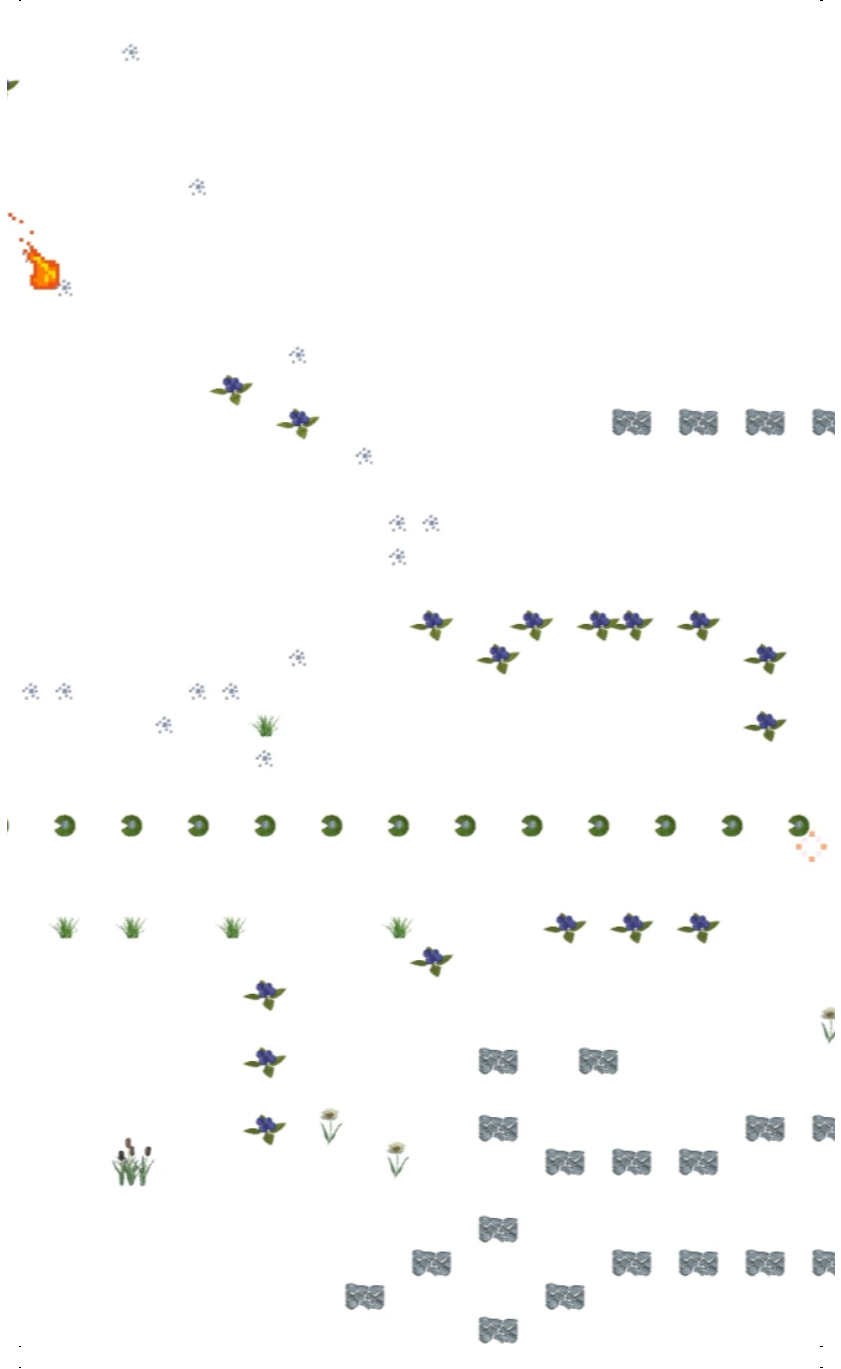


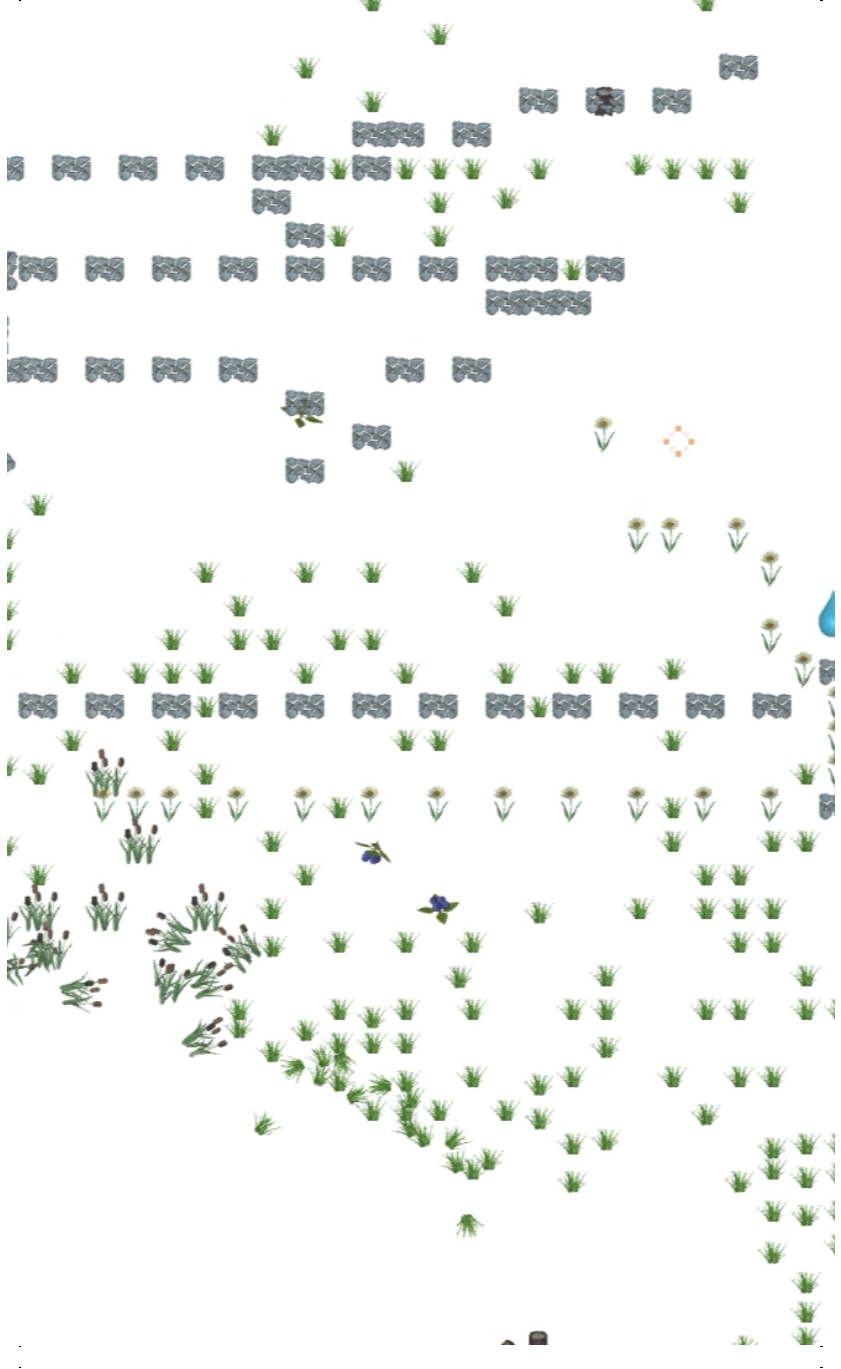


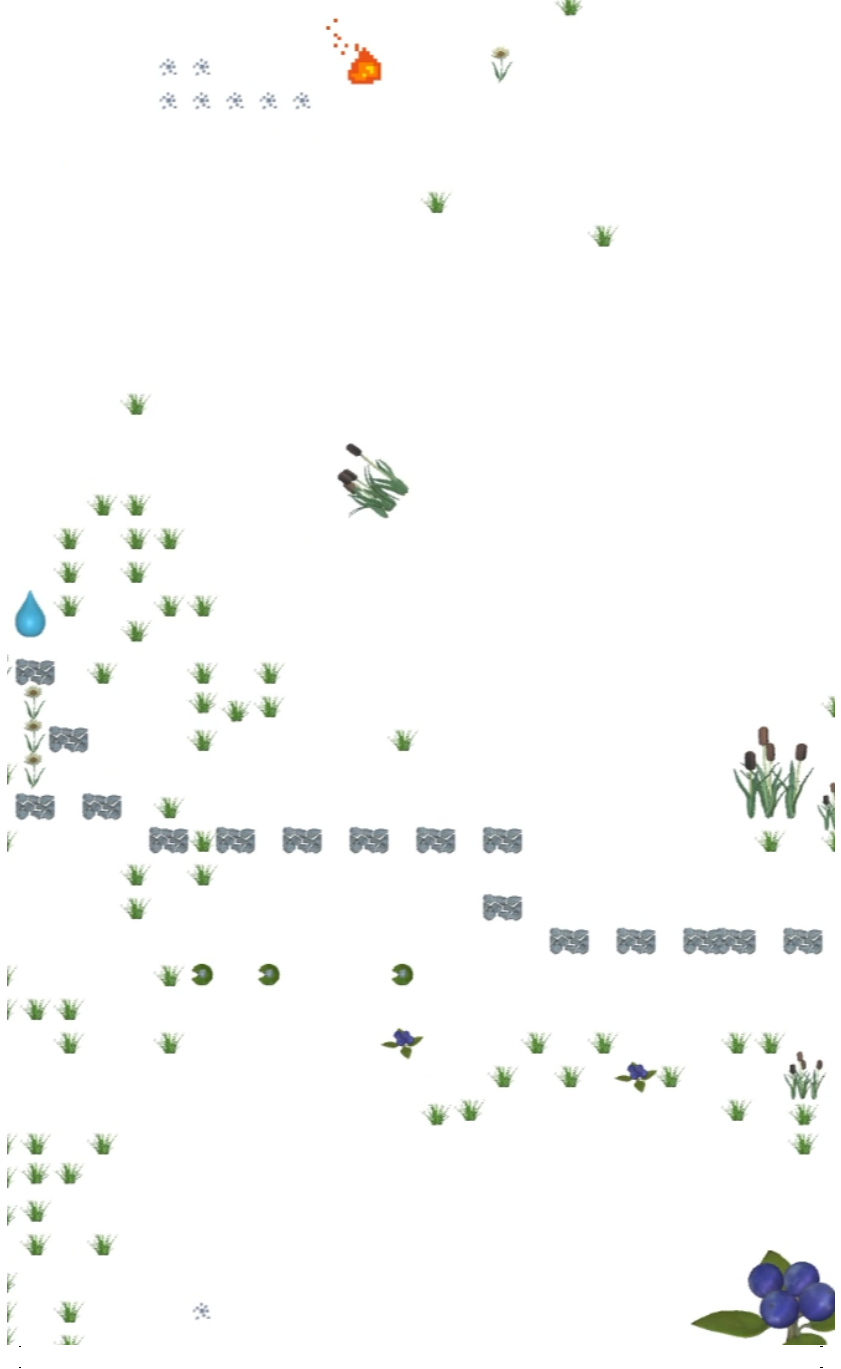


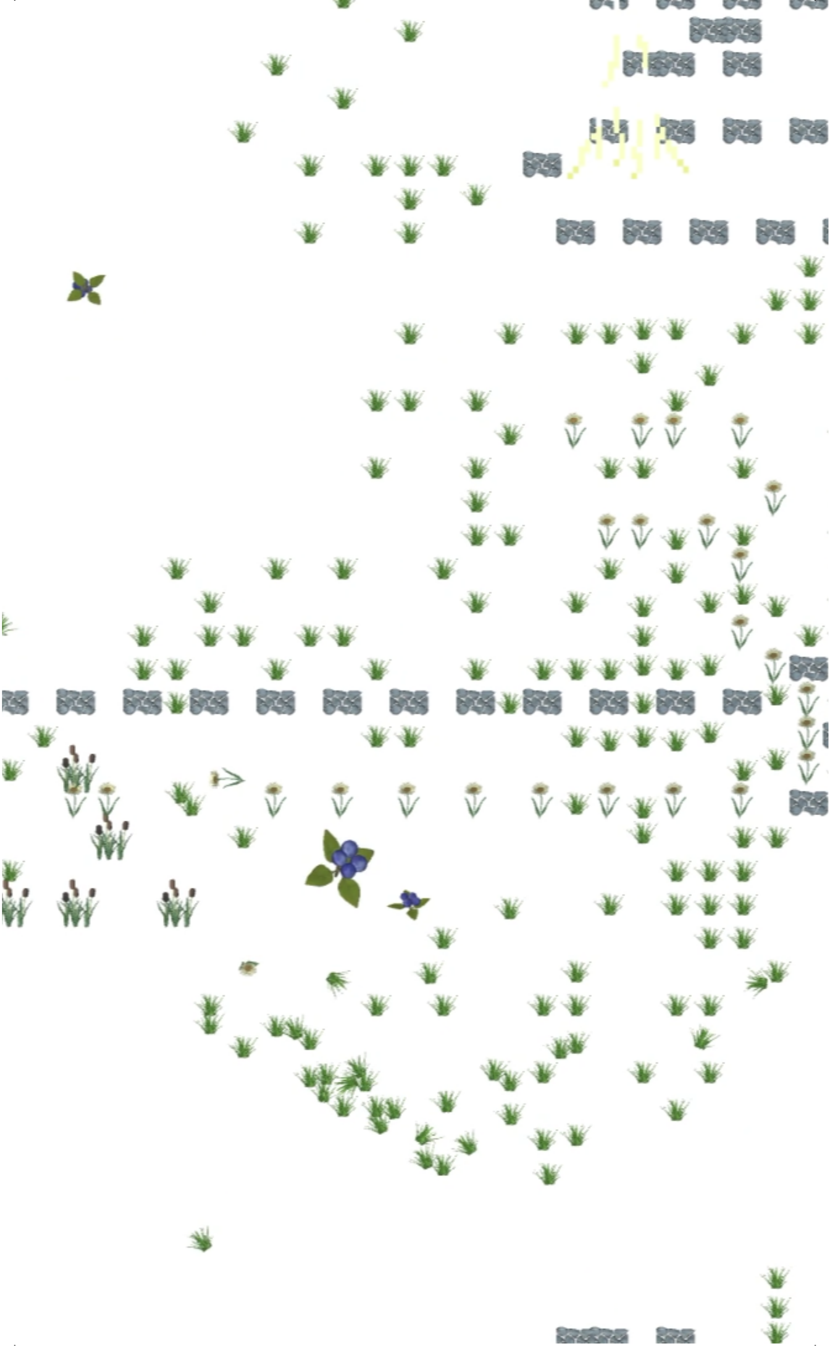


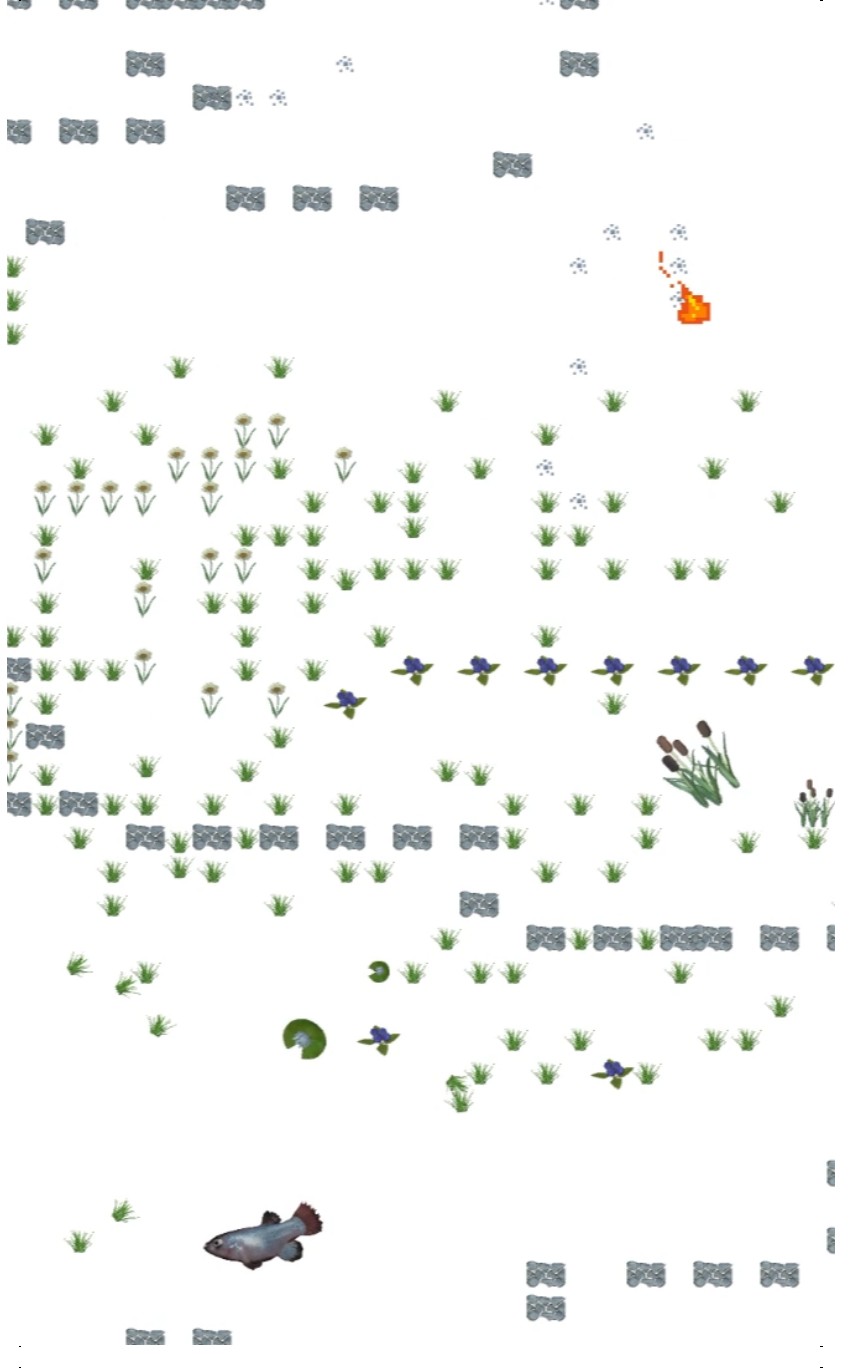


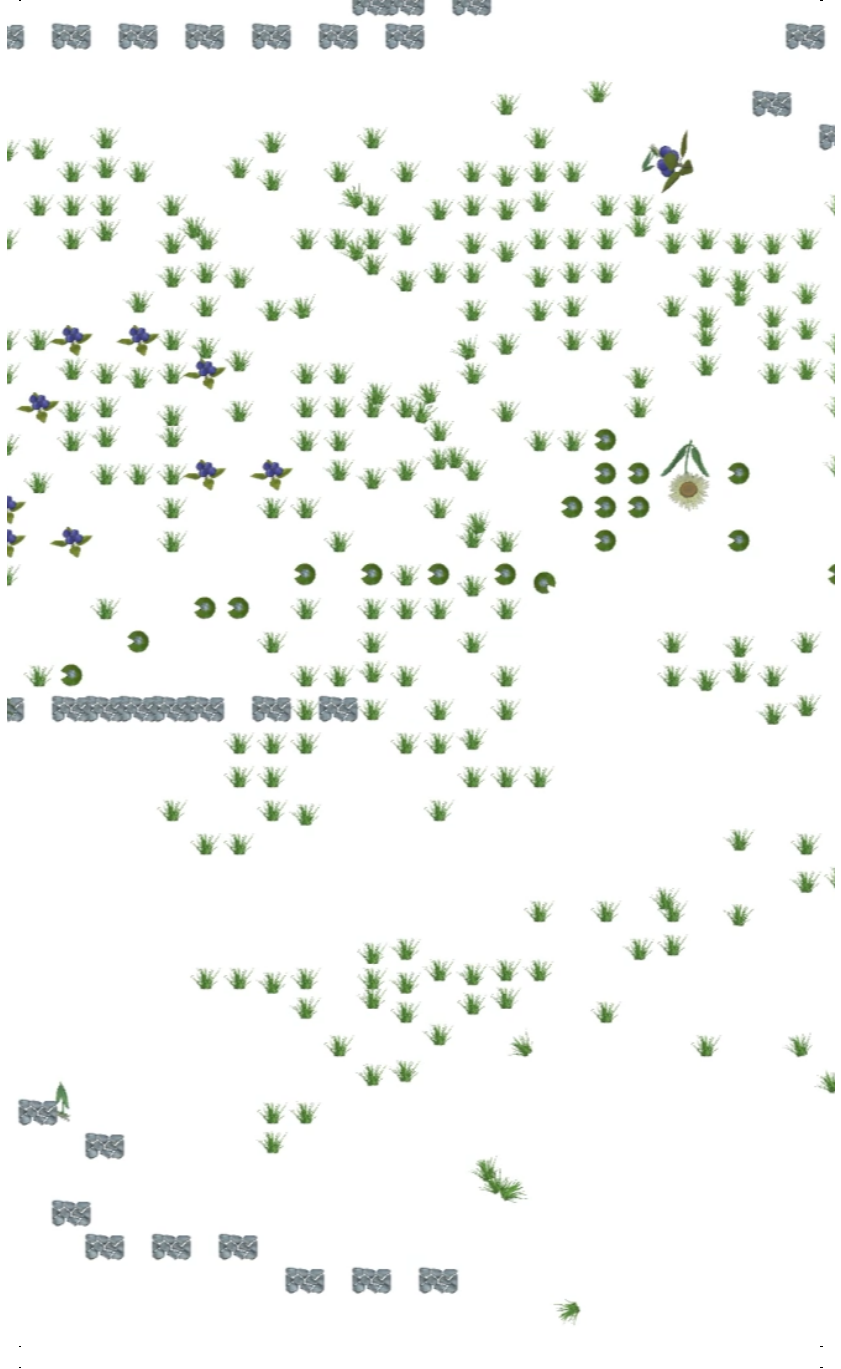


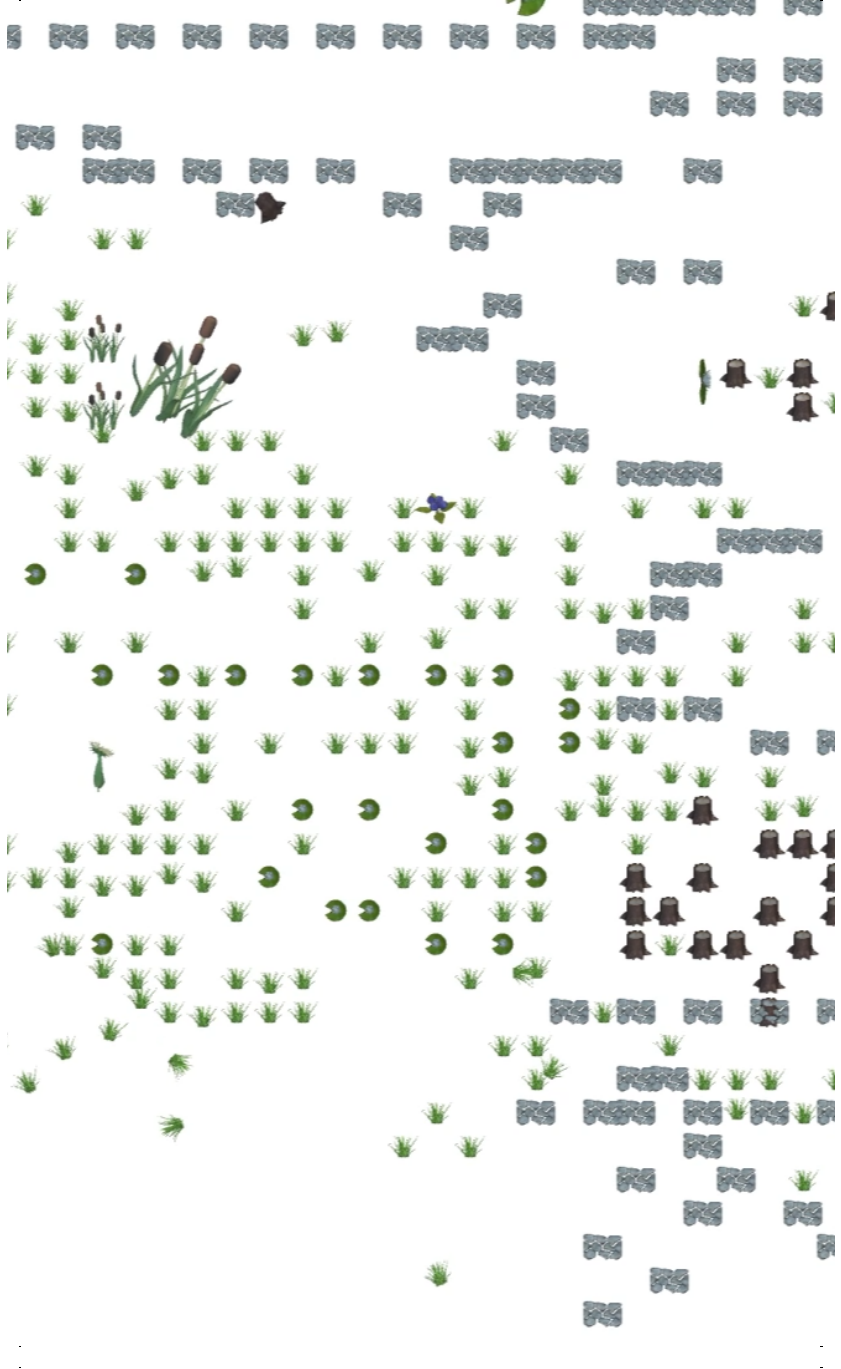


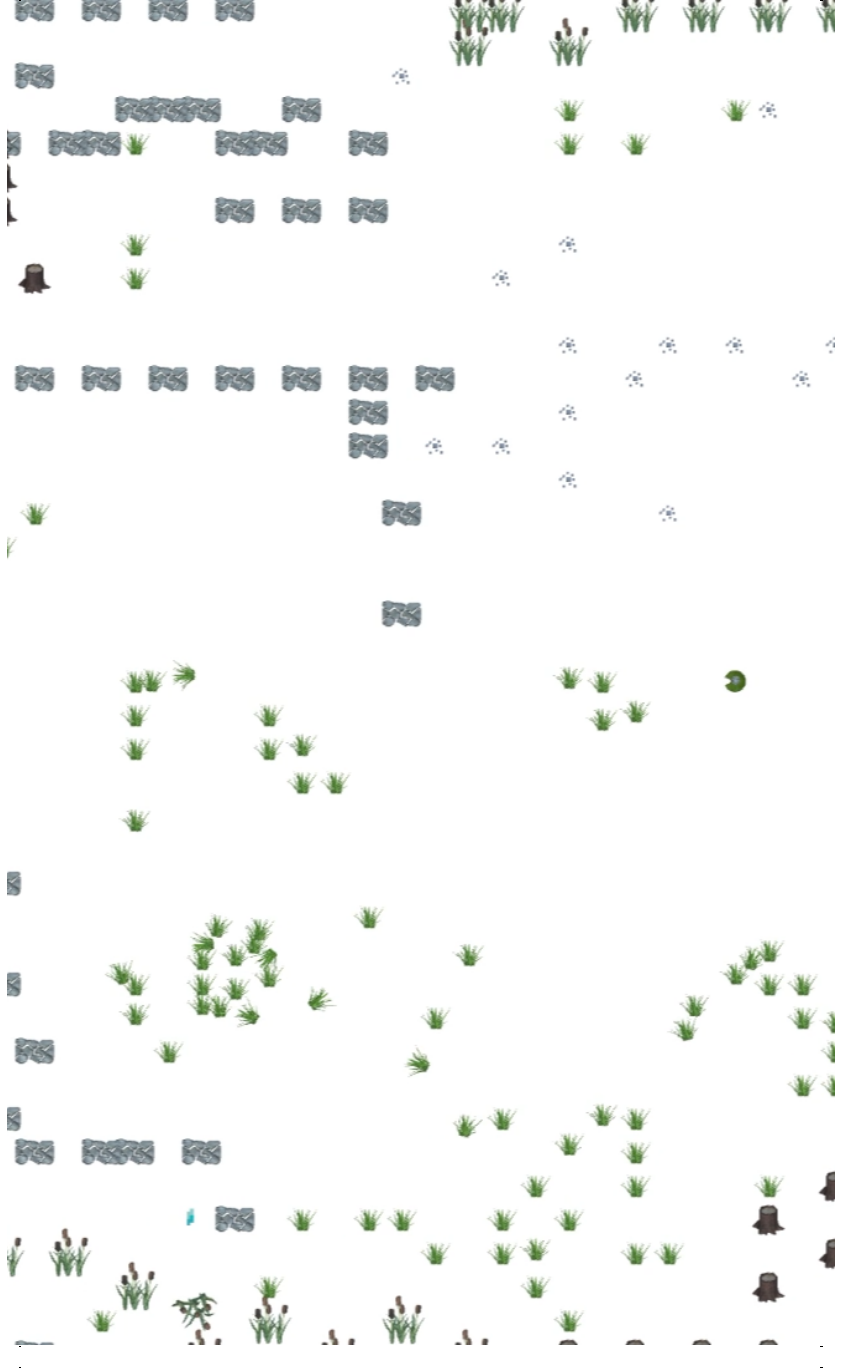


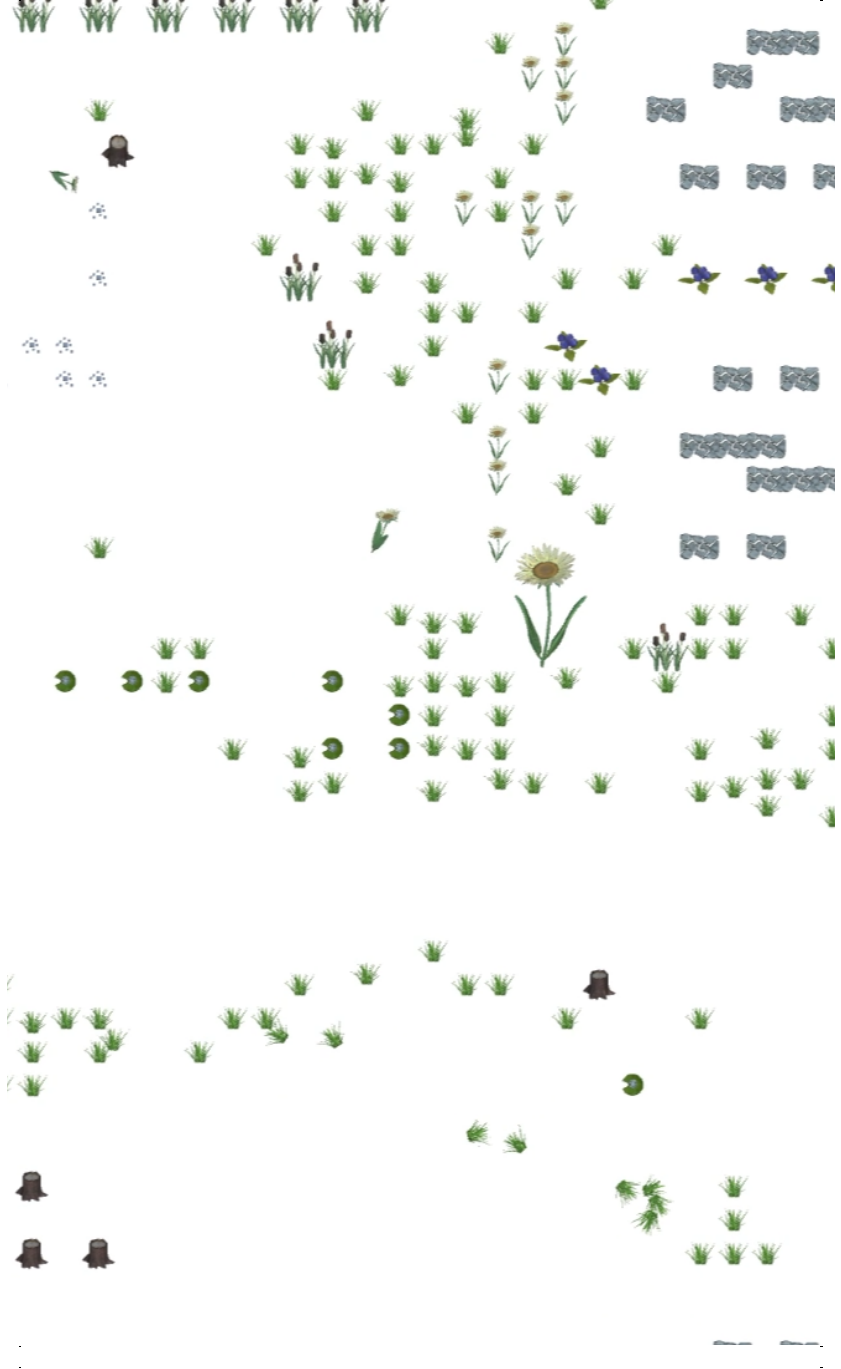


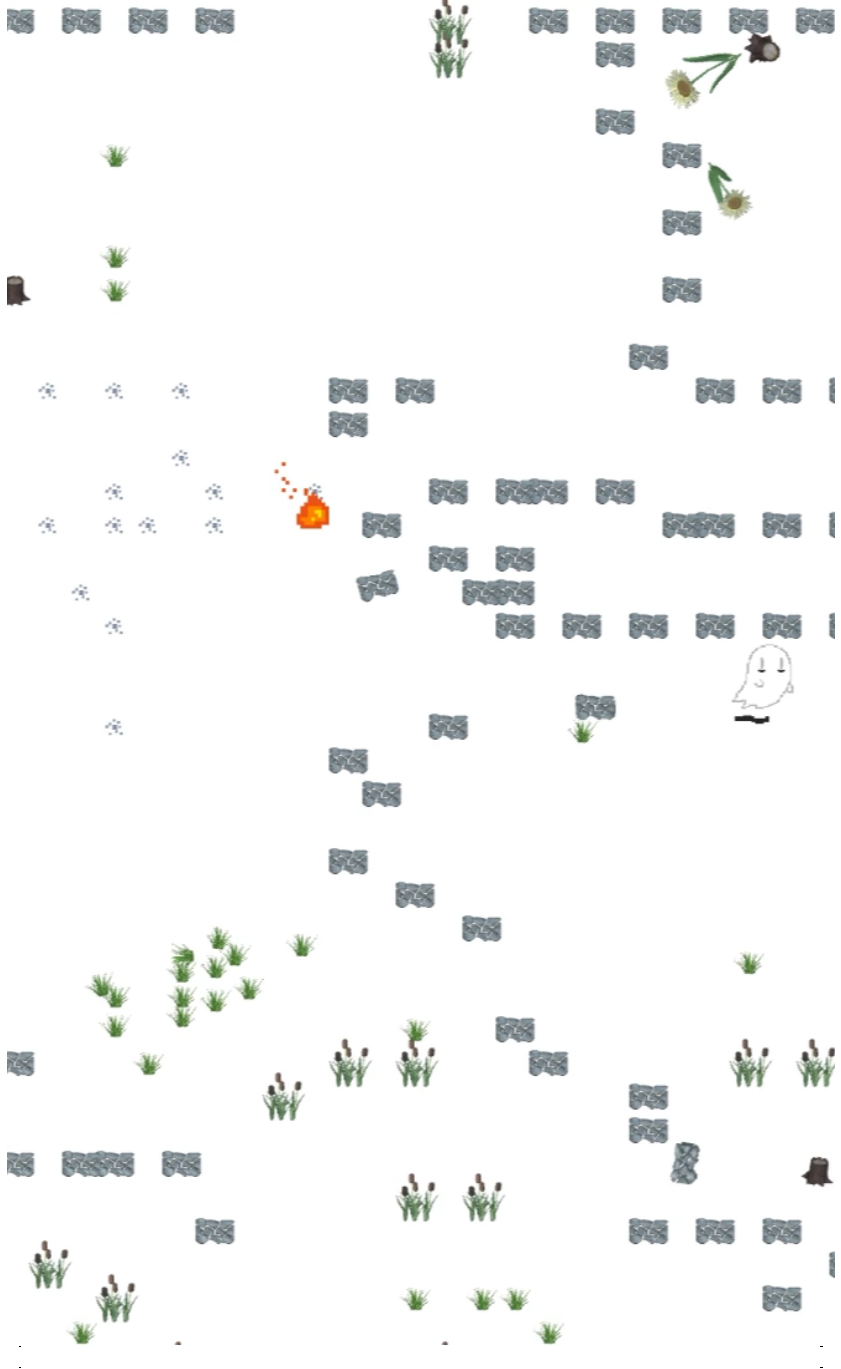


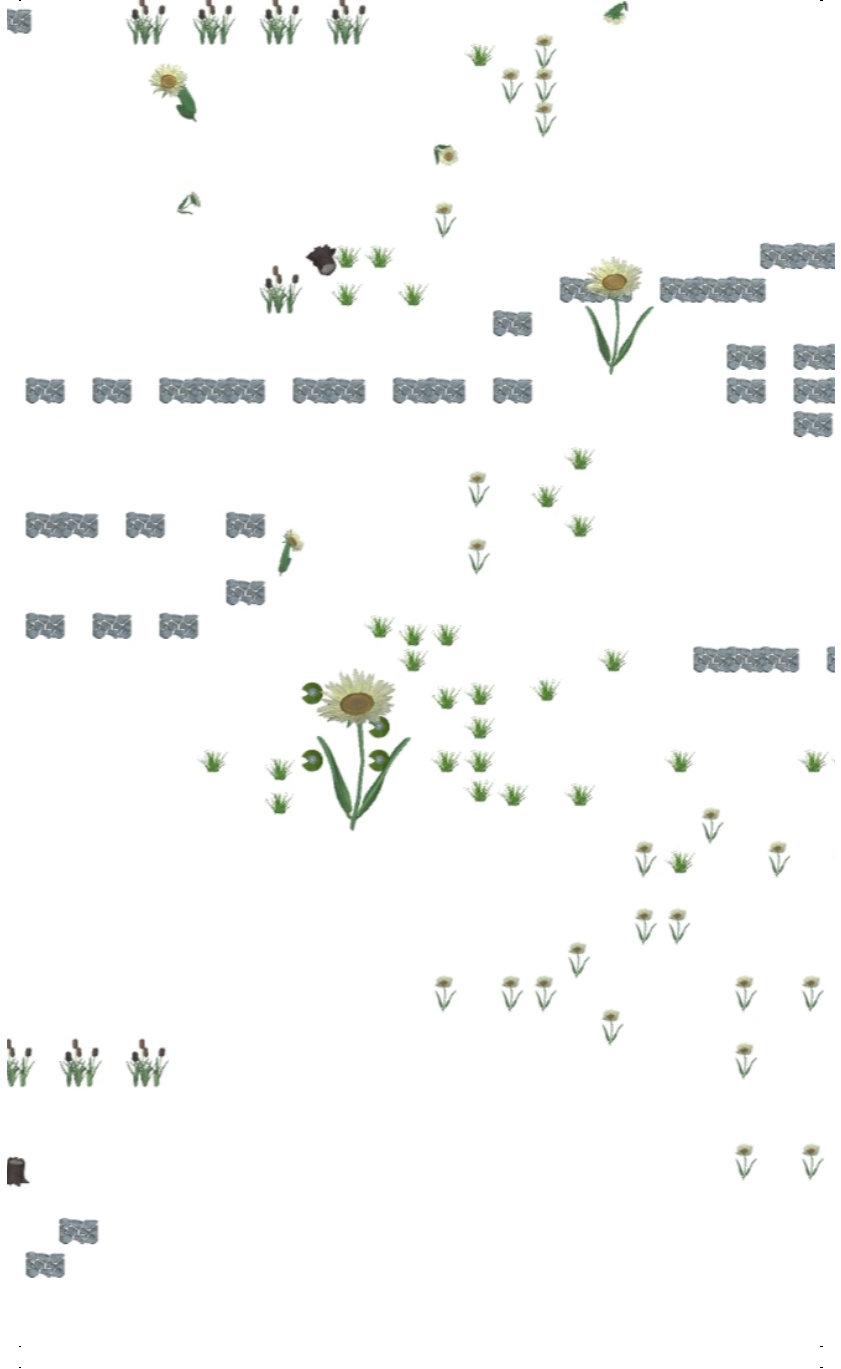


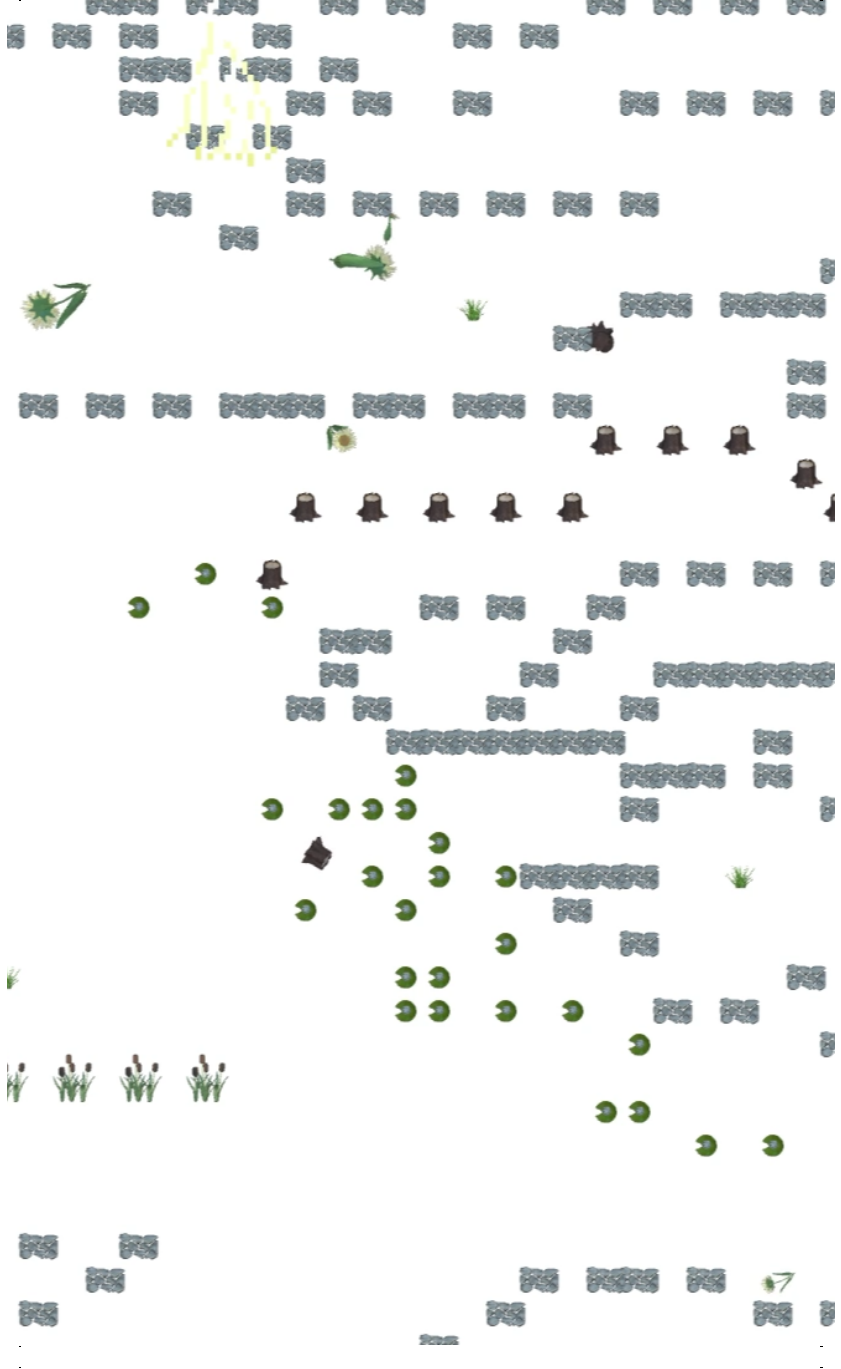


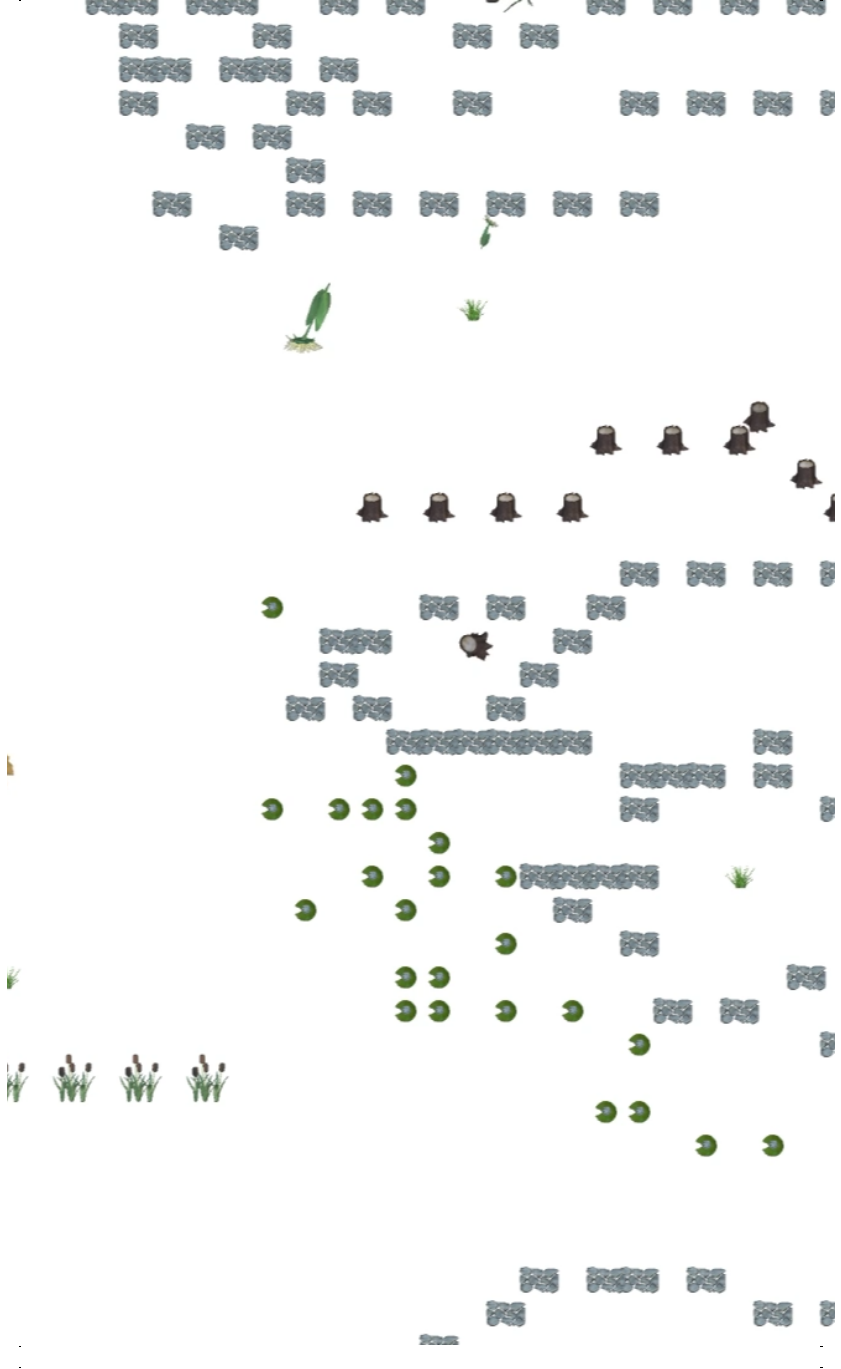


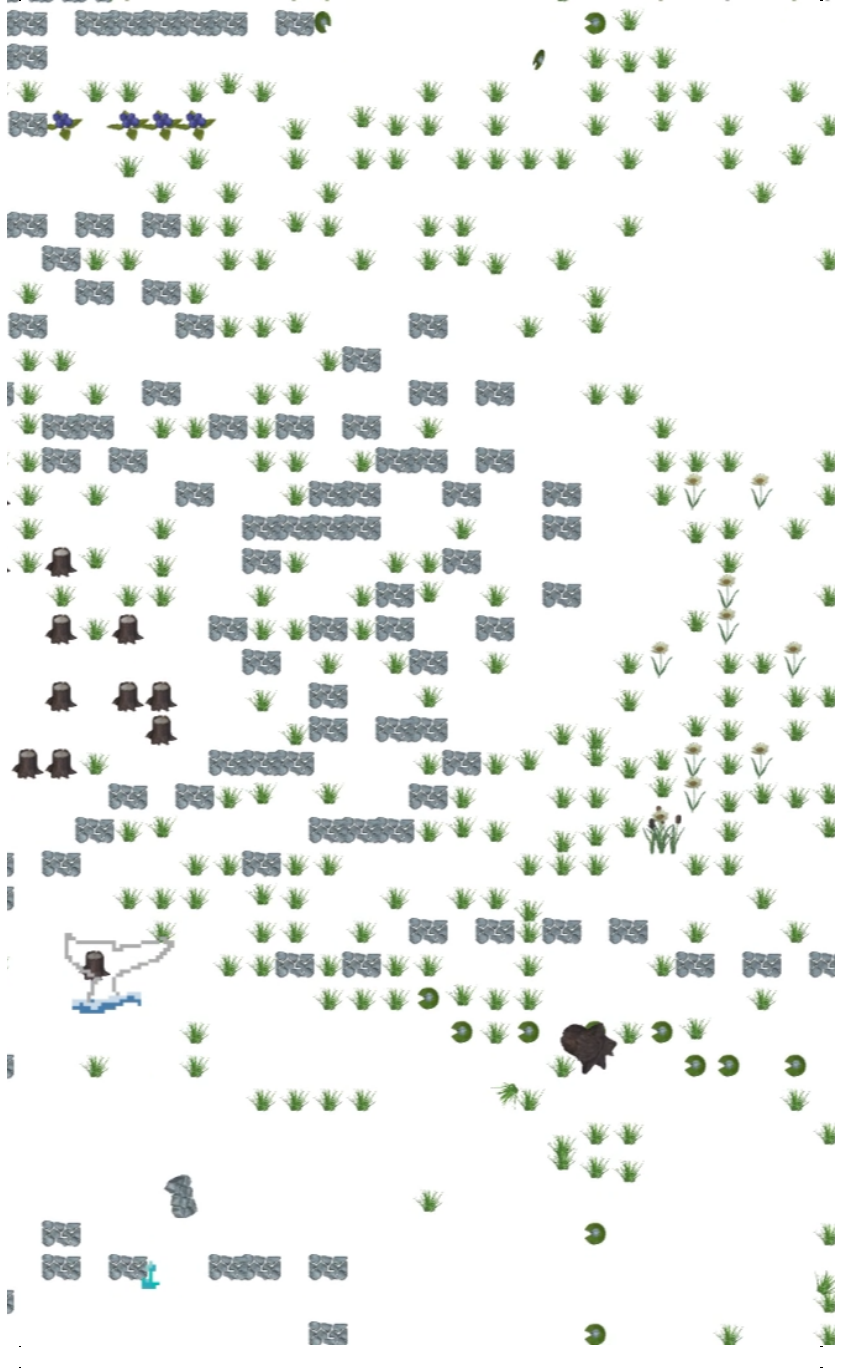


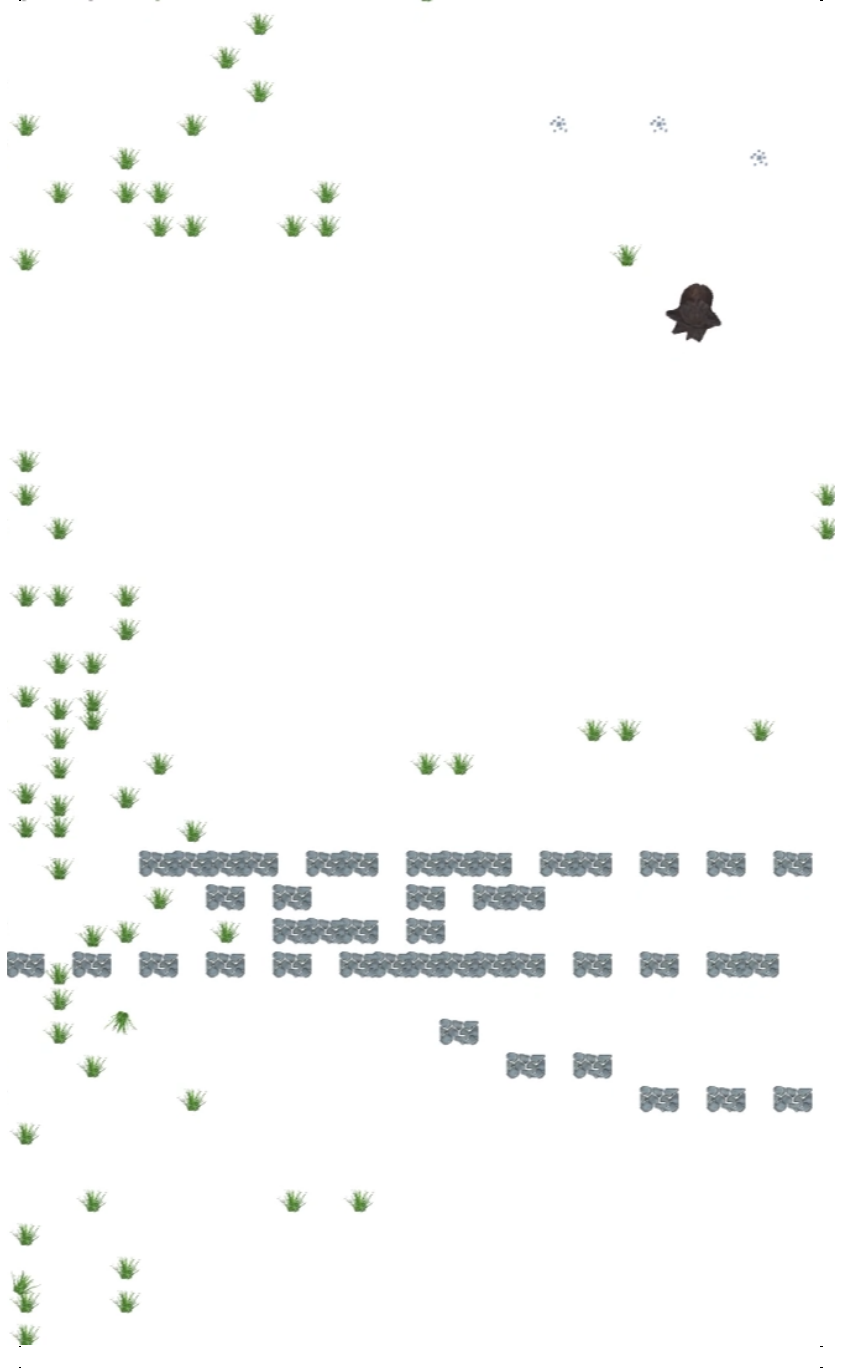


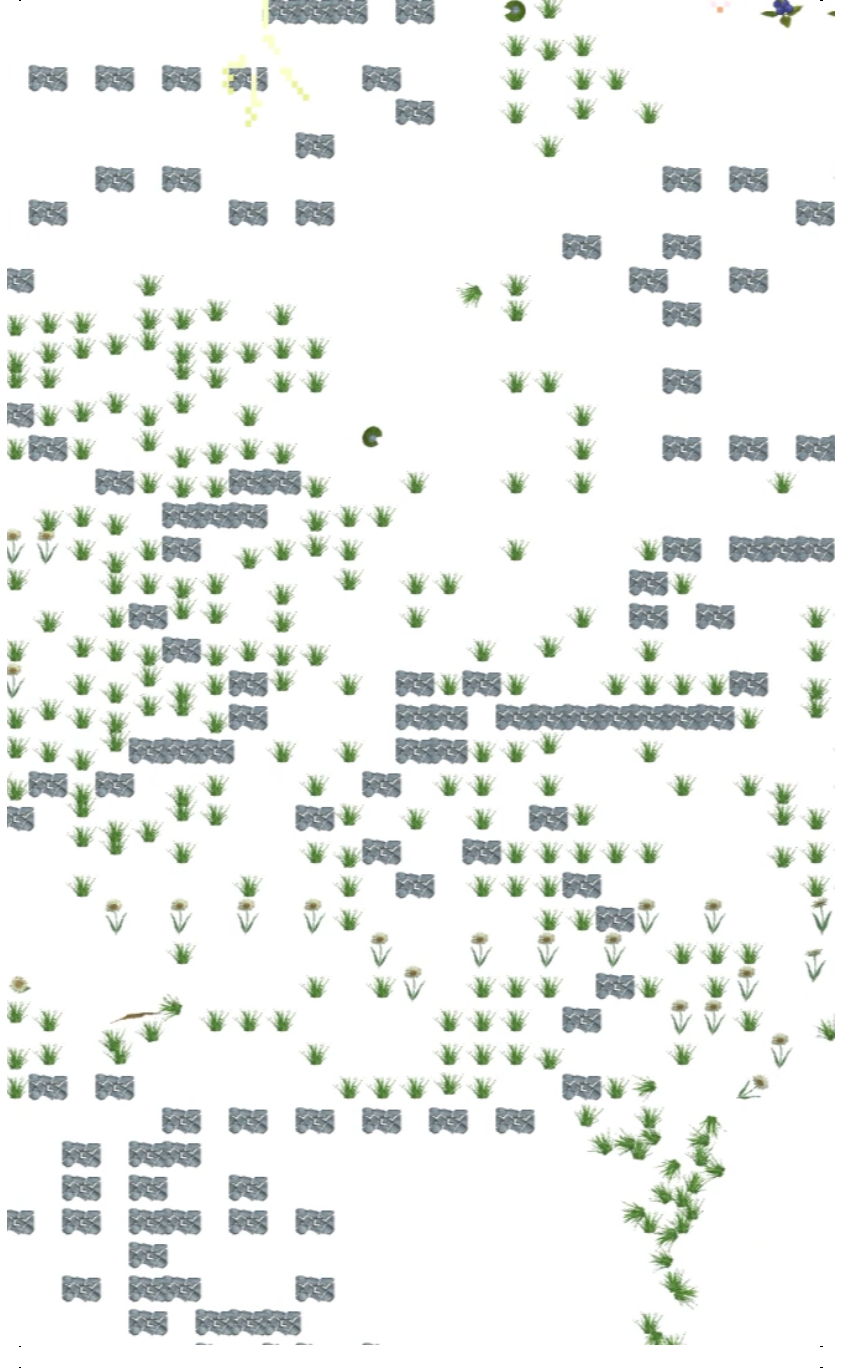


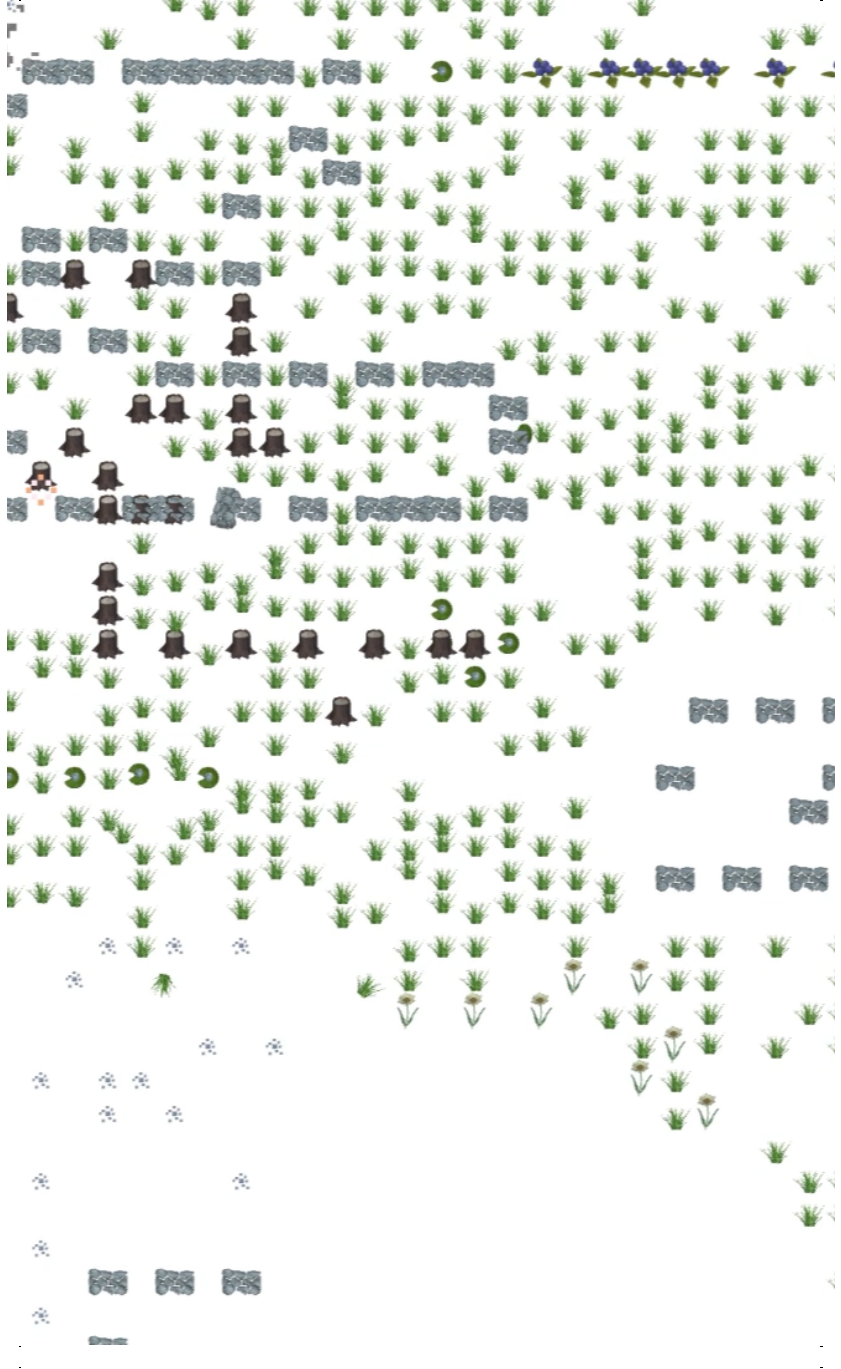


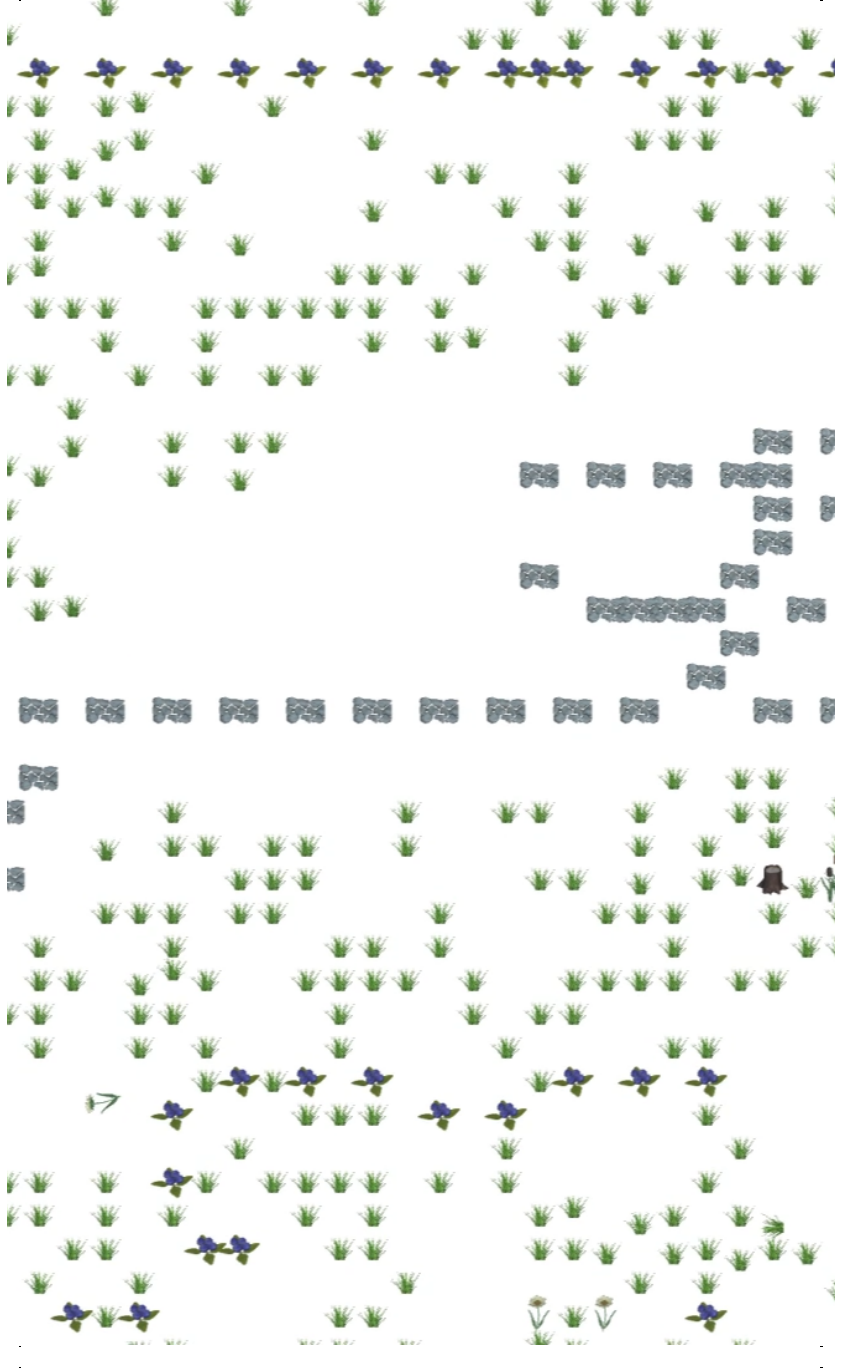


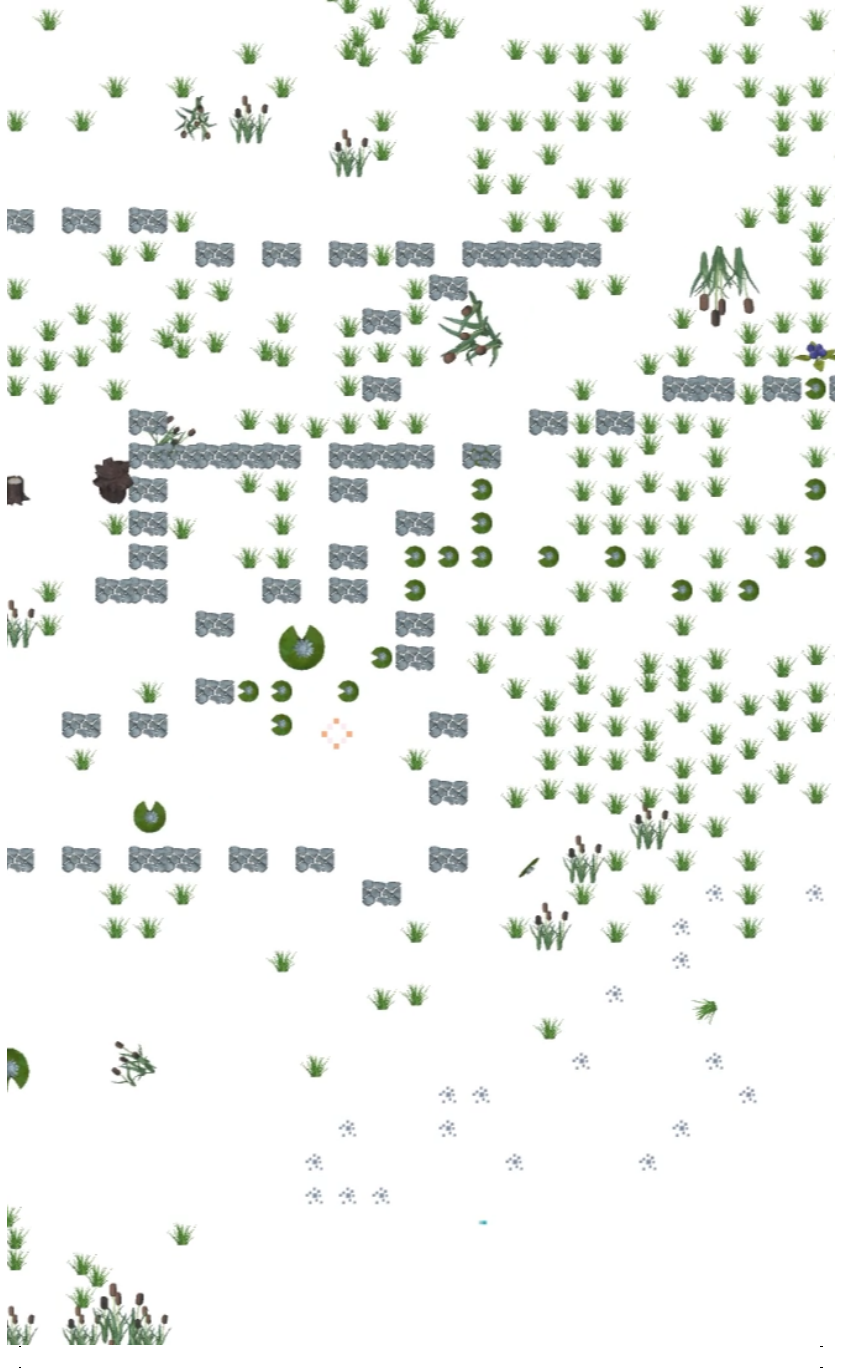


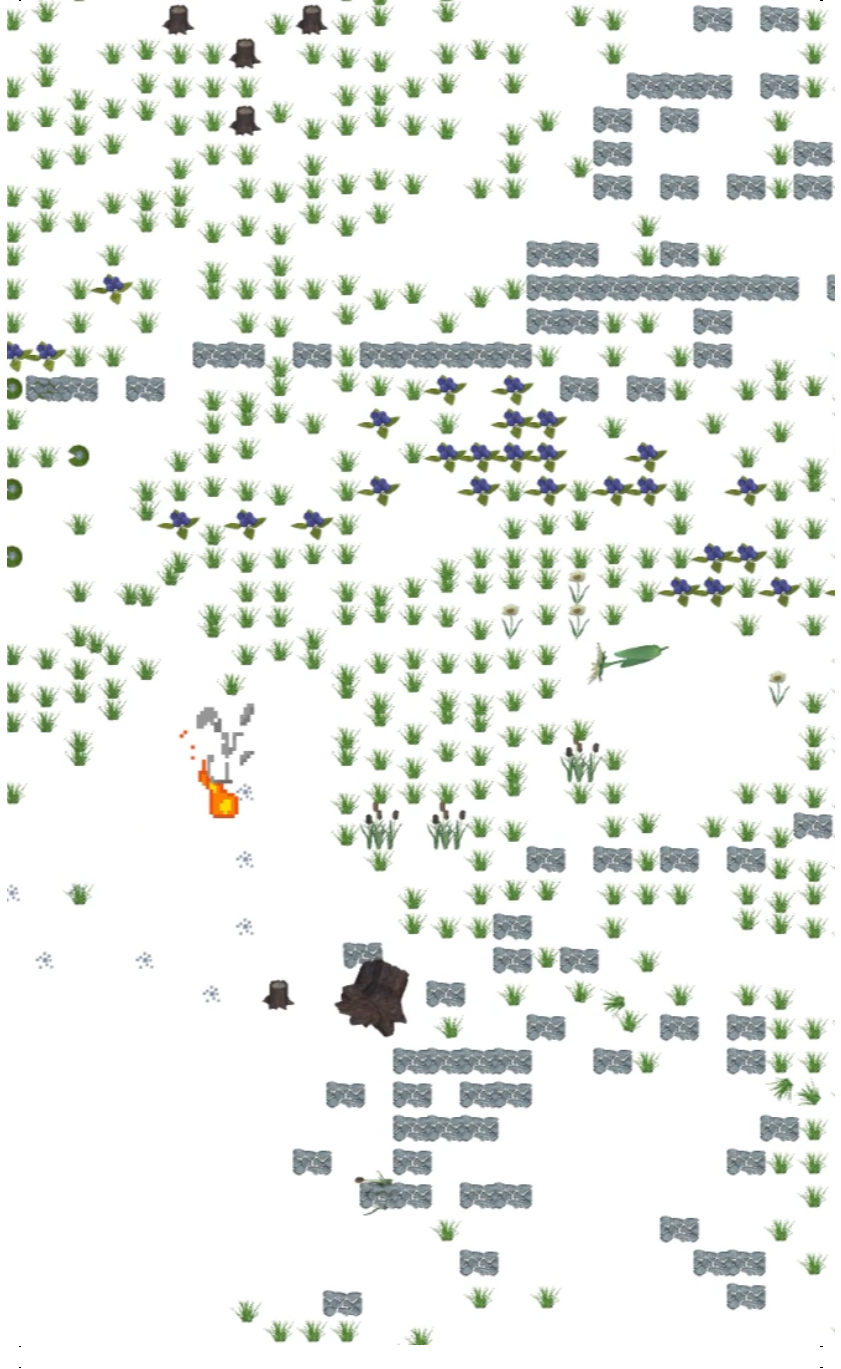


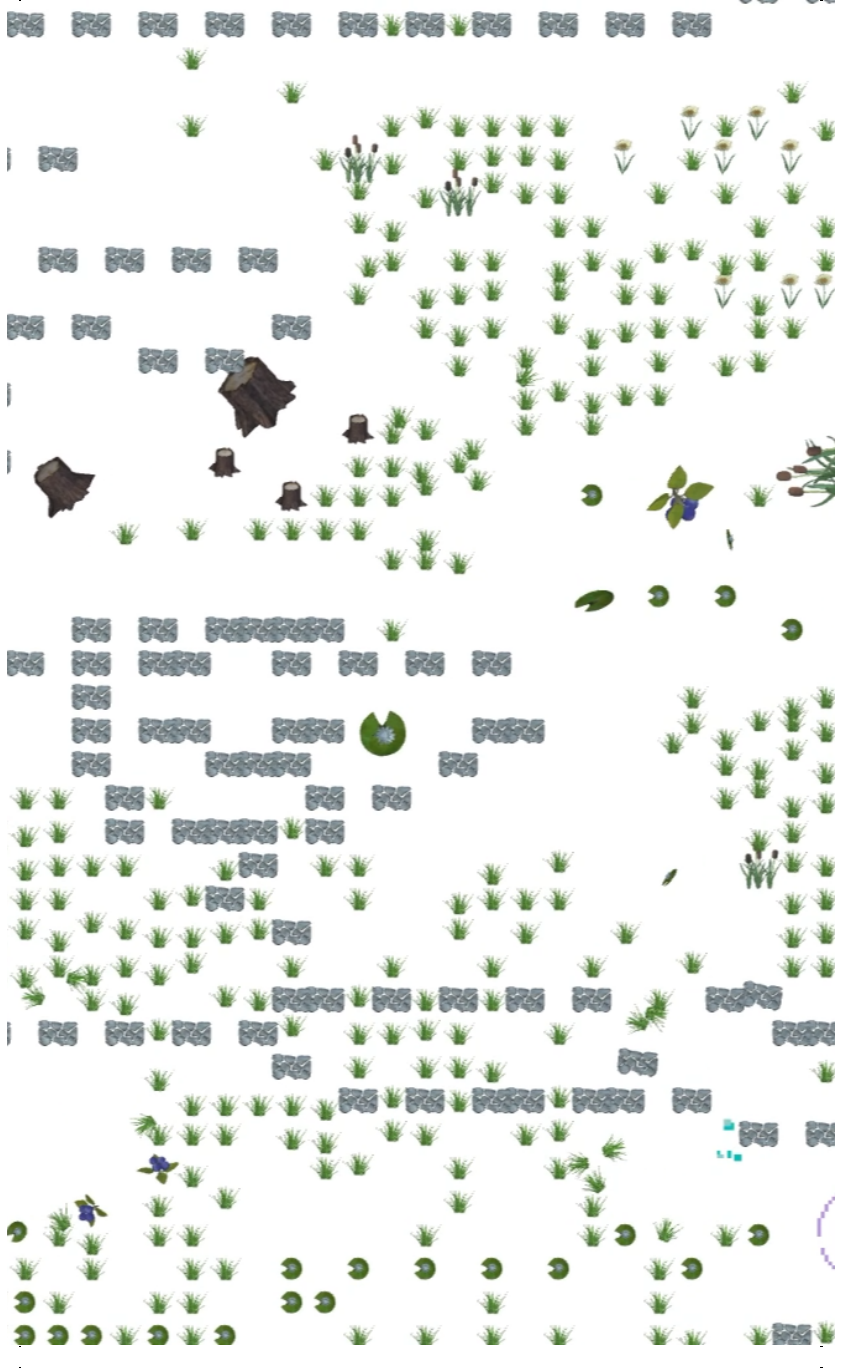


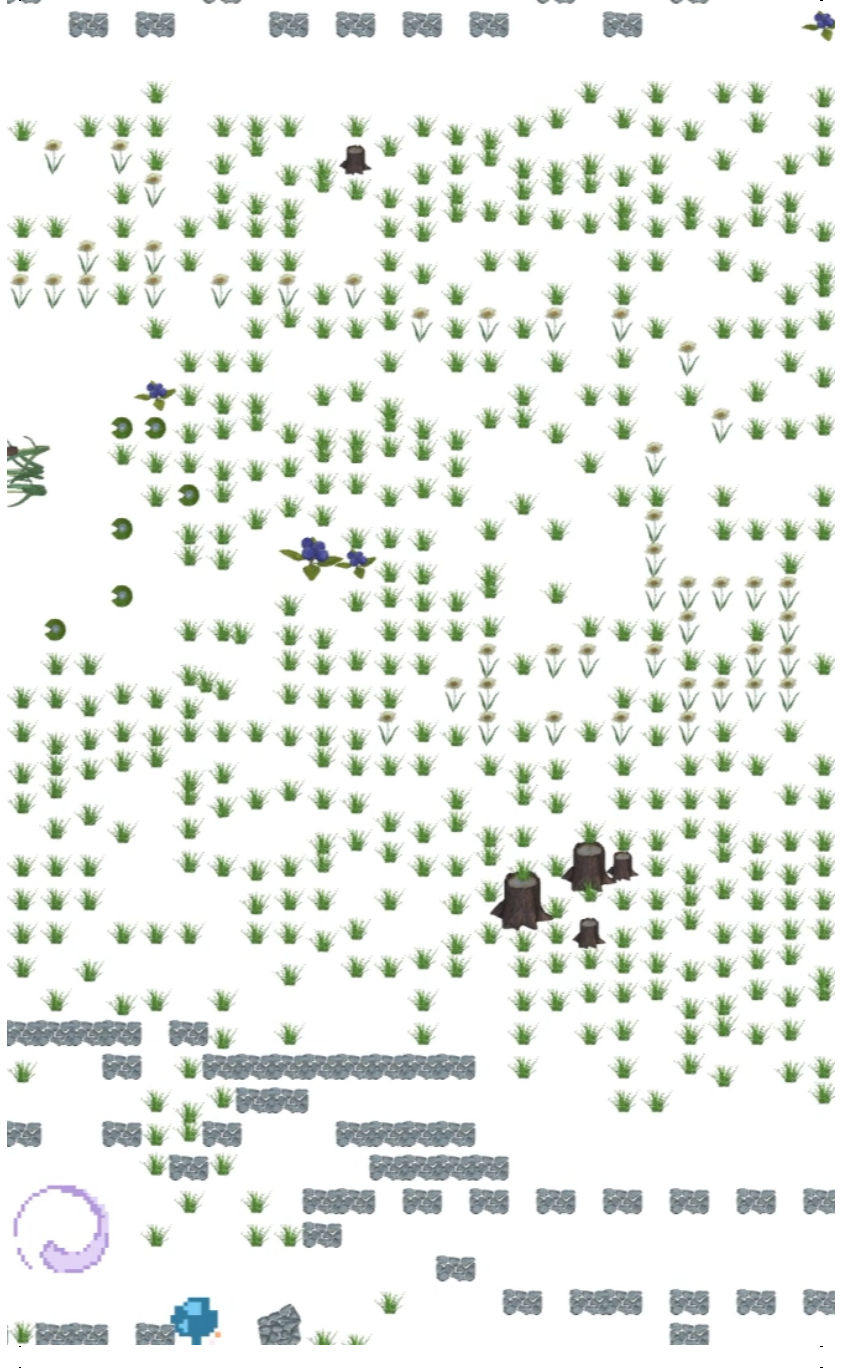


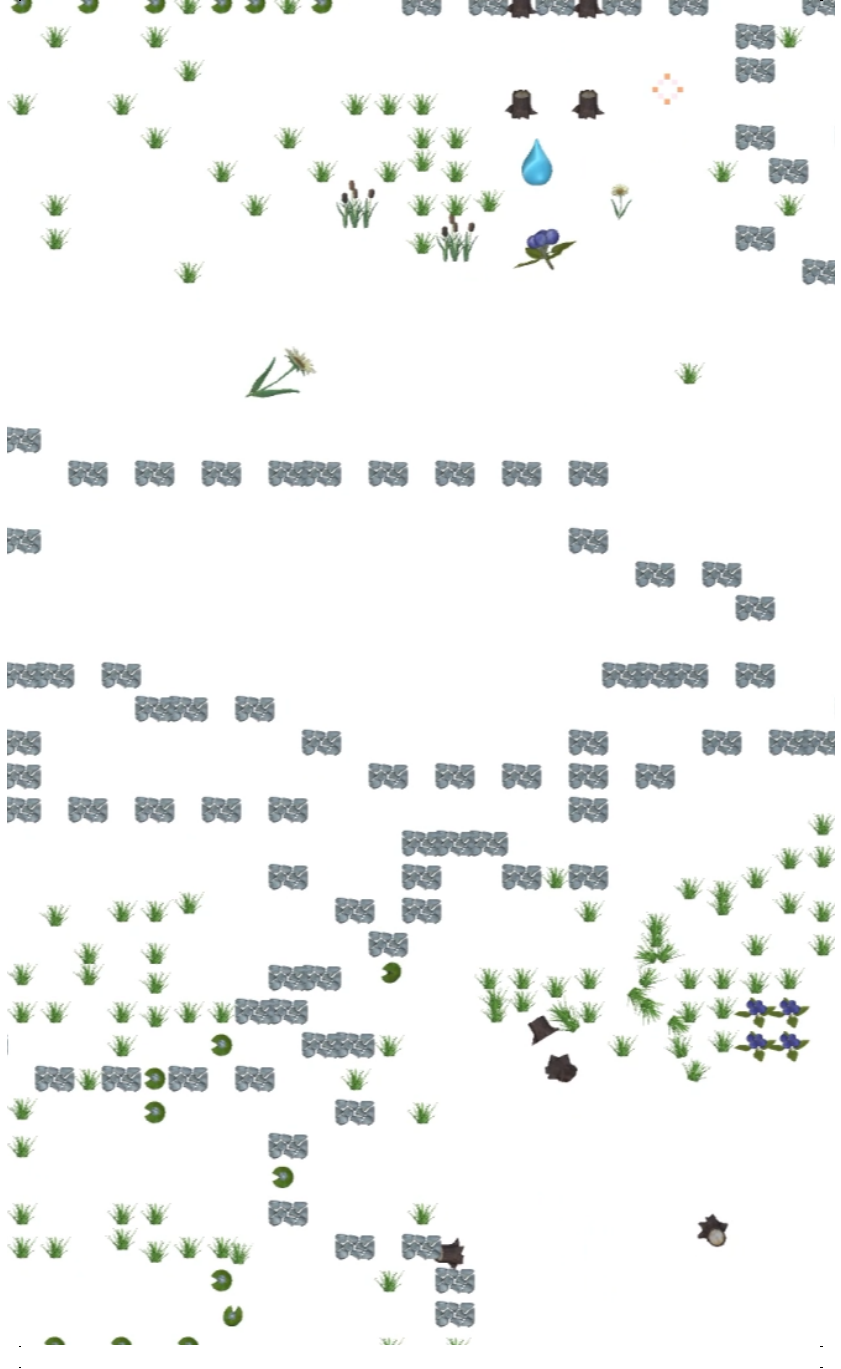


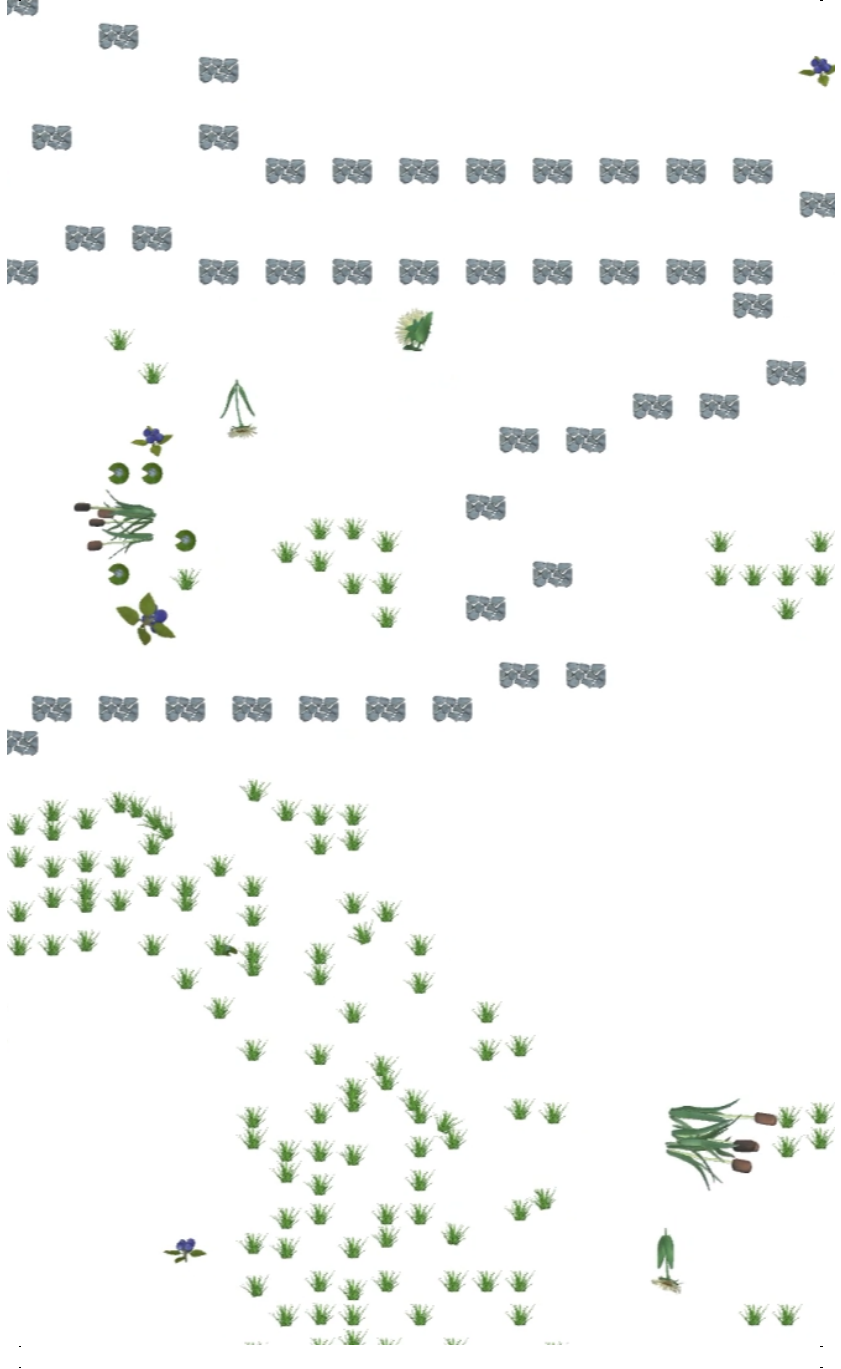












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