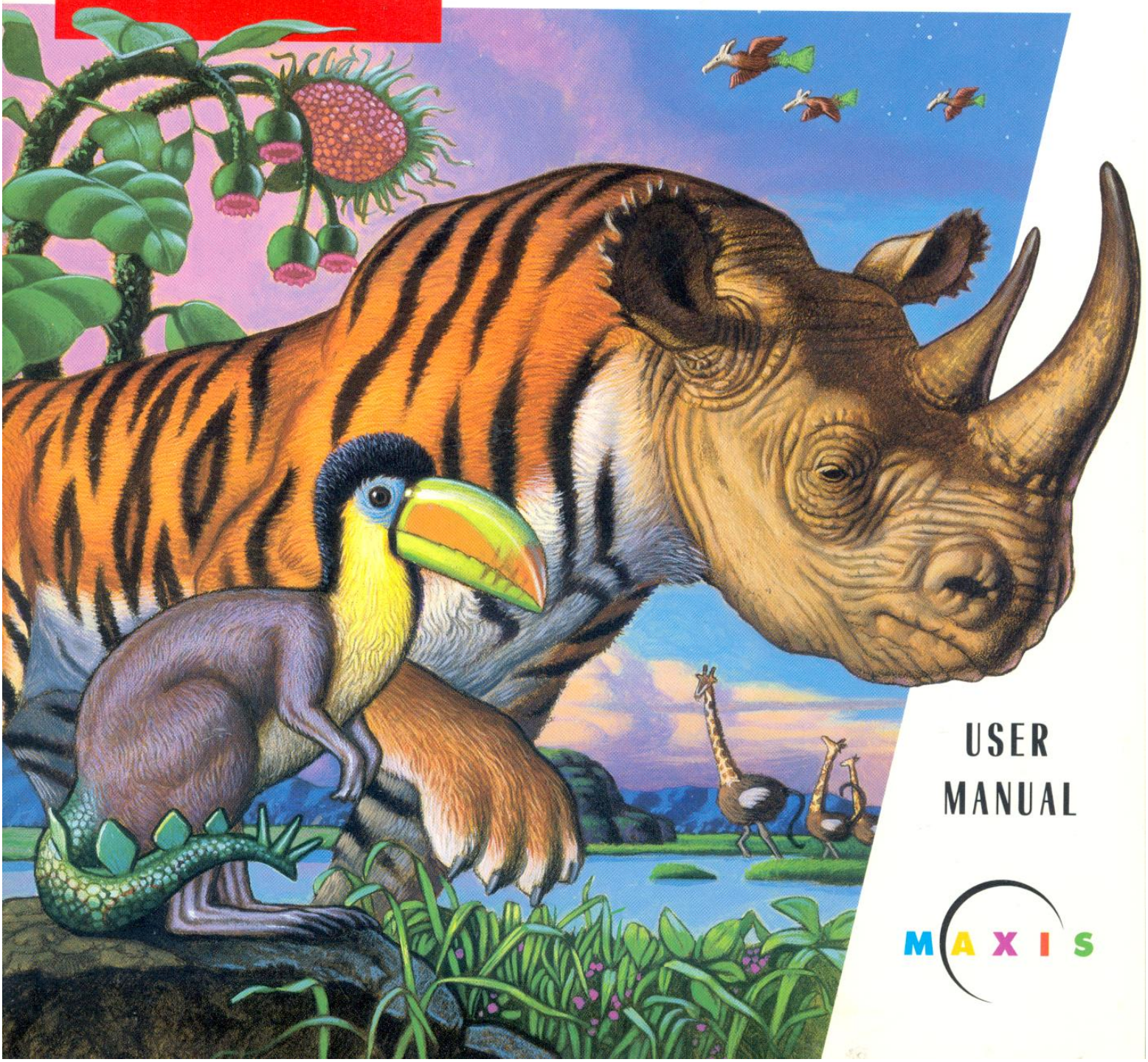
SIM LIFE™

THE GENETIC PLAYGROUND



USER MANUAL

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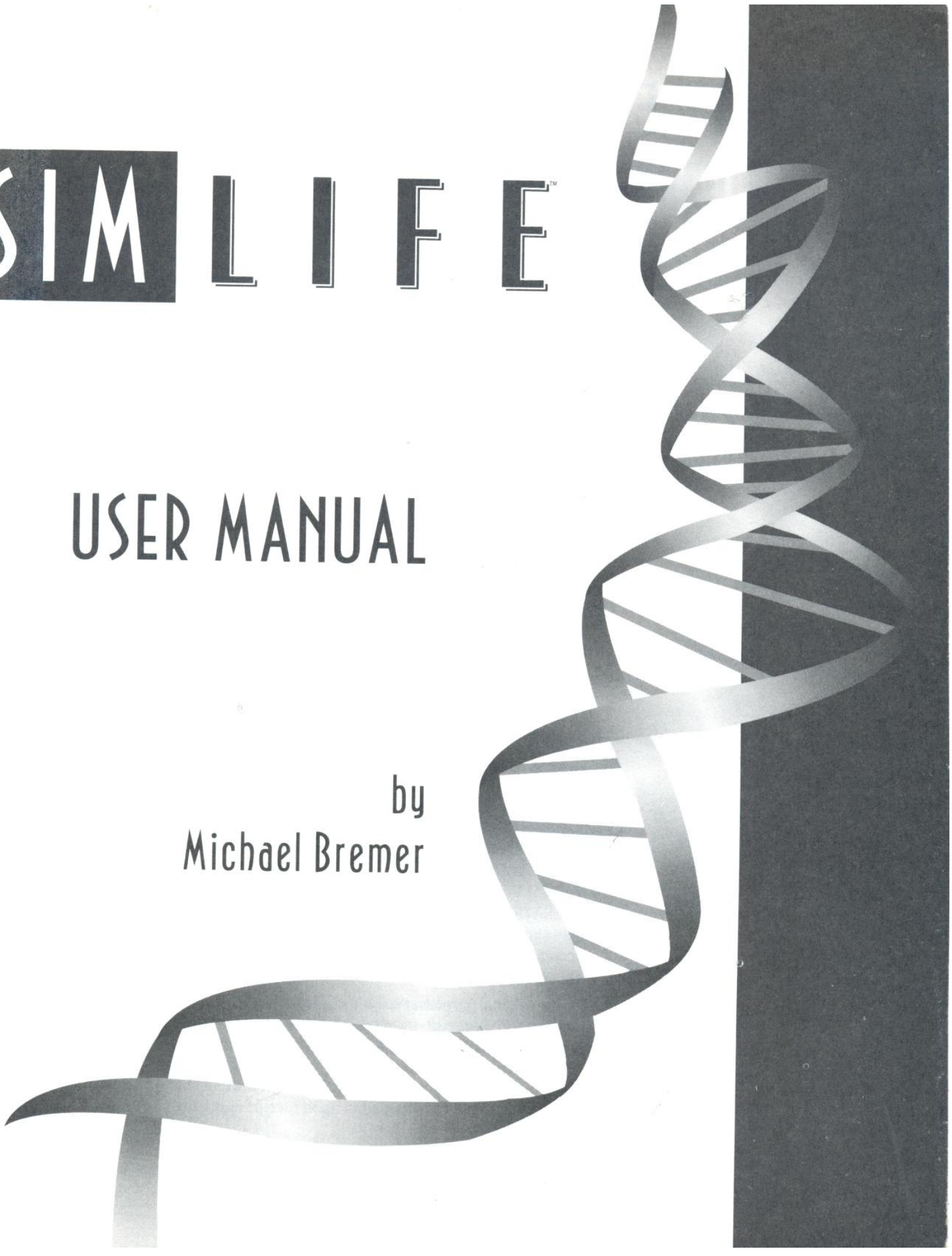
SIM LIFE™



USER MANUAL

by

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SIMLIFE

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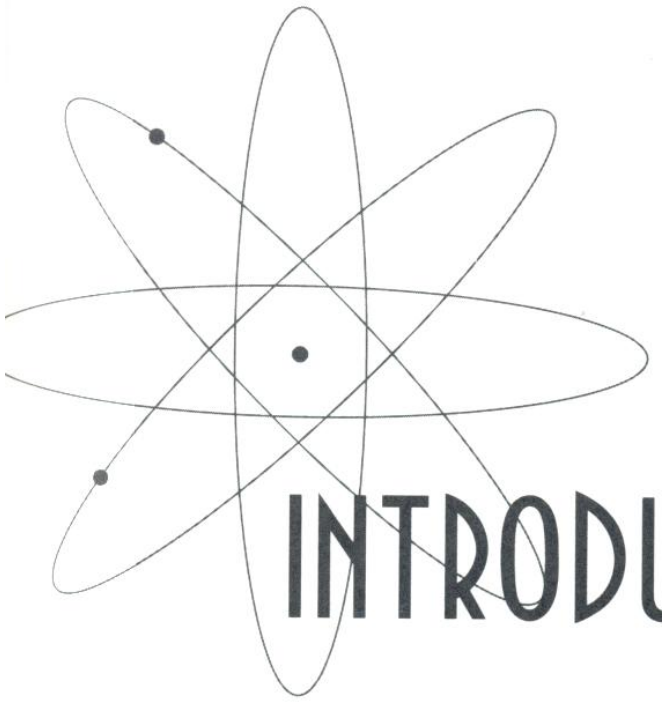
SIMLIFE

CONTENTS



INTRODUCTION

"Life! Don't talk to me about life."

— Marvin The Paranoid Android
from *The Hitchhiker's Guide to the Galaxy* by Douglas Adams

SIMLIFE

INTRODUCTION

WHAT IS SIMLIFE?

SimLife is an Artificial Life Laboratory/Playground designed to simulate environments, biology, evolution, ecosystems, and life.

It is a game, a toy and an experimental tool to learn about life, real *and* artificial.

As a game, SimLife challenges you to successfully solve the problems presented to you in each of six different scenarios.

As an experimental tool, SimLife gives you the power to:

- create and modify worlds;
- create and modify plants and animals at the genetic level;
- design environments and ecosystems;
- simulate and control evolution; and even
- change the physics of the universe.

A major feature and purpose of SimLife is that it is an exploration of the emerging computer field of Artificial Life.

YOUR REASONS TO (SIM)LIVE

The goals in playing SimLife are many, and, as with most Maxis products, are entirely up to you.

If you approach SimLife as a game, then your goals can be to win each of the scenarios. If you approach SimLife as a "laboratory in a computer," your goals are as limitless as your imagination. If you approach SimLife as a toy, you don't need goals; you can just play with plants, animals and ecosystems.

If you are interested in monitoring your personal progress or understanding of the ecological systems in SimLife, you can keep an eye on the Ecology Score in the Graphs Window. It displays an ongoing score of the ecological soundness of your ecosystem, which you can view as a rating of how well you are doing as master of life on your world. There is also an evaluation window that graphically shows how complex your ecosystem is, as well as assigning a score to your performance.

THE ULTIMATE GOAL?

Perhaps the greatest challenge of playing SimLife is to start from scratch and design and build a world with a sustainable ecosystem.

It's not an easy task, and once you do it you may realize just how fragile an ecosystem can be: how a small change in the environment or the extinction of a single species can cause a wave of destruction that destroys life up and down the food chain.

What can be considered the ultimate goal of SimLife is to look beyond the game, to understand that the real world with its millions of species with their combined billions of genes are all interrelated and carefully balanced in the food chain and the web of life, and that this balance can be upset. Once we realize this, maybe we'll treat our planet, our environment and life itself with the respect they deserve and need. OK. Enough heaviosity. Go play.

LEVELS OF PLAY

SimLife was designed to be played at different levels:

- On the simple game level of trying to solve the scenarios;
- On a simple experimental/play level of building your own worlds, animals, and ecosystems; and
- On a complex experimental level where you control (or meddle with) the laws of physics and manipulate plants and animals at the genetic level.

You can do these things in any of five difficulty levels, from beginner to expert.

SIMLIFE

SOFTWARE TOYS AND SYSTEM SIMULATIONS

SimLife isn't exactly a game — it's what we call a Software Toy. Toys, by definition, are more flexible and open-ended than games.

As an example, compare a game, tennis, with a toy, a ball. In every tennis game, there is one way to begin, one goal to pursue and one way to end. There are infinite variations in the middle, but they all start the same way, chase the same goal and end the same way. A ball is more flexible — there are more things you can do with it. With the ball, you can play tennis. You can play catch. You can throw it at someone. You can bounce it. You can make up a hundred different games using the ball. Besides games, there are other things you can do with a ball. You can paint it, use it to plug a leaky roof, or just contemplate its roundness.

In SimLife, the "toy" is a biology laboratory in a computer.

When you play with SimLife, or any of our other Software Toys®, don't limit yourself to trying to "win." Play with it. Experiment. Try new things. Just have fun.

There are many types of toys. SimLife, like *SimCity*®, *SimEarth*®, and *SimAnt*® before it, is a SYSTEM SIMULATION toy. In a system simulation, we provide you with a set of RULES and TOOLS that describe, create and control a system. In the case of SimLife, the system is an ecosystem. Part of the challenge of playing with a system simulation toy is to figure out how the system works and take control of it. As master of the system, you are free to use the Tools to create and control an unlimited number of systems (in this case, ecosystems) within the framework provided by the Rules.

In SimLife, the Rules to learn are based on biology and behavior, including:

Environment: All life is affected by its external environmental conditions, including the landscape, the climate, physical disasters and most importantly, other life-forms.

Genetics: Living beings are defined by the genes they carry and pass on to their offspring.

Evolution: Life changes in response to its environment; species adapt to their surroundings and evolve into new species.

Behavior: To survive individually and as a species, life-forms must find food and water, defend themselves from predators and reproduce.

The Food Chain: For an ecosystem to be stable, the food chain must be a complete circle; herbivores eat plants, carnivores eat herbivores, plants consume animal waste and rotted carcasses. The sun provides the energy to keep the cycle going.

Ecosystems: In addition to the cycling of material in the food chain, a stable ecosystem has to efficiently cycle oxygen, carbon dioxide, water and other important gasses and minerals between life, the atmosphere and the land.

The Tools provide you with the ability to design and build worlds and ecosystems:

- Create landforms with lakes, mountains, rivers and impassable barriers.
- Modify the climate: set temperature ranges, humidity, seasonal changes, and day-length variations with the Climate Lab.
- Mix and match pre-defined plants and animals, modify them at the genetic level, or create your own life-forms in the Biology Lab.
- Use mutagens to cause mutations and speed up evolution.
- Change the laws of physics: set the lengths of days and years, change the energy it takes to walk, swim, or fly.
- Track your data with graphs and charts that display population and genetic changes through time.

WHAT IS ARTIFICIAL LIFE?

But the most important Tool of all is the simulator itself. Test your knowledge, plans, theories and ideas as you watch your creatures and ecosystems thrive or die.

SimLife is an Artificial Life playshop/toolkit/workshop.

Artificial Life (A-life) is an emerging new field in computer science that is giving us a whole new way to study biology, evolution and life itself. Our Software Toys make use of A-life technology to simulate living systems that change and grow depending on the choices you make.

The idea behind A-life is to produce lifelike behavior on a computer (or other artificial media), where it can be studied in ways real living things cannot. A-life creates a laboratory in a computer, where the scientist can completely control all environmental factors—even time.

One of the most important features of A-life is *emergent behavior*—when complex behavior emerges from the combination of many individuals following simple rules. Two examples of emergent behavior are ant colonies in the real world, and *SimCity* in the computer world. In fact, biologic "life as we know it" can be considered a form of emergent behavior.

Another important aspect of A-life is *evolution*—artificial life-forms can react to their environment and grow, reproduce and evolve into more complex forms.

The future of A-life holds much potential and promise. It may someday go beyond the experimental world into the practical realm of design. The tools and techniques being developed now will someday allow us to grow or evolve designs for complex systems ranging from software to airplanes to intelligence.

In a sense, A-life has the same ultimate goal as Artificial Intelligence (AI), but uses opposite methods. AI uses a top-down approach to create a

thinking machine that emulates the human brain. A-life uses the bottom-up approach—start with single cells and grow/evolve life with intelligence.

ABOUT SIMLIFE DOCUMENTATION

There are five parts to the docs for SimLife: the manual, the machine-specific addendum, the lab book, the registration card and the President's letter/support info card.

The manual (that which you now hold in your hands) has:

- An Introduction chapter that gives you a little background on the game and a brief explanation of Artificial Life;
- A Getting Started chapter to get you up and running;
- A three-part Tutorial that gives you some background info, leads you through many of the windows and functions of the program and shows you how to set up, conduct and evaluate an experiment;
- A Reference section that gives more background information, complete descriptions of every menu, window, button and function, sample experiments to try and miscellaneous information on the simulation; and
- A Glossary, a Bibliography and an Index.

The machine-specific addendum gives you any special info you'll need for your particular computer, including loading, saving, printing, special menu items, and keyboard shortcuts. It also has any last-minute features that were too recent to make it into the manual. If you have any questions that aren't answered in the manual, check your machine-specific addendum.

The lab book goes along with the experiment in the tutorial to give you an example of one way to write up SimLife experiments. The lab book also has data sheets containing printed blanks of most of the windows that you can copy, draw in the data, and include in your own lab reports.

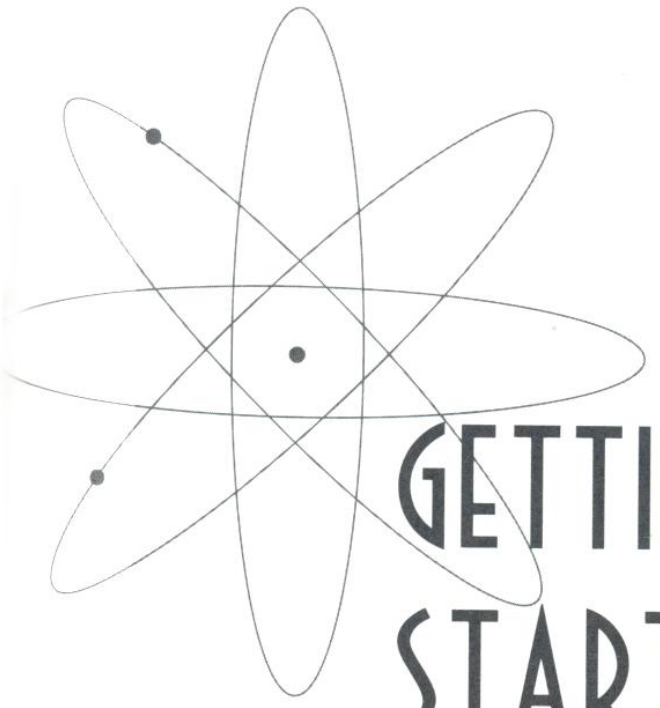
Sending in the registration card entitles you to free technical support, an extended warranty on SimLife and a whole bunch of other things. Read it, fill it out and send it in. You'll be glad you did.

The President's letter invites you to contact Maxis about any problems or suggestions you may have with or for SimLife. The support info (on the back of the President's letter) tells you how to contact us for customer service and technical support.

VARIOUS SIMLIFE VERSIONS AND MANUAL GRAPHICS

SimLife is (or soon will be) available on a number of different computer systems. We try to keep all the versions as close to each other as possible, while staying true to the individual interface differences of each machine.

The graphics for this manual are taken primarily from the Color Macintosh version of SimLife because it was ready first. On any other computer, there will be some *slight* differences in the look of the program. All the same features and functions will be there, but some things (like buttons) may be moved around a little. If your screen doesn't exactly match the graphics in the manual, check in the machine-specific addendum for a complete explanation of how SimLife has been customized for your computer.



GETTING STARTED

"All life is an experiment."

— Oliver Wendell Holmes

SIMLIFE

GETTING STARTED

INSTALLATION

On most computers, SimLife must be installed to a hard disk before it can be run. See your computer-specific addendum for installation instructions on your computer.

STARTING THE PROGRAM

Once again, see your computer-specific addendum for starting instructions.

ABOUT THE TUTORIALS

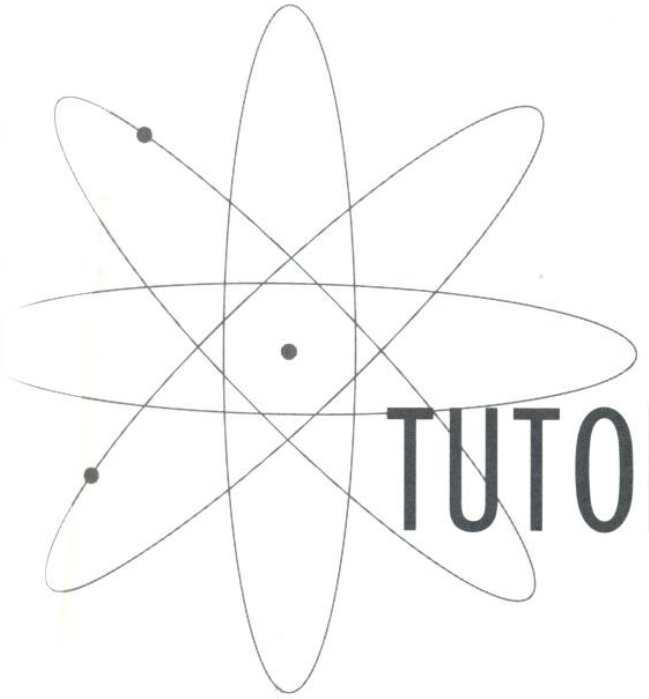
There is an on-screen tutorial built into SimLife. Once you start the program, you will see the New Game Window. Click on the button that says Tutorial, then click on Make It So. You will be taken on a quick tour through the basic features of SimLife.

In addition, there is a fairly extensive tutorial in this manual, written in three parts.

The first part gives some background information on SimLife, and on life itself. You may want to skim through this section before going on. Most of you will just jump right in and start messing around with the game. Enjoy yourself—the information will be here when you want it.

The second part is a tour of the major features, functions and windows. We won't be chasing any particular goal here, just playing around and getting familiar with many of the things you can do with SimLife.

The third part of the tutorial is the complete design, setup and execution of an experiment. We'll define the goals of the experiment, decide what kind of world and what kind of life would be best to reach the goals, and carry it out. Included in the SimLife package is a "lab book" that summarizes the steps in the experiment, and leaves room for recording data and conclusions.



TUTORIAL

"My boy, you are descended from a long line of determined, resourceful, microscopic tadpoles—champions every one."

— Kilgore Trout
from *Galápagos* by Kurt Vonnegut

SIMLIFE

TUTORIAL

This tutorial covers a lot of material fairly quickly. If you're not already somewhat familiar with SimLife, you'll probably want to run through the on-screen tutorial first. It can be started from the New Game Window. Or you may want to give the Before You Begin section below a quick once-over, then do the on-screen tutorial.

The graphics in this tutorial are from the color Macintosh version. The screens on your computer may vary a little. See your machine-specific addendum for more details.

BEFORE YOU BEGIN

Before playing SimLife, there are a few things you'll want to know.

WHO ARE YOU AND WHAT ARE YOU DOING HERE?

I hope you have many heads, because while playing SimLife you'll be wearing many hats. Depending on the scenario you play or the experiment you design, you can think of yourself as:

- a planetary game warden trying to protect and improve various ecosystems;
- a behavioral ecologist exploring the different ways plants and animals interact in their ecosystems;
- an evolutionary biologist trying to prove theories;
- Charles Darwin (only in his dreams);
- a being with amazing powers who creates worlds, populates them with plants and animals, and balances ecosystems for fun;
- an Artificial Life experimenter; and
- a normal human trying to play and win a pretty complex computer game.

What you are trying to do is:

- win each of the scenarios;
- stick your finger into an ecosystem, muck it up a bit and see what happens;
- simulate current ecological situations (and disasters) and try to recover before it's too late;
- build your own ecosystem from scratch;
- design and carry out any number of experiments that deal with plants, animals, genetics, evolution and ecosytems;
- casually observe the interactions between plants, animals and the environment over a long period of time; and
- have fun.

OF MICE AND KEYBOARDS

SimLife is much easier and more fun to play if you have a mouse. This tutorial and the manual in general assume you have one.

If you don't have a mouse, check in the computer-specific addendum for instructions on using menus and controlling windows, and for keyboard equivalents to terms like "clicking" and "dragging."

SIMPLICITY AND RICHNESS

SimLife deals with life and ecosystems in a very simplified way. Simplification serves a few purposes. If it were even 1/10th as complex as the world we live in, it would have taken us 100 years to make the program, it would cost you hundreds of thousands of dollars, and you'd need a computer the size of Baltimore to play it.

Because it is simple, time can be sped up and experiments that would take hundreds of years in real time can be performed in hours or minutes. Because it is simple, many external influences can be removed for experimental controls that cannot be removed in "real world" experiments.

SIMLIFE

SimLife, even while extremely simple compared to life as we live it, is a fairly deep game/simulation/toy. It has many interrelated features and functions that make it quite powerful and take a bit of thinking to master.

One of the most powerful features in SimLife is the ability to limit or ignore many of the features. Depending on the game or experiment you may require a large, rich, complex world with climatic changes, mountains and valleys, and a convoluted web of plants and animals preying on each other, or just a small spot of ground with no mountains, no weather changes and only one type of life.

Both the tutorial below and some of the scenarios will deal with some small, simple setups so you can play and explore right away without learning everything first, and gradually deal with more complex worlds and experiments.

BUTTONS AND MORE BUTTONS

This game has more buttons than all the bellies in China. It can be a little confusing at first, but follow the tutorial and you'll meet most of them one at a time. Then you can read the reference section of this manual (just kidding—I know nobody reads reference sections of manuals) to find out exactly what each and every button does. If all else fails and you can't decide which button to press, try eeny-meeny-miney-moe.

IT'S ABOUT TIME

Time in SimLife consists of Ticks, Days and Years. Each year is divided up into four seasons of equal length: summer, fall, winter and spring.

A tick is one simulation cycle. The actual length of a tick in real seconds depends on your computer's speed, the size of the world and the number of organisms in the world.

The number of ticks per day and days per year varies with the different scenarios and can be customized for different experiments. By adjusting ticks and days, you adjust the rate at which time passes. When a scenario or experiment deals with the behavior of one animal or one generation, then you will want time to go slowly so the animal has time to exhibit its

behavior. When a scenario or experiment deals with the genetic drift over many generations, then you will want time to pass quickly.

Here are a few things to keep in mind while working your way through the tutorial:

OTHER STUFF YOU SHOULD KNOW (SIMLIFE CONVENTIONS AND TERMINOLOGY)

MENUS

To play SimLife, you'll have to understand how to use menus. Many computers these days have menuing systems built into their operating systems, including Macintosh, Amiga and Windows-based computers. In these cases we follow all the standard menu-use conventions for your computer/operating system.

Check your machine-specific addendum for special menu details (if any) and for keyboard shortcuts for opening menus and selecting menu items.

DOWN-ARROW (TRIANGLE) BUTTONS

Whenever you see a button with a down-arrow, or triangle pointing down, it means you can click and hold on this button to open a pop-up menu of choices.



Clicking quickly on any down-arrow button will automatically reselect the last selection without opening the submenu.

SELECTED SPECIES

Within most windows, only one species will be "active" at a time. And when playing SimLife, you usually play with one species at a time, checking it out in one window, spreading it in another, and modifying it in yet another.

Reselecting the species each time you jump to another window would be a hassle, so in *most* windows, when you select a species, it becomes the default or Selected Species for *most* other windows. The Selected Species stays selected until you pick another one.

LOCAL SPECIES

Selecting a species in some windows does not make that species the "official" Selected Species. The lucky plant or animal you choose in these windows becomes the center of attention **for the current window only**—they are local stars. Since we need to call them something, these are called the Local Species.

Choosing or changing the Local Species in these windows does not change the Selected Species or Local Species in any other windows.

WHAT IS:

Warning: the following definitions are very short and simplified to give you just enough of a background to get started with SimLife. This is not a complete discussion of these topics, and they are dealt with primarily as they are used in SimLife, which is not a totally accurate representation of the real world. (In spite of this warning, I know I'll get some tersely reprimanding letters from biologists and other scientists for my casual treatment of these issues. I'm doing my best. So it's not perfect. So shoot me. I'll be taking notes for the upcoming manual for SimMartyr.)

LIFE

Defining life is not easy. (As if you'd believe me if I told you.) You'll get a different answer from everyone you ask and every book you read. But basically, life is a gene's way of making copies of itself.

Some definitions of life include the requirement that organisms be composed of one or more cells. Is this chauvinism? If cells can be considered "building blocks," can we stretch the definition of cell to include building blocks made of computer code as well as protoplasm? Is this a subject that is likely to keep philosophers and science fiction afficionados occupied for years to come?

For the purposes of playing with SimLife, we'll define life as anything that exhibits lifelike behavior, including: adaptive behavior, self-replication and the ability to extract order from the environment.

That's *what* life is. For answers to *why* it is or what it means, you'll have to look somewhere other than in a computer game.

SPECIES

A species is a group of related organisms or populations capable of interbreeding.

ENVIRONMENT

The environment, as used in SimLife, is the total external influence upon an organism. This includes the influences of climate, landscape, other life-forms and your computer. In fact, everything but the organism's genetic code.

ECOLOGY

Today, when most people hear the word *ecology,* they think of all the things that are going wrong, like pollution, endangered species and declining rainforests. But ecology, in our world as well as in SimLife, is also the "good stuff."

Ecology is the study of the interrelationships of organisms and their environment. All the interrelationships, both good and bad.

ECOSYSTEM

An ecosystem is the combination of the environment and the life in it functioning together as an ecological unit in nature (or in computer).

In SimLife, we will often refer to the world as an ecosystem, and use the words "world" and "ecosystem" interchangeably, since the SimLife world is such a small place compared to the world we live in. It is, however, possible to have two or more ecosystems running simultaneously in a SimLife world.

PLANTS AND ANIMALS

In SimLife, there are two basic types of life-forms: plants and animals, which roughly correspond to plants and animals in our world, but are, of course, much simplified.

All life wants to survive, individually and as a species. In order for an animal to survive as an individual, it must find food and eat without being eaten. To survive as a species, many of the individuals must also live long enough to find a mate and reproduce.

The process of an animal finding food while simultaneously avoiding becoming food is called *foraging*. Foraging includes defense from predators, and is 90% of animal behavior.

Finding a mate (in SimLife, at least) is almost a byproduct of foraging. Animals follow their foraging patterns looking for food and water and get distracted and sidetracked by the presence of the opposite sex.

Plants, as well as animals, have behavior. They aren't as active or as noisy as animals, but they have to absorb nourishment, reproduce and spread their seeds.

Plants don't have to forage for food; they get their nutrients from the soil, the atmosphere and the sun. In SimLife, areas with deeper soil have more nutrients for plants. Unlike animals, plants can't move around, but their seeds can.

As plants and animals die, they decompose and enrich the soil (increase the soil depth).

FOOD, FOOD CHAINS AND FOOD WEBS

Food

Food is anything that can be consumed by the life in SimLife. All the food that plants need is found in sunlight, air and soil. Food for animals is more varied and includes plants and plant products, other animals, filter food and Ultra-Food.

Plants

When animals eat plants, they don't necessarily eat all the plant, or enough of the plant to kill it. They can nibble the leaves and the plant can grow new ones. Animals can also eat seeds, fruit and nectar from plants.

Filter Food

Filter food is the microscopic and near-microscopic plants and animals in the water, air and soil that are eaten by filter food-eating animals. For example, some whales live on plankton, tiny plants and animals that live near the surface of the ocean.

Filter food is alive and needs nourishment, and often sunlight, so it concentrates at the surface of the water, and near shorelines both in and out of the water.

Other Animals

Animals can be predators and can eat other animals—if they can catch them.

Ultra-Food

The closest thing to Ultra-Food that occurs in our world is the supermarket, where you can walk in and get any and all the food you need. In SimLife, this food source looks like a shopping cart. It supplies an unlimited amount of whatever food an animal needs to any animal that approaches it.

Ultra-Food is a useful tool for helping new ecosystems get started and for miraculously saving the lives of starving animals.

Food Chains

A food chain is an arrangement of plants and animals in an ecosystem structured according to who eats whom. Usually with the eater shown above the eatee.

Plants and filter food are usually considered the bottom of the chain, with herbivores (animals that eat plants) in the middle and predatory carnivores (animals that eat other animals) at the top.

Food Webs

A food web is the combination of all the interacting food chains in an ecosystem.

GENETICS AND GENES

Genetics is the study of genes, the carriers of the genetic code that defines what we are and sets the limits of what we can become.

The genetic code of plants and animals in SimLife is much shorter and simpler than for organisms in our world. Whereas our genes are encoded and stored in a complex molecule called DNA, SimLife genes are encoded and stored in something like a database file.

While fewer and simpler, genes in SimLife are very powerful. One gene in a SimLife organism has the equivalent effect on that organism as hundreds or thousands of our genes have on us.

CHROMOSOMES

Chromosomes are long chains of genes. There can be many (thousands to millions) genes in a single chromosome. Different life-forms on earth have different amounts of chromosomes: Humans have 46, the fruit fly has 8, an onion has 16, a dog has 78 and a goldfish has 94.

In SimLife, each chromosome consists of a single gene.

GENOMES, PROTOTYPES, POPULATIONS AND GENE POOLS

Genomes

In SimLife, a genome is the set of all the genes in an individual organism. The genome will be different for each species and may vary from individual to individual within a species.

Prototype Genome

Every species in SimLife has a "prototype" genome. This is the original or master set of genes—the genetic starting point when a species is created. Through evolution, individuals will vary from the prototype genome. Over time, individuals may vary so much from the prototype that they would no longer be able to successfully mate with it, and by definition become another species.

Population

A population is a group of organisms from a single species.

Gene Pools

A species' gene pool is the total of all the genes in a population. It represents all the genetic possibilities currently being explored by that population.

A gene pool isn't an actual physical gathering of the genes—you don't take all the genes out of their organisms and mix 'em up in a big vat or pool. It's just a way to think of the information contained in a whole mess of genes at once, while they are spread out in their various organisms.

EVOLUTION

What most people think of as evolution—adaptation of plants and animals to changes in their environment, physical changes in plants and animals, survival of the fittest, and new species evolving from older ones—are not evolution, they are the *results* of evolution.

Evolution, simply put, is the constantly ongoing process of changes in the gene pool over time. Nothing more, nothing less. It is the combination of many minute genetic changes over a long period of time that produces the noticeable results mentioned above.

The mechanisms that bring about changes in the gene pool are natural selection, genetic drift, gene flow, mutation and recombination.

In SimLife, evolution can occur by all of these naturally occurring mechanisms, plus one more. In SimLife, you can directly look at an organism's genes and physically change them.

SPECIATION

Speciation is the process of one species evolving into another (or group of other) species. It usually occurs when populations of the same species become physically separated and are subject to different environmental pressures. Over a long period of time, the gene pools in the two populations drift apart and eventually the two populations cannot interbreed (even if physically brought back together), and they become two different species.

In SimLife, species will automatically change into new species as they diverge from the prototype (if you have AutoSpeciate turned on). These new species will retain the same icon and name—with the addition of the subname Version 2—until you change them.

You can also manually speciate—pick an individual and change it into another species.

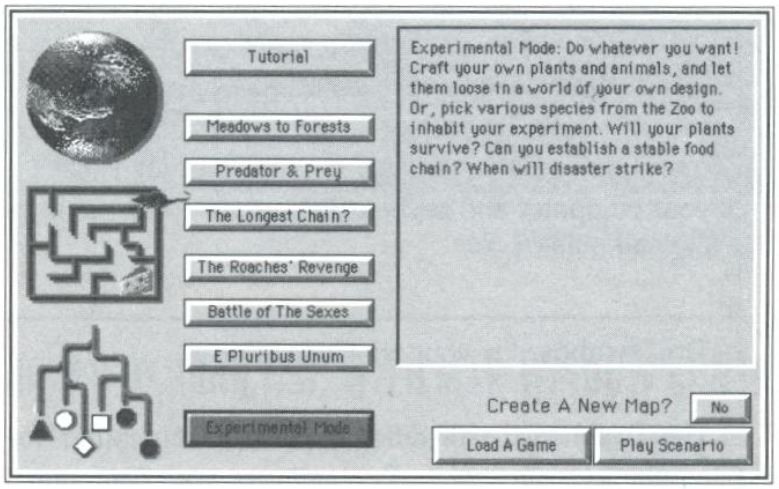
TAKE A TOUR OF YOUR COMPUTERIZED ECOSYSTEM

Make sure the game is installed properly, then start it up. See your machine-specific addendum for instructions.

This tutorial assumes that you have a mouse and know how to click, double-click, and click-and-drag. If you don't have a mouse and/or don't know how to do these things, see the manual that came with your computer, and the SimLife machine-specific addendum.

DECISIONS, DECISIONS

Once the game has started, you will immediately be faced with the New Game Window and a decision: picking a scenario to play.



Each of the six scenarios present a different gaming and learning challenge. You can also play SimLife in Experimental Mode and set up your own scenarios and experiments. In addition, this window can launch you into the on-screen tutorial. (If you haven't already been through it, now would be a fine time for it.)

Click on (and highlight) the names of each of the scenarios—*without* clicking on the Play Scenario button. Read the descriptions of each scenario as they appear in the big box in the upper-right corner of the window.

After you've looked them all over, click on Experimental Mode, then click on Play Scenario. We'll take a quick tour of the various menus and windows in SimLife, then build our own scenario.

AND ON THE MENU TONIGHT...

Take a moment and look at the Menu Bar. It will be at or near the top of the screen. As usual, these menus group similar types of commands together for easy access: all the file-related commands are in the File Menu and so on.

Click and hold on each of the menus and take a quick look at the commands. Slide the pointer (while still holding down the mouse button) down to the different menu items. Notice that some items bring up submenus. Look these over, too.

Check your machine-specific addendum for special menu details for your computer and keyboard shortcuts for opening menus and selecting menu items.

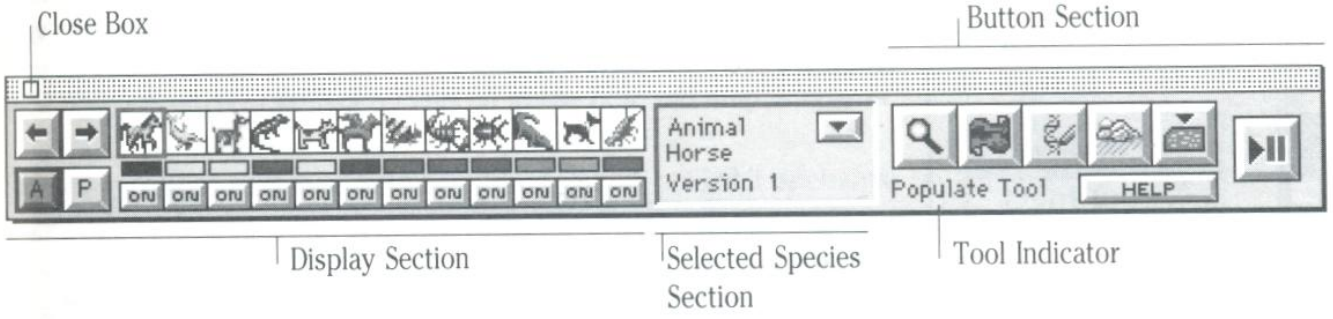
HOW DASHING!

The Dashboard is your control center.

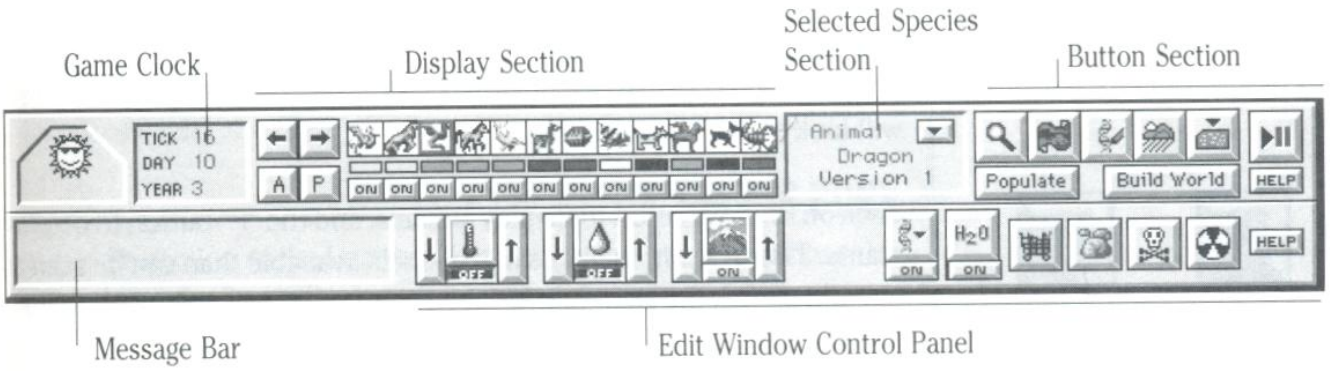
The Dashboard will differ more from computer to computer than anything else in SimLife. Depending on your computer, it may appear as either a separate moveable window at the bottom of the screen, or as a control bar at the top of the screen. It may or may not have the game clock included, and it may have some other slight variations.

In addition, in some versions (including DOS and Windows), the Map and Edit Window Control Panels appear at the top of the screen along with the Dashboard.

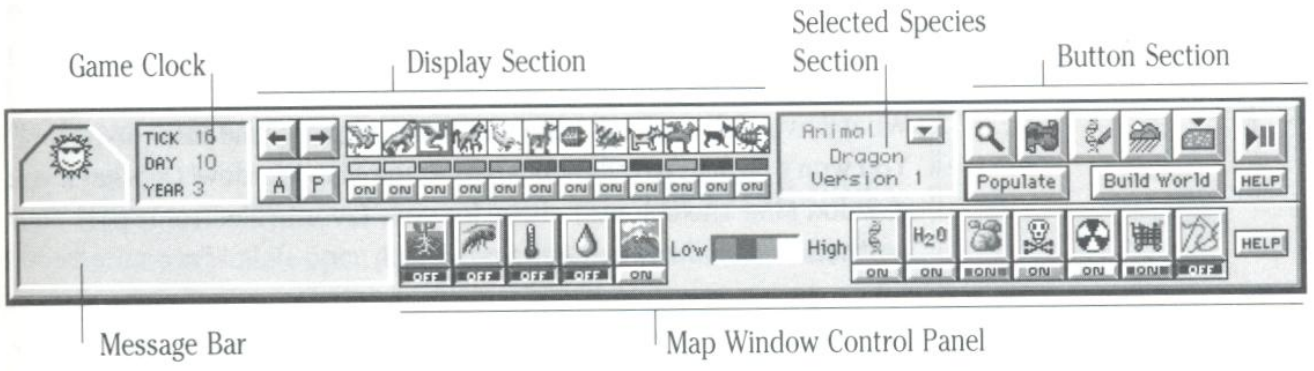
MACINTOSH DASHBOARD



DOS AND WINDOWS DASHBOARD, WITH EDIT WINDOW CONTROL PANEL



DOS AND WINDOWS DASHBOARD, WITH MAP WINDOW CONTROL PANEL



NOW YOU SEE IT...

The left side of the Dashboard has lots of buttons and pictures. These are for controlling which plants and animals are visible in the Edit and Map Windows.

A row of icons displays the different life-forms in SimLife, and how they will look in the Edit Window.

Click on the "A" button to display animals, and the "P" button to display plants. There are more plants and animals available than can be seen at one time. Click the right and left arrows to scroll through all of them.

There is a little rectangle below each icon. Depending on your monitor, the rectangle will be a color, a shade or a symbol. This rectangle shows what the organism will look like in the Map Window. (Since the Map Window covers such a big area, the life-forms look so small that they can't be shown as icons or pictures, so they show up as small colored dots on color monitors and little symbols on black and white monitors.)

What if two of the animals you want to use are the same color or symbol? You won't be able to tell them apart in the Map Window! Or what if you just don't like the color we chose for your favorite electronic pet? Your aesthetic sensibilities might be offended!

Never fear: you have the power to change the color/shade/pattern of any organism. Click and hold on any rectangle to reveal a submenu of all the available colors/shades/patterns. (This is a super-secret hidden feature,

so don't tell anybody about it. This information isn't in anyone else's manual, just yours. We think you're special.)

Below each rectangle is an On/Off button. Clicking these buttons toggles the display of each organism on and off in the Edit and Map Windows.

Turning a plant or animal off in the Dashboard does not kill it or change it or remove it from the game or disk. It only turns the organism invisible.

At the moment, other than the buttons changing from saying "on" to "off" and back again, nothing will happen since we haven't placed any of these life-forms in the world yet.

Why not see everything all the time? It can be confusing to have hundreds or thousands of animals running around on your screen. Sometimes it's easiest to remove all the clutter and just look at one plant or animal (or a couple of each) at a time.

A STAR IS BORN

The middle section of the Dashboard displays and lets you choose the "Selected Species," which is, at least for a while, the star of the show.

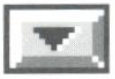
Often while playing with SimLife, you'll be concentrating on one species at a time, jumping from one window to another gathering information. If you select a species in one window, it is automatically selected for most of the other windows. This way you don't have to reselect the same organism every time you switch windows.

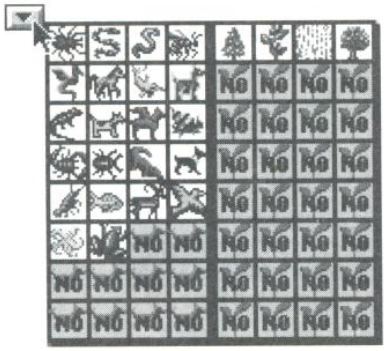
The Selected Species can be chosen in most windows. To select it in the Dashboard, read on.

GETTING DOWN

Some buttons in SimLife open pop-up menus when you click and hold on them.

These buttons are marked by a small down-arrow. The Dashboard has two of them, one near the middle, and one near the right side.





Depending on your computer, click or click and hold on the down-arrow button near the center of the Dashboard. You now see a menu of all the plants and animals in SimLife. To select an item, click on your choice or slide the cursor to it and let go.

The name of the new Selected Species will appear in the middle of the Dashboard, and its icon will be highlighted in the Display section to the left.

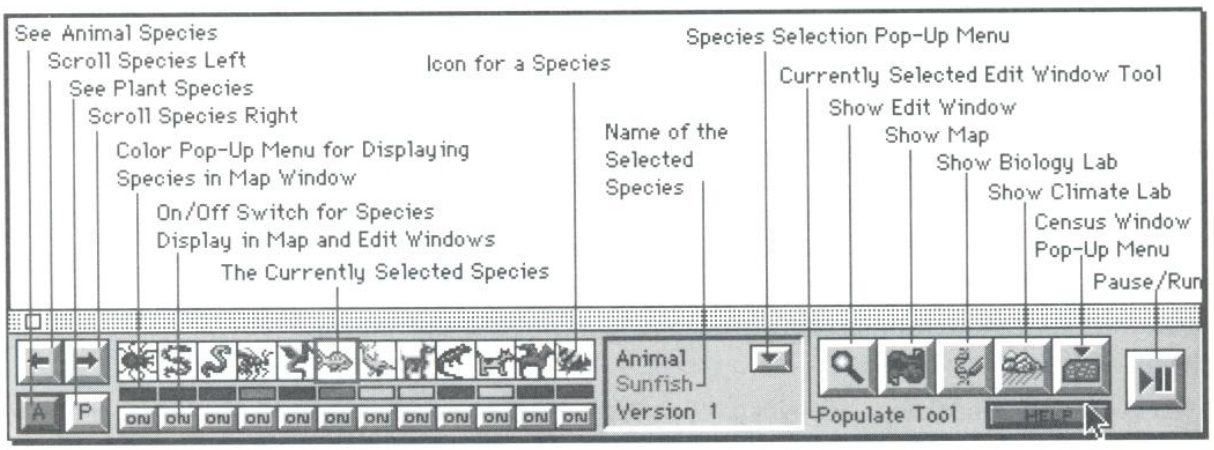
WITH A LITTLE HELP FROM MY BUTTONS

As you may have noticed, many of the windows in SimLife have a lot of buttons, including the Dashboard. To help you remember what all the buttons do, we give you yet another button.

Click and hold on the Help button. As long as you hold down the mouse button, you'll see a display of what every button in the Dashboard does.

Most windows in SimLife have these Help buttons, and they all work the same way. Use them any time you want a reminder of what does what.

Near the Help button are a couple of words. These words indicate the currently active tool in the Edit Window. We'll come back to this later.



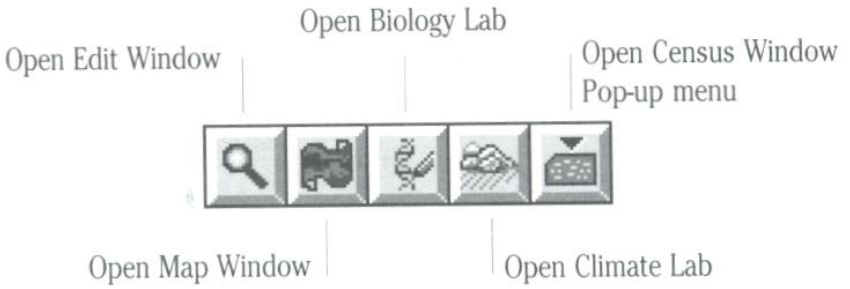
HOLD ON A MINUTE

The button on the far right of the Dashboard pauses the simulation. It works just like a pause button on a tape player. Click it to stop time. Click it again to start time.

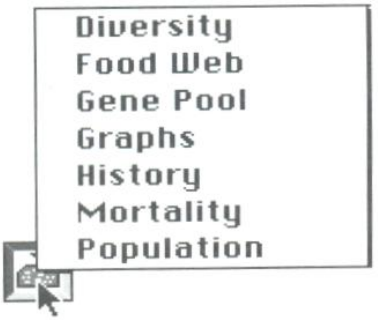
When you're done playing with it, leave the Pause off.

YOU *CAN* GET THERE FROM HERE

To the left of the Pause button are five window-opening buttons.



From left to right, these buttons open or activate the Edit Window, Map Window, Biology Lab, Climate Lab, and the many Census Windows.



Notice that the Census Windows button has the down-arrow—that famous down-arrow that means a pop-up menu is hidden under it.

Click and hold on the Census Windows button and look at the pop-up menu of all the Census Windows.

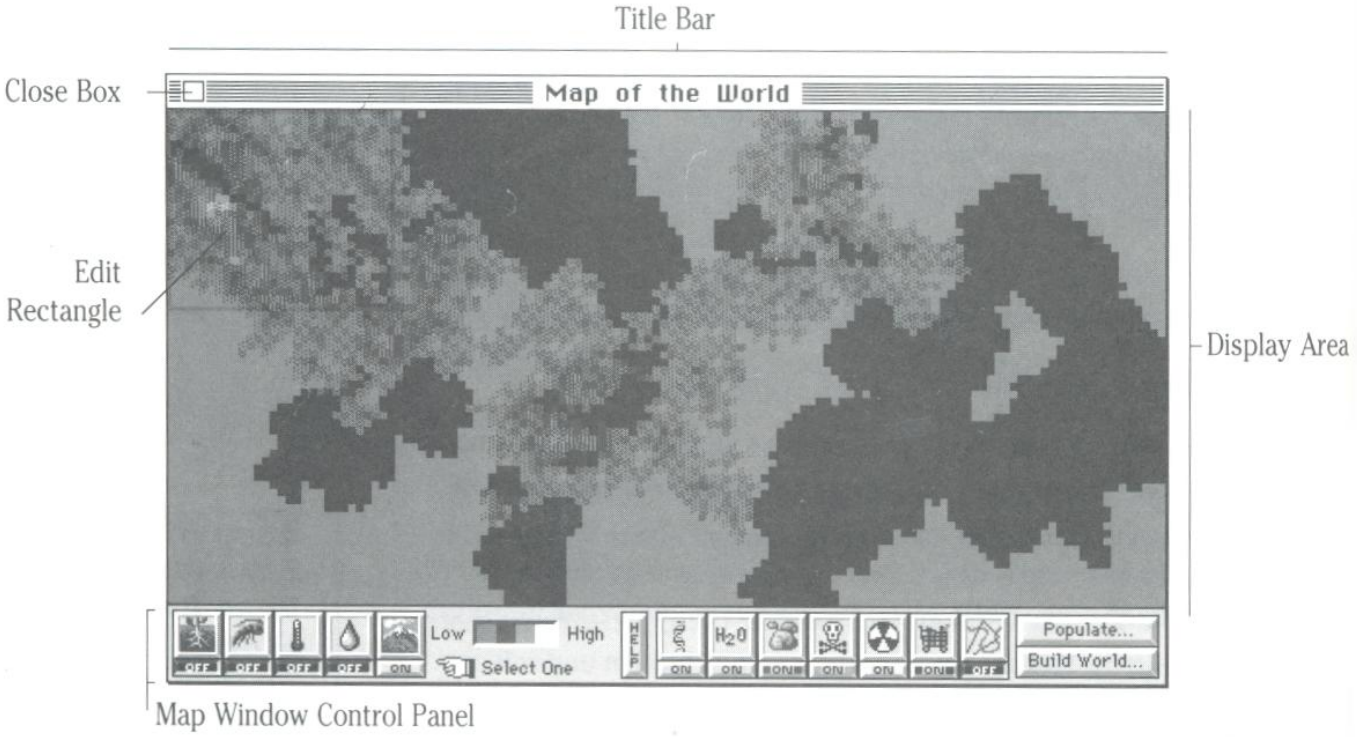
Take a minute or two and click on each of these buttons, open all the windows, including all the Census Windows, take a quick look at them and then close them. Except for the Edit Window, they can all be closed by clicking in the close box in the upper-left corner of the window. As the windows appear, you'll notice a couple things:

- The Dashboard always stays on top of any other window—even active ones.
- Only one Census Window can be displayed at once.

SIMLIFE

SEE THE WORLD

Once you've had a chance to glimpse each of the windows, take a closer look at the Map Window. You can open or activate it either by clicking on the Map Window button on the Dashboard or by selecting Map in the Windows menu.



This window shows you the entire world. If your screen is big enough, you can move the window around by clicking and dragging the title bar. You can close the Map Window by clicking in the Close Box in the upper-left corner.

The main portion of this window is the map of your world. Somewhere in the map is a rectangle—the Edit Rectangle. It outlines the part of the map that is visible in the Edit Window (a close-up view of parts of the world that we'll be looking at soon).

CONTROL THE WORLD

Note: as shown in this manual, the Map Window Control Panel is found at the bottom of the Map Window. On some computers, it will appear at the top of the screen, as part of the Dashboard. Don't worry, it's there somewhere. See your machine-specific addendum for details.

At the bottom of the window is the Map Window Control Panel. It controls what information is seen in the map.

In just about the middle of the Map Window Control Panel is a Help button. Click and hold on it to see an explanation of what all the other buttons do.

The five buttons on the left toggle on and off displays of multi-level data. Each of these displays a range of information, like Altitude low to high. Only one of these can be on at a time. Just to the right of these buttons is a color key to help interpret the multi-level information.

Go ahead and click on them. When you're done, leave the Altitude display on.

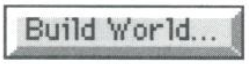
To the right of the Help button are seven buttons that toggle on and off displays of single-level information. Any or all or none of these can be on at the same time.

At this point, since the world is still very empty, the only button that will change anything in the display is the Water button. But go ahead and click on all of them if it makes you happy.

At the far right of the Map Window Control Panel are two buttons that open two more windows, one to build worlds and one to populate them.

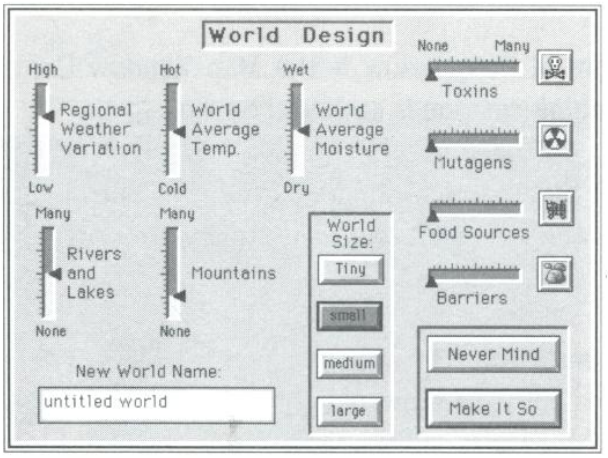
SIMLIFE

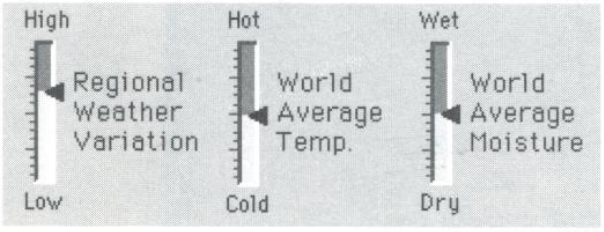
WORLD BUILDING 101



We will now design a world and build it. For this tutorial, any world will do, so go ahead and be rash in your upcoming decisions.

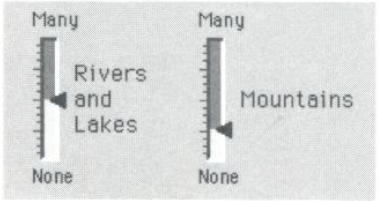
Click on the Build World button in the Map Window Control Panel to open the World Design Window.





The World Design Window has a number of sliders and buttons. Three of the sliders control the world's climate, controlling the average weather variation, average temperature and average moisture. (In SimLife, moisture includes both humidity and precipitation.)

Set these anywhere you want by clicking and sliding the arrows on each slider.

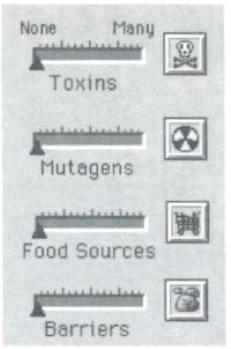


Next, set the sliders for the amount of rivers and lakes you want and for the number of mountains you want.

Over on the right are sliders that control how many artifacts will be spread around the world. In SimLife, artifacts are anything that can appear in the world that is not plant, animal, land, or water. The four artifacts are:

- **Toxins**—poisons that negatively affect the health of organisms;
- **Mutagens**—substances that increase the odds of mutation;

- **Food Sources**—this refers to Ultra-Food sources that supply any and all food that animals require; and
- **Barriers**—barricades that SimLife organisms cannot cross.

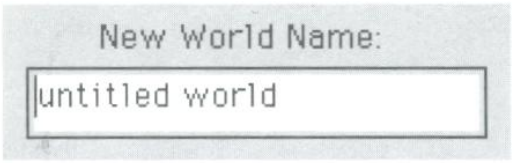


Set these four sliders anywhere you want.

Next, we'll pick a size for the world. There are four choices, each of which is best for different experiments. Keep in mind while choosing a world size that the larger the world, the longer it takes the computer to build it, and the slower the simulation will run.

Choose the world size you want. (I recommend small, but it's your world.)

Now you get to name the new world. Highlight the words below New World Name: and type in whatever you want.

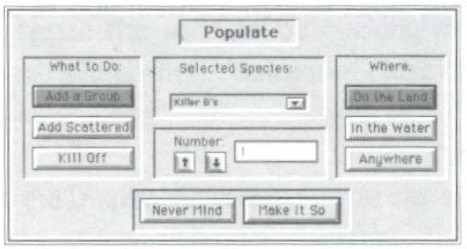


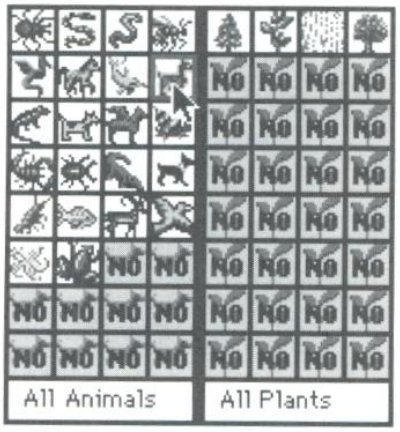
Now, click on the Make It So button, and the world will be built, layer by layer, before your very eyes. If a dialog box or requester asks if you want to save the current world, click No.

LIVE AND LET SIMLIVE

Now we have a world. A barren, desolate, lonely world. Nothing to do, no one to talk to. Time to get a life—or better yet, a whole lot of it. Click on the Populate... button in the Map Window.

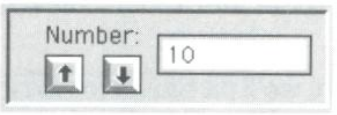
The Populate Window lets us add plants and animals to the world singly or in large groups.





Click or click and hold on the down-arrow button in the Species box. A submenu of all the available plants and animals—just like the one in the Dashboard—appears. Slide the cursor until the llama is highlighted, then either click or release the mouse button.

Now click on the up-arrow in the Number box until you reach 10 or 20.



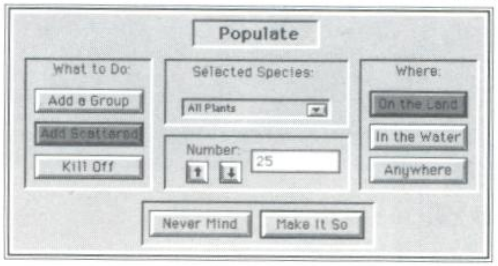
Click on the Add a Group button.

Click on the On the Land Button.

Now click on Make It So. Ten (or however many you wanted) llamas are now alive and kicking in the new world. Now we have ten lonely llamas.

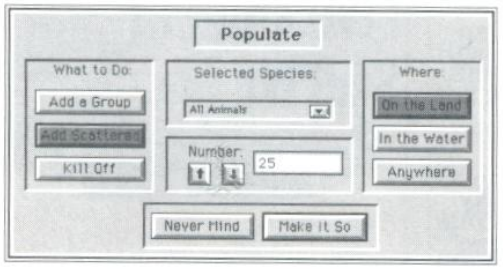
THE LIFE OF THE PARTY

Let's get this party moving and really put some life into it. Again, open the Populate Window by clicking on the Populate... button in the Map Window.



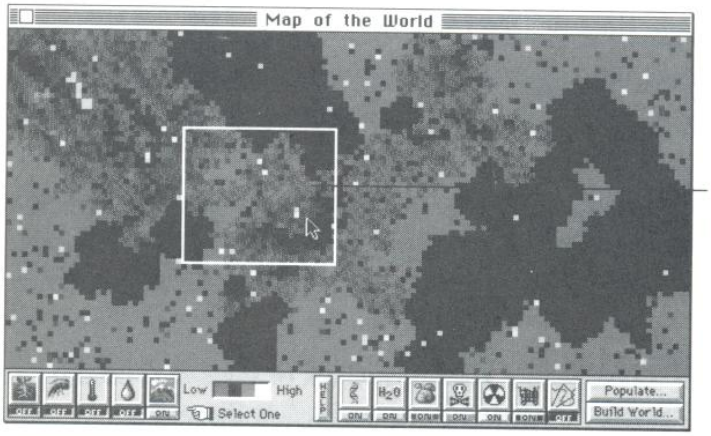
Click and hold in the Species box, then slide the cursor to All Plants. Set the Number box to 25. Click on Add Scattered. Click on On the Land, then click Make It So. Twenty-five of each plant species will be scattered all over the world.

Repeat the above process, but for Species, select All Animals.



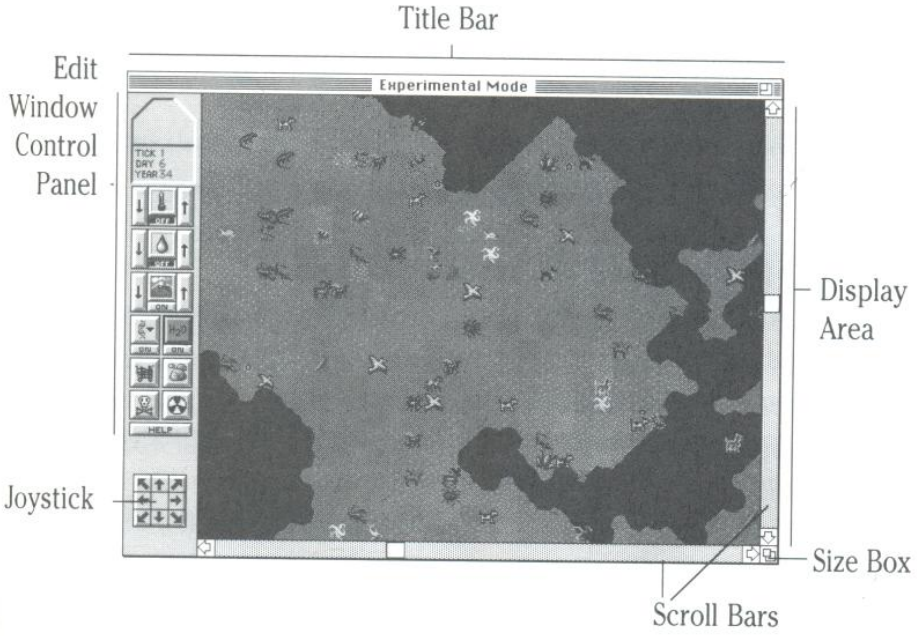
The world is now filled with life of all sorts. You can see the animals scurrying around in the Map Window, but let's take a closer look.

Find the Edit Rectangle in the map. Drag it to a part of the world you want to explore, then double-click in it.



LOOK CLOSELY

You are now in the Edit Window, ready for a close-up tour of the world.



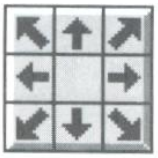
You can move the Edit Window around the screen by clicking and dragging the Title Bar. You can resize the window by clicking and dragging the Resize Box in the lower-right corner. You cannot close the Edit Window.

The main section of the window is the Display Area, where you can see various plants, animals and artifacts, as well as land and water.

THE DEAD SEA SCROLLS. SO DOES THE LAND.

Since the world is too large to show in the Edit Window all at once, you can scroll the window to show different parts of the map.

Depending on your computer, there are a few ways to scroll. Check with your machine-specific addendum for more information on scrolling with your computer.



There is a "joystick" for scrolling. Click or click and hold on any of the arrows to scroll the window in the arrow's direction.

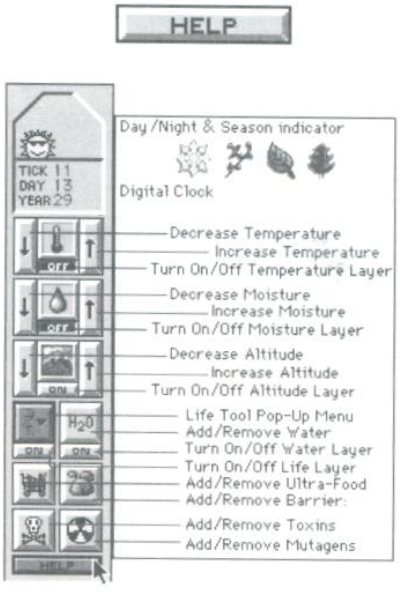
Note: On computers with small monitors the joystick will not be visible. Sorry.

In addition, if your Edit Window has Scroll Bars and Arrows, you can use them. If not, you can move the mouse to any edge or corner of the screen to scroll.

However you do it, scroll around and look the world over.

THE DISTINGUISHED PANEL

Note: as shown in this manual, the Edit Window Control Panel is found on the left side of the Edit Window. On some computers, it will appear at the top of the screen, as part of the Dashboard. See your machine-specific addendum for details.

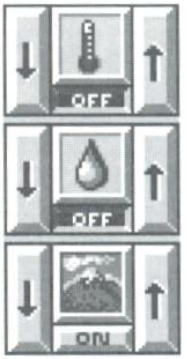


Along the left side of the Edit Window is the Edit Window Control Panel, filled with buttons and tools. Notice our old friend, the Help button. Click and hold on it to see a display of what everything does.

At the top of the panel is the clock. It graphically shows the passing of day, night and the seasons. It also gives the Tick, Day and Year. Ticks are the smallest unit of time in SimLife. A tick is the time it takes an animal to move one step and do one thing. The actual time a tick takes depends on your computer's speed, the size of the world and the number of plants and animals currently living.

Below the clock are a lot of buttons that activate the different Edit Window tools. The name of the active button is displayed in the Dashboard to the left of the Help button.

Immediately below the clock are three groups of buttons. These let you not only choose whether or not to display the simulation information on temperature, moisture and altitude, but let you adjust the settings.



Moving Up In The World

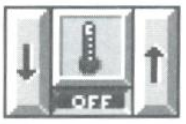
Click on the Altitude button. Notice that the land is all shown in one color/shade/pattern. The altitude data is not shown. Click on it again and the mountains and valleys come back.

Now click on the up-arrow button to the right of the Altitude button, then click and/or click and drag the cursor in the Display Area. A mountain rises from the land.

Click on the down-arrow button to the left of the Altitude button, then click and hold on the mountain. It settles back into the plains.

A Hot Time In The Old World Tonight

Now click on the Temperature button. A display of the temperature data is added to the Display Area using colors or shades, depending on your computer. A key to interpreting the colors/shades can be found in the Map Window Control Panel, when the multi-level temperature display is on. If you can arrange your screen so the Map Window Control Panel shows below the Edit Window, it will make it easier to see the key.



Click on the up-arrow button to the right of the Temperature button, then click and/or click and drag the cursor in the Display Area. The temperature rises.

Click on the down-arrow button to the left of the Temperature button, then click and hold in the Display Area. The temperature lowers.

The Moisture buttons work the same way.

Turn the temperature display off.

Just The Artifacts, Ma'am

Now look at the four buttons just above the Help button. These let you place or remove Artifacts.

Click on the Food Source button (the one that looks like a shopping cart). Now click or click and drag in the Display Area. You've placed Ultra-Food (a universal, unlimited food source) for your animals. To remove the sources, just click on them.

The other artifact buttons let you place and remove barriers, toxins and mutagens in the same way.

Water You Doing?

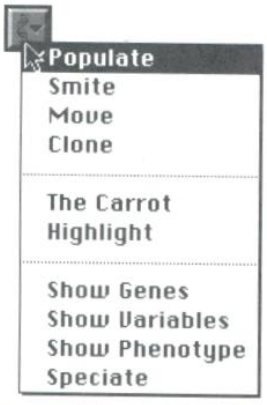
Just above the Barriers button is the Water button. Click on the little On/Off button below it to toggle the display of water on and off. Turning it off doesn't make the water go away, it just makes it invisible.

Make sure the display of water in set to On. Click on the Water button, then click or click and drag the cursor in the display area to make water. If you click or click and drag on water, it will turn back into land.

This Is The Life (button)

We've saved the most powerful button for last. The Life button does a lot of different things, all related to adding, removing, displaying and modifying life.

> *Note: In any of the steps below, if you find it difficult when asked to click on animals while they are moving, pause the simulation by clicking on the Pause button in the Dashboard.*

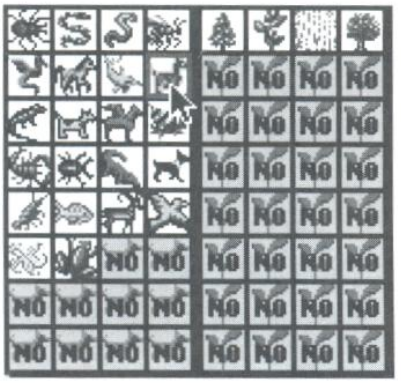


Click on the little On/Off button below it to toggle the display of life on and off. Turning life off doesn't make the life go away, it just makes it invisible.

To choose what you want the Life button to do, click and hold on it. A submenu of all the button's functions will appear. Then slide the cursor to your choice and release the mouse button.

Pop—You Late!

The default setting for the Life button is Populate, which adds life to the world. The species to be added can be set in the Dashboard (the Selected Species).



Go to the Dashboard and select LLucia's Llama as the Selected Species. Then go back to the Edit Window, click and hold on the Life button, and select Populate. Now click in the Display Area to add llamas.

I Smite And I Smite Not

Click and hold the Life button and select Smite. Click on any living thing in the Display area, and it will die. Use this judiciously.

Get A Move On

Click and hold the Life button, and select Move. Now click and drag any living thing to move it to another location.

Send In The Clones

Click and hold the Life button, and select Clone. Now click and drag any living thing to another location. Instead of moving the original organism, Clone makes a duplicate organism and places it where you release the mouse button.

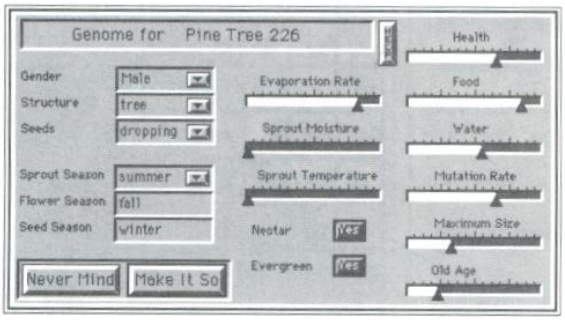
If you hold down the Option key—or Control key if your keyboard has no Option key—while cloning, the clone will be mutated in some random way.

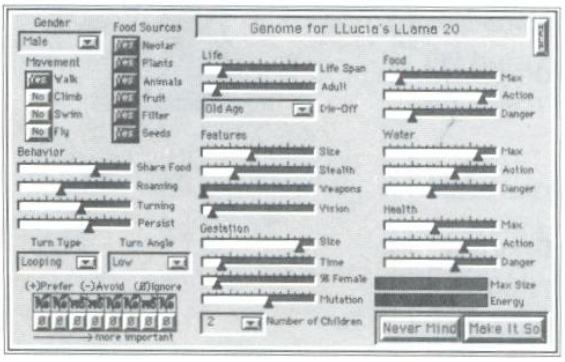
Highlite The Low Life

Click and hold the Life button, and select Highlight. Now click on an animal to highlight it. Open the Simulation Menu, open the Goodies submenu, and select Auto Tracking. Now the Edit Window will automatically scroll to keep your highlighted animal showing. The animal will stay highlighted until it dies or you highlight something else.

I Don't Carrot All For This

Click and hold the Life button, and select The Carrot. Now click and hold somewhere in the Display Area. All the members of the Species you highlighted will flock to the cursor.





Pull Down Your Genes

Click and hold the Life button, and select Show Genes. Click on any plant. The Genome Window with the complete genetic code for the plant will appear. We'll play more with the Genome Window later. For now, click on Never Mind.

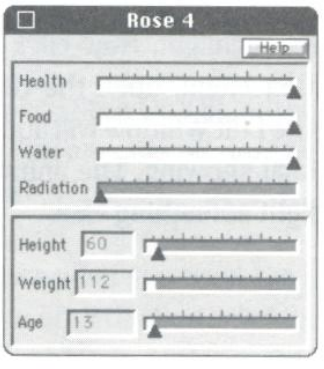
Now, with the Life button still set to Show Genes, click on an animal. The Genome Window with the complete genetic code for the animal will appear. Notice that animals have a more complex genetic code.

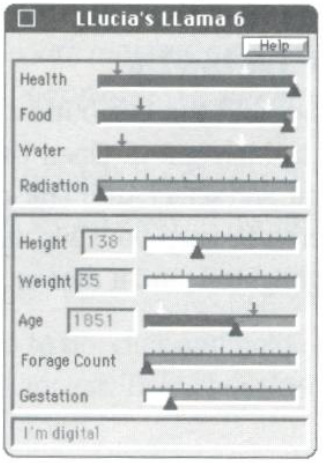
Click on Never Mind.

Let's Get Personal

Click and hold the Life button, and select Show Variables, then click on a plant. This brings up the Variables Window, which gives the current status of the plant you clicked on. The Variables are all the information the simulation has about an organism that isn't in its genetic code, like age and size.

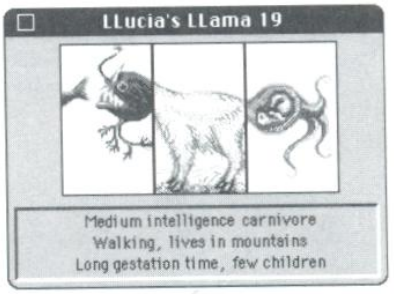
Click in the Close Box to close the Variables Window. Repeat the process for an animal.





Let Me Look At You

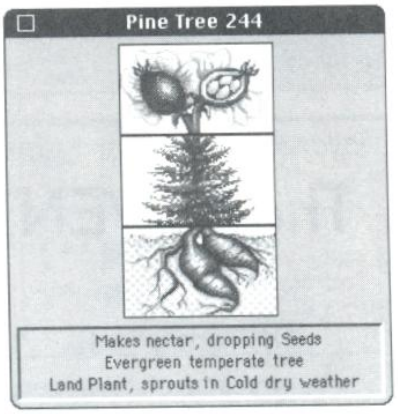
Click and hold the Life button, and select Show Phenotype, then click on an animal.



This opens the Phenotype Window for the animal you clicked on, which is sort of a close-up view of the animal—and sort of isn't.

This picture isn't really what the animal looks like. It's a compilation picture made out of parts of animals that we are all familiar with, to give us some idea of how the animal fits into its environment.

From the picture, you should be able to tell what the animal eats, how it moves, where it lives, and how many young it has at a time.



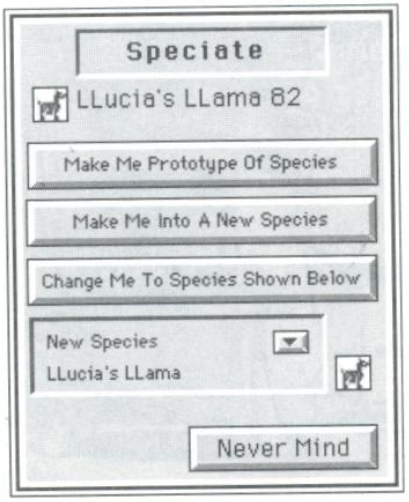
These compilation pictures are the flash cards used in the Biology Lab for designing plants and animals.

Click in the Close Box to close the Phenotype Window. Repeat the process for a plant.

Let's Split

Click and hold the Life button, and select Speciate. Now click on any plant or animal. The Speciate Window opens.

Among other things, you can use this window to change the organism into another species, or a new species. For complete details, see the Reference section below.



Click on Never Mind to make this window go away.

SIMLIFE

A HISTORICAL EVENT

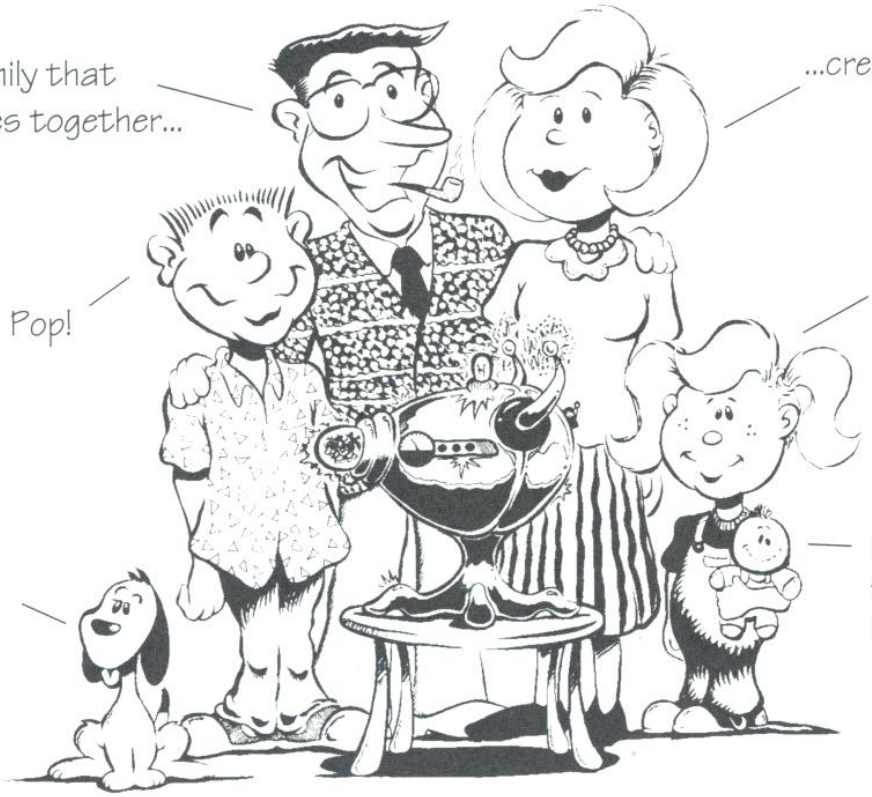
A goodly amount of time has passed since this world was created. And a lot of things have happened. But what happened when? And what might have happened that we didn't notice?

Click and hold on the Census button in the Dashboard, slide the cursor to History and release the mouse button.

This window lists the world's important events along with the date they happened. You can use the Older, Newer and Latest buttons to page through all the events.

Beyond the Nuclear Family...beyond the Atomic Family...beyond the Generic Family...it's...

The ADVENTURES of the GENETIC FAMILY!



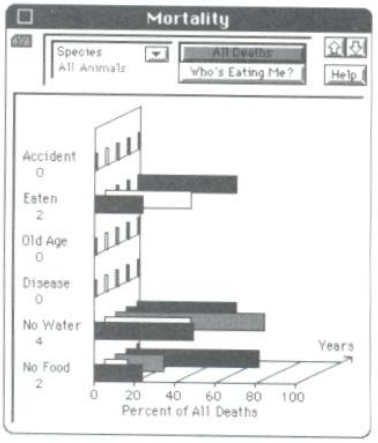
Featuring:
Mr. and Mrs. **Gene Poole,** their son **Codon,** their daughter **Allele,** and their dog **Bowser.**

DEATH, WHERE IS THY STING?

All things come to an end. And until you get the hang of building a viable food chain and ecosystem, you may be tempted to call this game SimDeath instead of SimLife.

Tracking down the causes of death can give you insight into problems in the ecosystem. And to help you investigate the causes of death, we present the Mortality Window.

Click and hold on the Census button in the Dashboard, slide the cursor to Mortality, and release the mouse button.



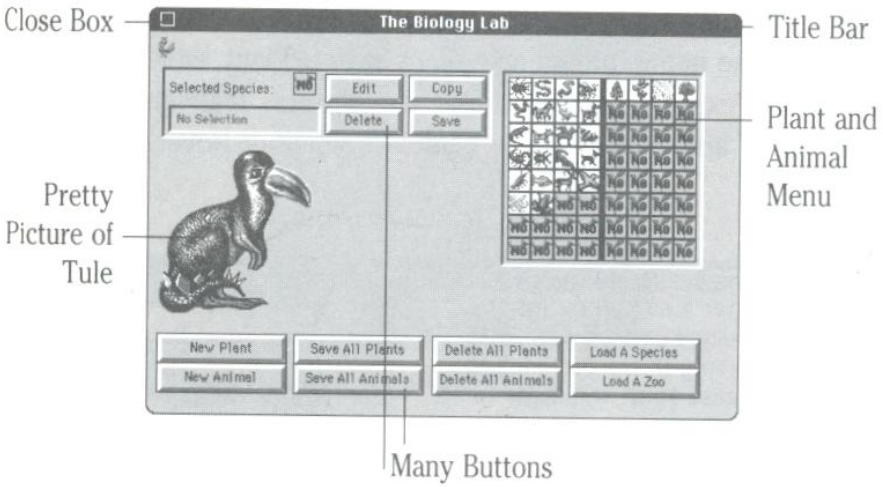
This window graphically and numerically shows how many organisms have died and what killed them. You can look at mortality data for an individual organism, or for All Animals or All Plants at once. The data shown goes back five years.

When you've had enough of digging through death, close the Mortality Window by clicking in the Close Box.

GOING TO SEED

Let's design a new plant. Click on the Biology Lab button in the Dashboard to open the Biology Lab.

Biology Lab at Select Level

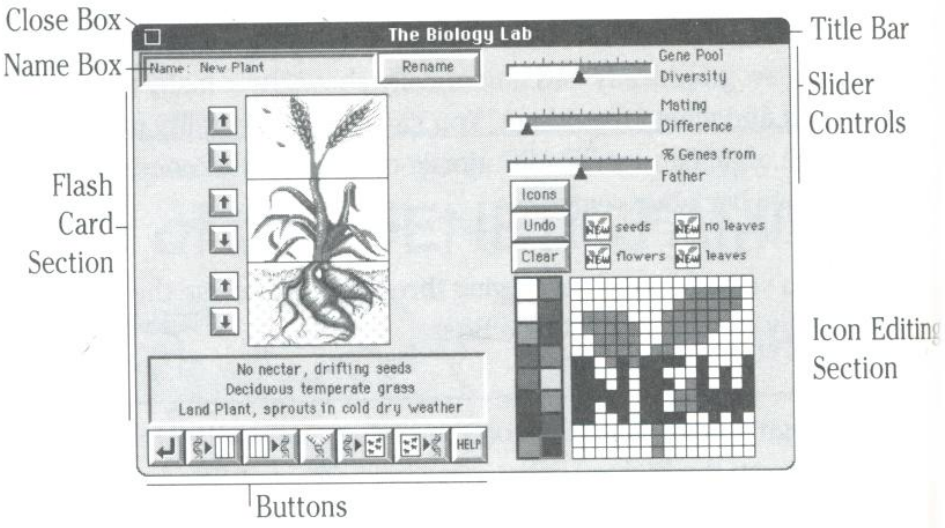


The Biology Lab has two levels, the Select Level and the Edit Level. You are now looking at the Select Level. This is where you can load and save organisms individually or in groups, or start new ones.

We're going to make a new plant, so click on the New Plant button.

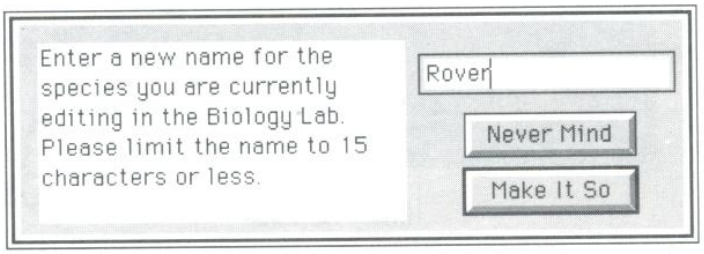
You are now at the Edit Level of the Biology Lab, ready to work on your new plant.

Biology Lab at Edit Level



A ROSE BY ANY OTHER NAME

Right now the name for the new plant is New Plant, which isn't very charming or expressive. Click the Rename button, highlight the words "New Plant," and type in a new name—how about Rover?—and click Make It So.



WOW. WHAT A FLASH

Below the name is the composite picture of the plant, as seen in the Phenotype Window. The plant is made of three pictures. To the left of each picture are arrows.

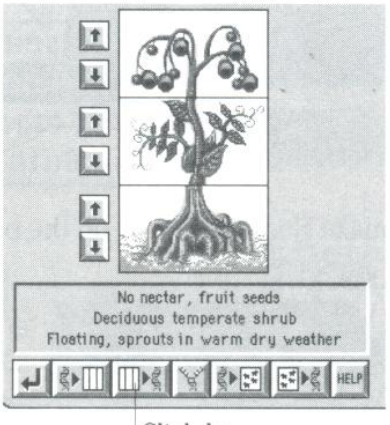
You can click on these arrows to cycle through all the pictures. Go ahead and do some clicking. As you do, notice the text below the pictures—it describes the plant you are designing.

The top line of text describes the top picture, which defines the plant's flower: whether or not it makes nectar, and what type of seeds it has.

The middle line of text describes the middle picture, which defines the plant's structure, its preferred climate and whether it is deciduous or evergreen.

The bottom line of text describes the bottom picture, which gives the plant's sprouting needs and tells whether the plant lives on land or water.

So we're on the same track for the next step, click around until your text and picture match this:



Click here

Once your picture matches, notice the row of buttons below the plant description. Click on the third button from the left. This button writes the genetic code for your new plant based on the flash cards you chose.

That was easy. We designed a plant by making only a few major decisions and left the details up to the computer. Let's go a step deeper and play directly with the plant's genetic code to do some fine-tuning.

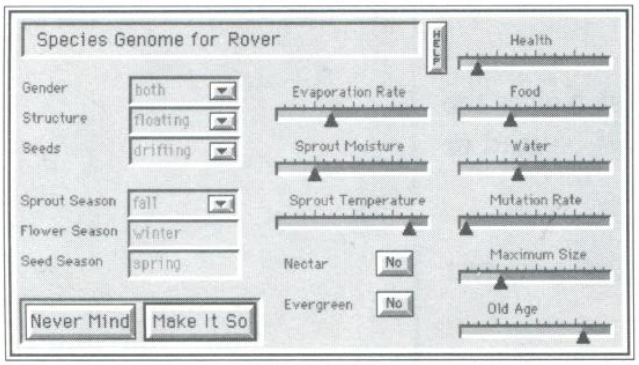
Roll up your sleeves and read on.

I DREAM OF GENOME

Look again at all the buttons below the text section. Click and hold on the Help button and look it over for a few seconds.

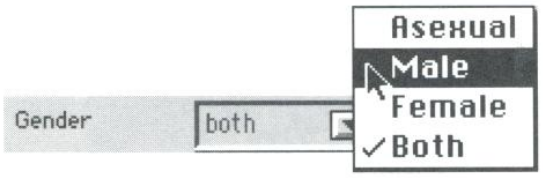
Most of these buttons are very powerful tools for advanced experiments, so for now, we'll only deal with one or two.

Click on the Edit Species Prototype Genome button.

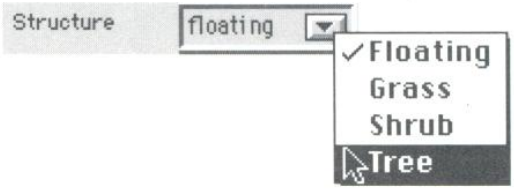


You now see the Genome Window that defines Rover. All the genetic information in the text and pictures is here, plus a few other genes.

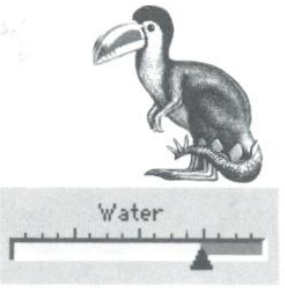
Let's modify Rover a little. First, we'll give Rover male flowers instead of both. Click and hold in the little down-arrow button to the right of the word Gender, slide the cursor to Male, and release the mouse button.



Now, let's let Rover make Nectar, so click on the button next to Nectar.



Now, something big: let's turn Rover into a tree. Click and hold on the down-arrow button to the right of the words Structure and Floating, slide the cursor to Tree and release the mouse button.



When it was a floating plant, Rover didn't need to store much water, but now as a tree, it will need a lot of water storage capability. Click and drag the arrow on the Water slider about three-quarters of the way to the right.

Note: when you make major changes in the genome, be sure to check over any related genes. If we didn't adjust the Water Storage gene while making Rover a tree, they all would have died of thirst before maturity.

That's enough genetic tinkering for now. Click on Make It So to return to the Biology Lab.

FLASHBACKS

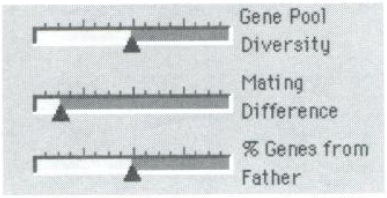
Now look at the flash cards. The flashcard image automatically updated to match the changes in the Genome Window.

TIME OUT!

OK, here's something to remember: we haven't been designing an individual plant—we've been designing an entire species. The "Rover" we've been working on is the prototype for a whole species of Rovers.

As you place new Rovers into the world, they will be based on this prototype, and vary only slightly. When new Rovers are born, they will be based on their parents.

OK. Back to the Biology Lab.



THE FINAL TOUCHES

Just three more items to be mentioned and Rover is done. There are three sliders in the upper-right section of the Biology Lab.

The top slider sets the amount that the Rovers you place in the world will vary from the prototype. The farther to the right you set the Gene Pool Diversity slider, the more variation in the genes in all the Rovers-to-be. The more the variation, the more possibility for evolution. This slider does not affect Rovers that are born to other Rovers.

The middle slider, Mating Difference, sets how genetically different two Rovers can be and still produce offspring.

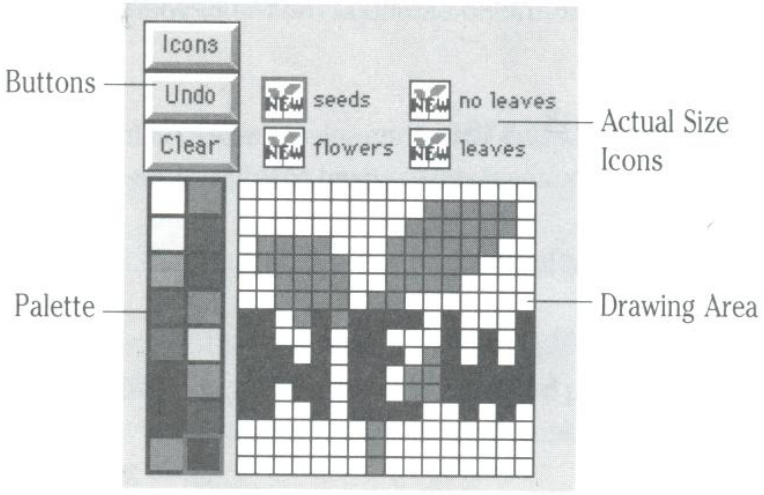
The last slider, %Genes from Father, sets how many of the Rover-offspring's genes come from each parent. We humans get ours 50/50, but you can set Rover anywhere you want.

That's it. Rover's all designed and done... except for the way it looks in the Edit Window. Now we get to draw some pictures.

ICON DO IT. CAN YOU?

The icon we draw for Rover won't affect it or its genes in any way. The only thing the icon does is help us identify it when we see it in its environment. You can be as silly or abstract as you want when drawing icons, as long as you can remember what they are.

A plant needs four icons, one for when it's a seed, one with no leaves, one with leaves, and one with flowers.

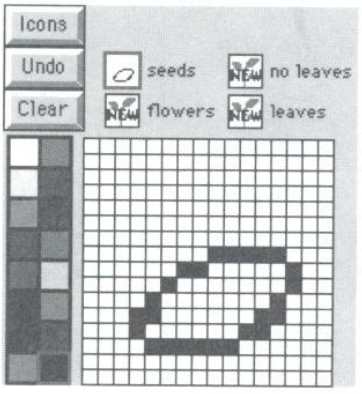


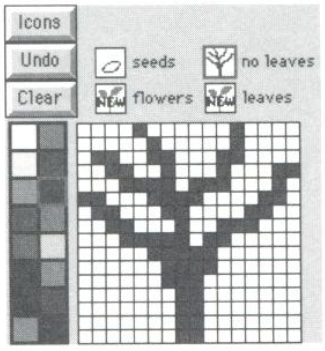
A Seedy Spot

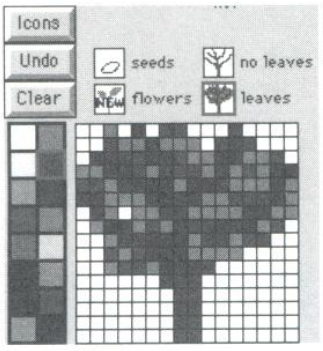
First, we'll draw the seed icon. Click on the little icon for seeds, then click on the Clear button.

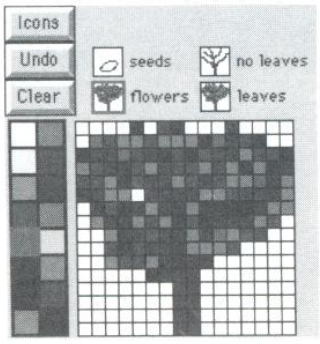
Now click on a color. Draw the seed just as you would with any paint program: click or click and drag on a blank spot to draw, click or click and drag on a colored spot to erase it. As you draw the icon in the large drawing area, it appears real-size above.

If you wish, and you have them, use other colors to adorn the seed. My icon for Rover as a seed is here, to the right.









Branching Out

Click on the "No Leaves" icon, then click Clear. This icon represents the plant when it has branches, but no leaves or flowers.

Draw it however you want (but remember, Rover *is* a tree). My Rover with no leaves is shown to the left.

Leaf Me Alone

Now we want to draw the same thing and add leaves. Before changing to the next icon, go to the Edit Menu at the top of your screen, and select Copy Icon.

Next click on the Leaves icon, then select Paste Icon from the Edit Menu. We've got our branches—all we need to add are the leaves.

Go ahead and add leaves.

Rover In Bloom

Choose Copy Icon from the Edit Menu again, select the "Flowers" icon, then select Paste Icon from the Edit Menu.

Now add your flowers.

The Easy Way

For those of us who can't draw worth beans—or are in a hurry—there are a number of professionally pre-drawn icons. Click and hold on the Icons button just above Undo to see a submenu of 32 icons to choose from. Just look now—be careful not to choose one or your personal artwork will be lost.

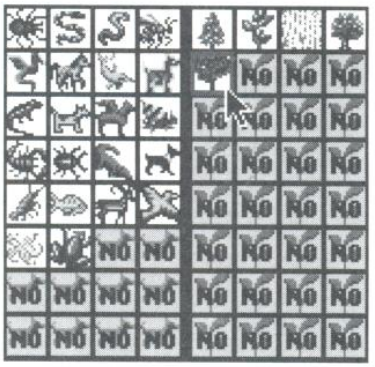
Each of these icons only shows the one stage with leaves, but if you choose one it supplies all four icon stages of the plant.

We could have just chosen one of these and saved all the time and trouble of drawing our Rover, but don't you feel like a better human being for having done it yourself?

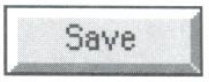
Rover's All Over

Now click on the Return To Select Level button.

Notice that Rover is now amongst all the other plants in the Species Display.



Click on the Save button to save all our hard work to disk for future use. Not only can you use Rover now, but you can load it into any future games or experiments.



If you have any questions about saving plants, see your machine-specific addendum.

Spreading Your Seed

Close the Biology Lab by clicking in the Close Box.

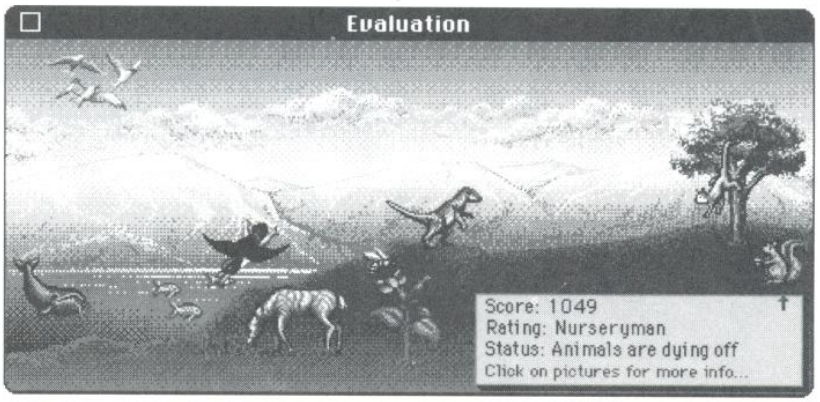
Make sure Rover is the Selected Species in the Dashboard.

Go to Edit Window, set the Life Button to Populate and place a few Rovers. When you place them, they are seeds. As time passes, they grow branches, then leaves, then bloom. If Rover is too stupid to bloom, it must be a blooming idiot.

YOUR REPORT CARD

Now we'll look at one more window. Open the Windows Menu and select Evaluation.

The Evaluation Window lets you know how well you're doing at ecosystem management by giving you a Score, a Rating, and a Status report. It also pictorially shows which ecological niches are currently filled with plants and animals. You can click on any of the pictures to get an explanation of what they represent.



SEMI-SORTA-SUMMARY

This concludes Part 2 of the tutorial. We've been through a lot of windows, features and functions and you should understand enough to figure out any new ones you run across. Congratulations.

In addition, we've gone through the process of plant design. The process of animal design is very similar and will be dealt with in detail in the next section of the tutorial... speaking of which...

The next and final part of this tutorial will be the design, setup and execution of a complete experiment. Thrills, spills and fun for the whole family. Don't miss it!

BUILDING AN EXPERIMENT: SPLATT

Now it's time to design, set up, carry out and evaluate an experiment.

SimLife is very complex and has a massive amount of features. One of most powerful features of SimLife is the ability to turn off or eliminate many of the features for better experimental control.

In any experiment, control is a primary issue. All possible outside influences must be eliminated for the experiment to be valid and to really find out who did what to whom and why.

Now, we'll set up a very simple experiment. We'll turn off and leave out a number of factors. This gives us complete control over the experiment and will also make the simulation run faster.

THE SIMLIFE LAB BOOK

A summary of this experiment, along with blanks to fill in your data and write your conclusions, can be found in the lab book included with this product. If you don't want to mark up your lab book, you may make a photocopy of it for your personal use and mark that up. No selling copies of the lab book in dark alleys to minors while wearing a trenchcoat.

THE GOAL OF THIS EXPERIMENT

The goal of this experiment is to observe evolution (a change in the gene pool) through natural selection.

THE APPROACH

We will focus on a few genes in particular: Roaming, Turning, Turn Type and Turn Angle. The Roaming gene controls how likely an animal is to keep moving even though it is not necessarily hungry or thirsty. The Turning gene controls how often the animal turns while moving. The Turn Type and Turn Angle genes control how the animal moves when it is turning.

We will set up a world where environmental pressures favor survival for an animal with a high tendency for roaming and turning and see if, after a number of generations, the animal's gene pool changes to increase these tendencies.

For simplicity—and control—the world will have only two species of animals—the experimental subjects and the control group. Both species will be supplied with all the food and water they need.

Environmental pressure to promote roaming and turning will only be applied to the subject group. And that pressure will be you. You will act as the predator and use the Smite function of the Life button to kill any of the subject animals that hold still too long—those that don't roam very often.

No other predators will be allowed into the world where they might cause different or unknown environmental influences.

THE PLAN OF ATTACK

The steps we'll be taking in setting up the experiment will be:

1. Design and build the subject animal.
2. Duplicate and rename the subject as the control animal.
3. Design and build the world needed for the experiment.
4. Modify the climate for optimum control.
5. Change the laws of physics for optimum time passage.
6. Populate the world with the subject and control species.
7. Record the starting genetic data for both populations.
8. Apply the environmental pressure for a number of generations.
9. Observe the results, at two points in time.
10. Analyze the results.

STEP ONE: BUILD-A-BUG

The first thing we need to do is design and build the animal that we will be hunting down and killing.

We at Maxis believe in the sacredness of all life, both real *and* artificial. All life-forms have their place in the ecosystem and the universe. We suggest you only destroy animals, even electronic ones, for a good cause—like this tutorial.

When deciding who should live and who should die, keep in mind that some organisms are, well, let's just say that killing some animals inspires less guilt than others. Speaking of cockroaches, let's model our experimental subject after them.

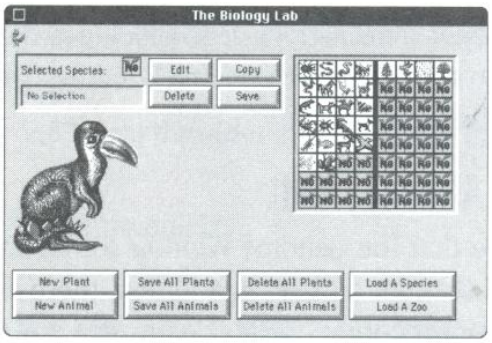
If you feel personally offended by using cockroaches as test subjects, then you can always turn off your computer and curl up with a good Franz Kafka story. Or, instead of modeling the subjects after cockroaches, base them on something else... since we're dealing with the Roaming gene, you can make your critters look like noses and call them the Roamin' Noses. (I was going to use the Roamin' Noses in this experiment, but I couldn't draw good nose icons.) Or you could make the animal look like your older brother, your boss, or anyone or anything else you'd enjoy splatting.

PREPARATION

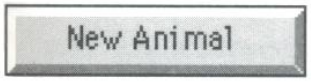
Before you can continue with this experiment, make sure SimLife is running and in Experimental Mode.

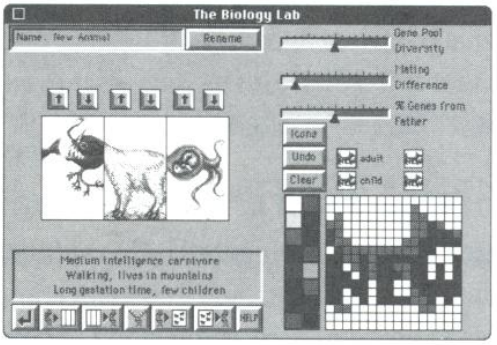
BIO-MANIPULATION

Click on the Biology Lab button in the Dashboard.

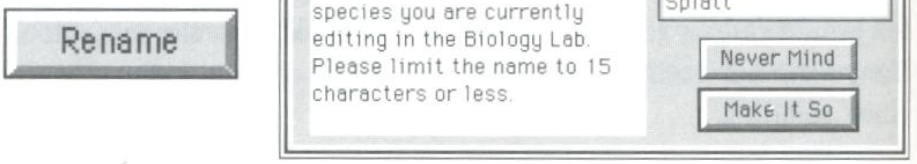


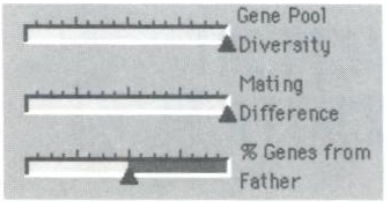
When the Biology Lab opens, click on New Animal.





Now we name our new test-subject-to-be. Click on the Rename button, highlight the old name, type in a new one, and click Make It So. I'm naming my new animal Splatt.





Next, we'll set the three sliders above the icon section. Since we'll be dealing with a relatively small population, we'll need as much Gene Pool Diversity as possible. Set it all the way up.

Set Mating Difference all the way up, and set %Genes from Father to 50%.

We've got some serious gene-splicing to do, so we'll skip the flash cards and go straight to the Genome Window. Click on the Edit Species Prototype Genome button.

YOU ANIMAL, YOU

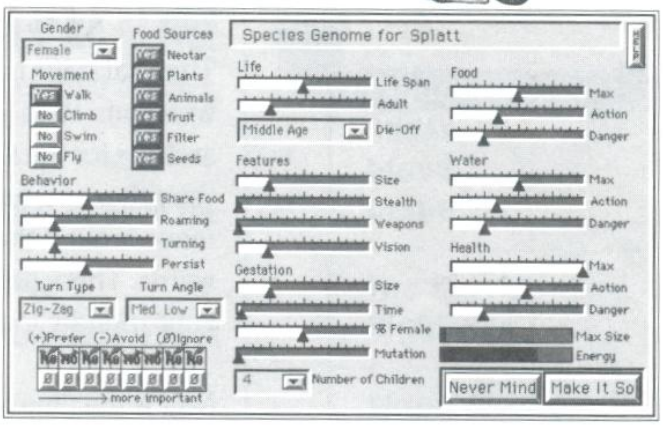
Notice that the Genome Window for an animal is much more complicated than for a plant. In addition, there are two indicator bars in the lower-right corner, for Maximum Size and Energy Requirements.

There is no free lunch in SimLife. The more powerful and versatile you make an animal, the more energy it will need to survive. You can make an animal so strong and fast and stealthy and dangerous with such great vision that it would be invincible—but even if it lived in a supermarket it couldn't eat fast enough to survive.

THE SPLICE OF LIFE

In general, our requirements for this animal aren't very demanding. All we want it to do is eat and reproduce and roam. It won't have any enemies to contend with, and it won't have to search or fight for food or water.

Set your animal's window to look something like this:



Animal Design Summary

Here I will just mention what each setting should be. See the Reference section below for a complete description of what each gene does.

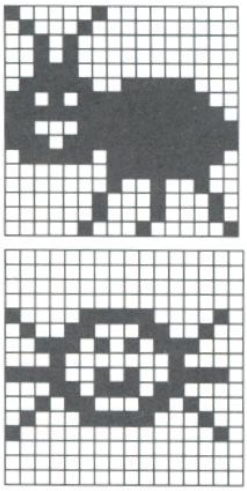
1. Keep the **Gender** Male or Female; if it's sterile or asexual it won't show us very much evolution.
2. For **Movement**, just Walking will do.
3. It will only need one **Food Source**, but since we're using cockroaches for our model, click them all. (Notice that each type of food you add increases the animal's energy requirements. For this experiment, it won't matter, but be careful in others.)
4. Set **Share Food** and **Persist** to about 50%.
5. Set **Roaming** and **Turning** to about 25%.
6. Set **Turn Type** to Zig-Zag, and **Turn Angle** to Medium-Low.
7. There will be nothing to prefer, avoid or ignore, so we'll prefer to ignore the avoidance settings.
8. Set **Life span** to 50%. (We don't want the older bugs to clutter up our ecosystem.)
9. Set **Adult** to 25% so they'll mature quickly.
10. Set **Die-off** to middle-age.
11. On the **Features**, set **Size** and **Vision** to about 25%, and **Stealth** and **Weapons** to 0.
12. For **Gestation**, set **Size** to 25% (or less), **Time** to about 5%, **%Female** to 50%, and **Mutation** all the way down.
13. Set **Number Of Children** to 4.
14. For **Food** (internal food storage), set **Max** to 50%, **Danger** to 25%, and **Action** between them.
15. Set **Water** the same as **Food**.
16. For **Health**, set **Max** all the way up, **Action** at about 50%, and **Danger** at about 25%.

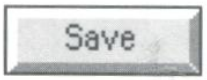
Now click on Make It So to return to the Biology Lab.

PRETTY PICTURES

The final stage in designing Splatt is making the icons. With plants, there were four. With animals, there are only two, one for the animal as a child and one for the animal as an adult. (There are actually four animal icons: the other two are flipped images of the first two, so when the animals move around the Edit Window they don't look like they're going backwards. These flipped icons are automatically made for you, courtesy of your friendly local computer.)

Now is the time to let your artistic talents shine, to express the very soul of Splatt in a grid of 16 x 16 colored dots. Try to evoke the essence of Splattness, or just do anything—as long as you will be able to recognize it in the Edit Window, and are able to distinguish it from any other lifeforms.





Click on the Adult icon, then click Clear. Now draw an icon to represent Splatt the Roach, or Splatt the Nose, or Splatt the little sister, or whatever. My Splatt is shown to the left.

So, maybe it does look more like a rabbit than a bug. I know what it is, and that's what counts.

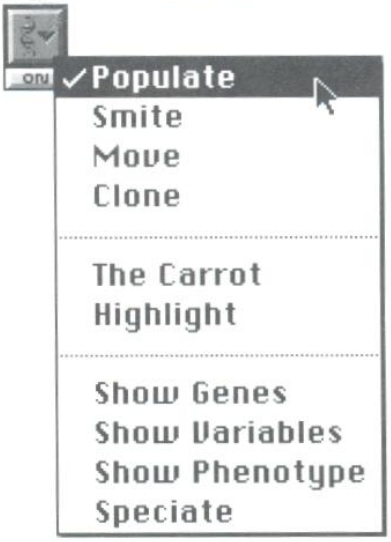
Next click on the Child icon, then click Clear. Now draw a portrait of the insect as a young bug. Make sure it looks different enough from the adult so you don't stomp on children by mistake during the experiment.

Once you're done with the icons, click on the Return to Select Level button.

Now click on the Save button. If you need help saving Splatt, see your machine-specific addendum.

Close the Biology Lab for now by clicking in the Close Box.

THEY'RE ALIVE!



Look at the Dashboard. Notice that Splatt is now the Selected Species, and its icon has been added to the other icons.

Now go to the Edit Window. Click and hold the Life button. Slide the cursor to Populate and release the mouse button.

Now click or click and drag the cursor in the Edit Window Display Area to set a bunch of Splatts loose in the world.

FOR USE AT A LATER TIME

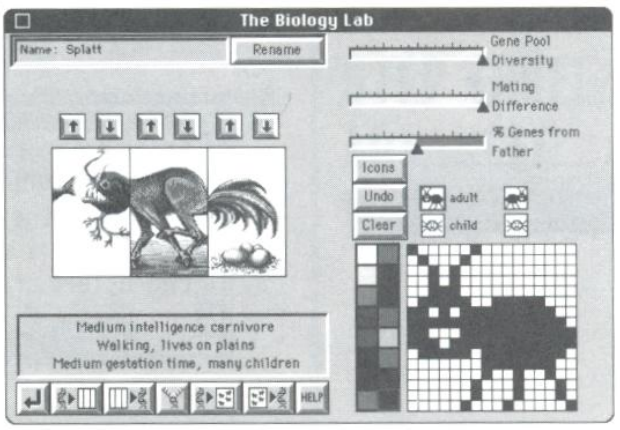
This new animal we've created will not automatically appear in the Dashboard if you start a new game at a later time. If you have saved the animal to disk, you can load it into the game (and Dashboard) by using the Load Species button in the Biology Lab at the Select Level.

Take a few moments to watch your creations scurry about, living and dying; then it's time to get back to work. Click on the Pause button in the Dashboard to pause the simulation.

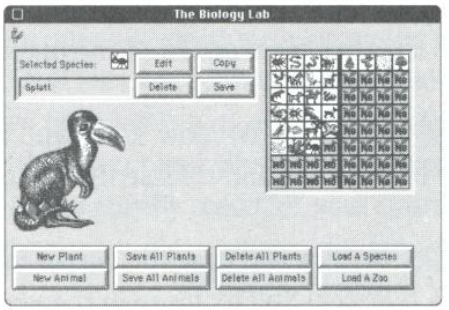
STEP TWO: THE CONTROL SPECIES

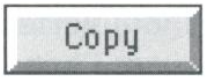
We are now going to make our control species. It will be an exact duplicate of Splatt except for two things: its name and its icons. We need to give it another name so the simulation will keep its data separate from Splatt's, and we need it to look different so we can be sure to apply our environmental influence only on the subject and not the control.

Double-click on Splatt's icon in the Dashboard. The Biology Lab will open, with Splatt ready to edit.



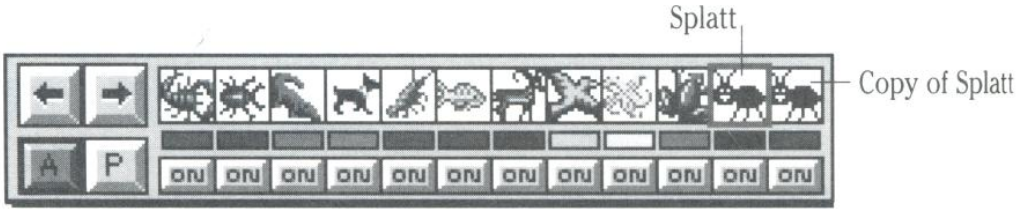
Click on the Return to Select Level button to go to the Select Level of the Biology Lab.



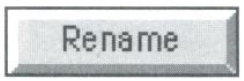


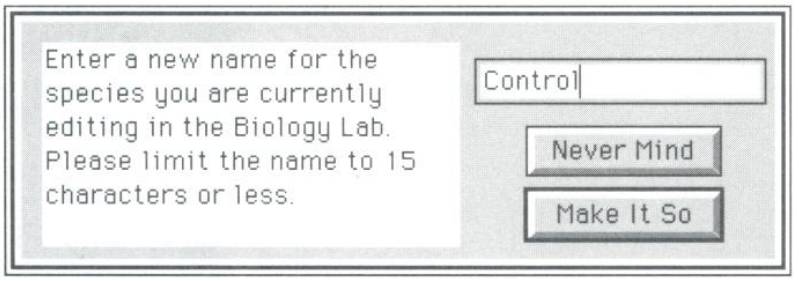
We now want to make a duplicate of Splatt, so click on the Copy button.

Look at the Dashboard. Notice that there is now a duplicate of Splatt pictured just to its right. If it isn't showing, click on the right arrow to scroll until you see it. This is our copy. Double-click on the copy's icon in the Dashboard.



Our new species is now showing in the Biology Lab. It has been named Copy of Species, which is kind of a dumb name, so let's rename it. Click on the the Rename button, type in a new name (I'm using Control), and click Make It So.



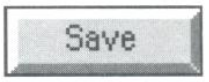


A BUG OF A DIFFERENT COLOR

We need to make our control bugs look different from Splatt, so we need new icons. You can be as creative as you want here, but I'll be lazy and make mine identical, except for the color. My Splatts are black. I'll make Controls red.

Be sure to change both the adult and child icons.

Once you've changed the icons, click on the Return to Select Level button, then save the new species.



Close the Biology Lab.

ON DASHBOARD!

One Last Detail: check the colors assigned to Splatt and Control in the Dashboard.

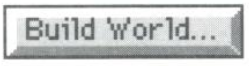
Below the icons of each species is a colored rectangle. This is the color that the animal will appear in the Map Window. (The Map Window represents such a large area that there's no room for icons, just colored dots.)

If the default colors for Splatt and Control are aesthetically pleasing to you and different enough from each other that you can easily tell them apart, do nothing. If you want to change one or both, click and hold on the colored rectangles to open a submenu of color choices, then slide the cursor to the color you want.

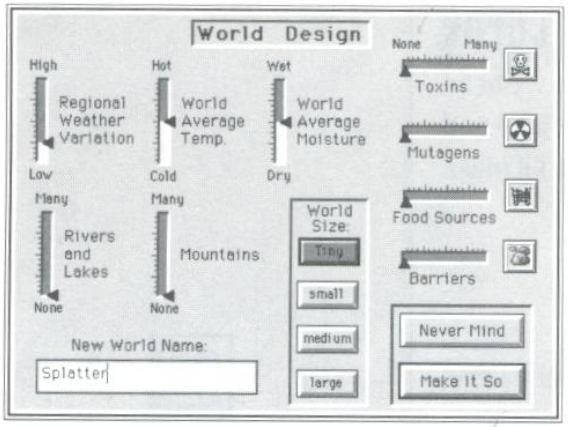
STEP THREE: ADVANCED WORLD DESIGN

Now it's time to custom-build the laboratory/world for this experiment.

Open the Map Window by clicking on the Map Window button in the Dashboard, then click on the Build World... button to open the World Design Window.



SIMLIFE



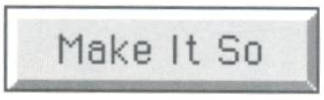
Adjust your World Design Window to look like the sample on the left. You can name it anything you want. I'm using Splatter.

In general, we want our experimental world to be absolutely non-hostile. We, as the smiters, are going to be the only danger to life in this world.

WORLD DESIGN SUMMARY

Here's a listing of all the settings and why I chose them.

1. We want the climate to be pleasant and forgiving, so set **Regional Weather Variation** low (about 25%), and the **Average Temperature** and **Average Moisture** to average (about 50%).
2. We'll be customizing the terrain later, so for now, set **Rivers and Lakes** and **Mountains** all the way down. In any event, we won't want any mountains in this world, because mountains affect the climate and we want our climate to be identical in all parts of the world.
3. We'll want no **Toxins** that might interfere with our experiment; set them to none.
4. Absolutely no **Mutagens!** We want *all* evolution in this experiment to result from natural selection.
5. We'll be strategically placing **Food Sources** by hand, so, for now, set them to none.
6. We won't need any **Barriers**, so set them to none.
7. Set **World Size** to Tiny. We won't need much space, and since we'll be dealing with a number of generations, we'll want time to pass quickly. (The smaller the world, the faster the simulation runs.)



When you've made all the adjustments and named your world, click on the Make It So button.

EXTERIOR DECORATING

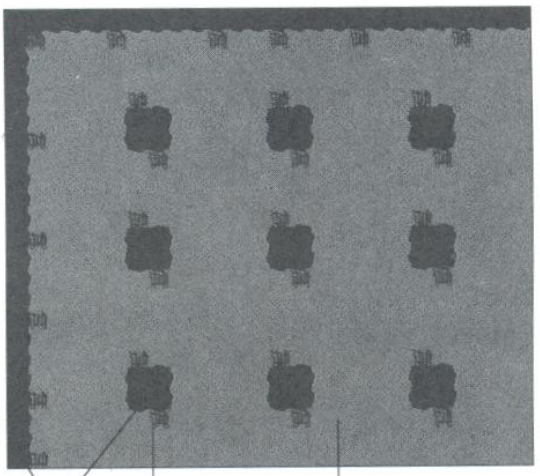
Our new world is pretty boring, and very barren. Now it's time to put on some finishing touches.

We want our Splatts and Controls to have unlimited food and water, so let's ring the world with water, and place lots of food sources around the border. We'll also want to scatter numerous watering holes and more food sources all over the interior.

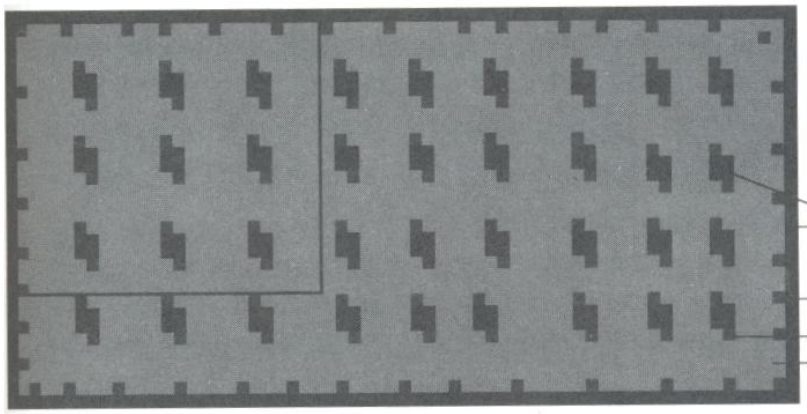
Go to the Edit Window, click on the Water button, and draw a border of water all the way around the world, then dot the interior of the world with small ponds. Be careful not to put so many that it makes it hard for the animals to move around.

Next, click on the Food Source button, and scatter food around the border. Place a Food Source near each pond.

When you are done, the view in the Edit Window should look something like the graphic to the right.



The view in the Map Window should look something like the graphic below.



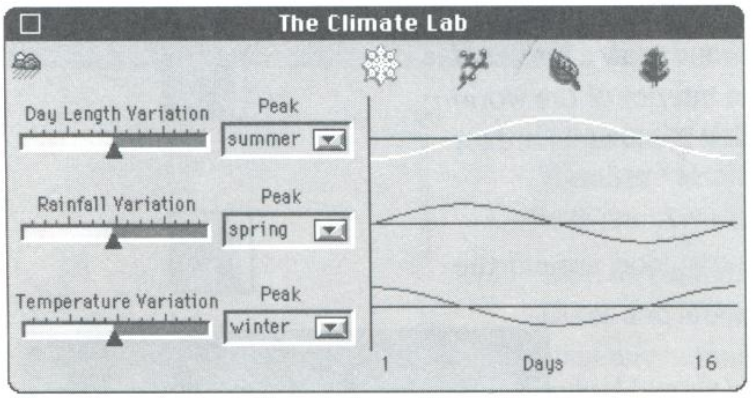
We now have our world. It would be a shame to lose all your hard work, so open the File Menu and select Save. See your machine-specific addendum if you need more information on saving games.

SIMLIFE

STEP FOUR: CLIMATE CONTROL

Click on the Climate Lab button in the Dashboard to open the Climate Lab.

We don't really need to mess around with the climate for this experiment, but since this is a tutorial, we'll go through the motions so you'll know how to do it when you need to.



Remember way back when we set the average moisture and average temperature in the World Design Window? Here you can set the amount that the heat and water vary around the average we already set. You can also set the amount of variation in day length during the year.

Set all three of the sliders around 50%—we don't want to put our little critters under too much climatic stress, but we don't want to bore them to death, either.

Each of these three settings lets you select the season at which it peaks. Set the Temperature Variation peak to Winter by clicking and holding on the down-arrow button, opening the submenu, sliding the cursor to Winter and releasing the mouse button. Why would anyone want to make it hot in the winter? Because they can.

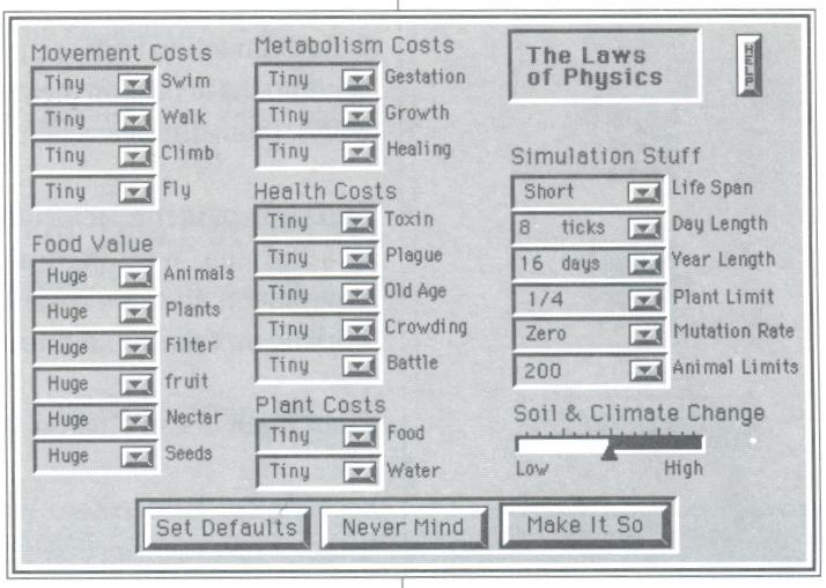
Close the Climate Lab.

STEP FIVE: THE LAWS OF PHYSICS

Next, we need to mess with the Laws of Physics to compress time and remove other influences and factors that might "taint" the experiment.

Open the Simulation Menu, then open the Technical Submenu and select Change Physics... to open the Laws of Physics Window.

This is the stuff experimenters' dreams are made of. The control over time and energy this window gives you is one of the main incentives for experimenting with artificial life (as opposed to non-artificial life). Every biologist in the world would love to have this type of power and control over experiments. (So would every meglomaniacal lunatic, but that's another story.)



Basically, what we want to do here is make life as easy as possible for our bugs, make time pass very quickly and make a few other minor adjustments.

To change any of the settings, click and hold on the down-arrow buttons, slide the cursor to your new choice, then release the mouse button.

Go ahead and adjust your Laws of Physics Window to match the picture above, then click on Make It So. The Laws of Physics Window will close.

LET'S GET PHYSICSFUL

Here's a summary of all the settings, with brief reasons why they suit this experiment. A more complete explanation of what each control does can be found in the Reference section below.

Set all the **Movement Costs**, **Metabolism Costs** and **Health Costs** to Tiny. We don't want to drain our critters of any more energy than we have to.

Since we're supplying the animals with unlimited Food Sources, the **Food Value** settings don't really matter. But go ahead and set them all to Huge, just for the principle of the thing.

We won't have any plants in this world, so you can set **Plant Costs** to anything your heart desires.

In the **Simulation Stuff** section, set **Life span** to Short. We want our older generations to pass on their genes, then nobly die, and not clutter up the world. (Sometimes science is cruel.)

Set **Day Length** to 8 Ticks and **Year Length** to 16 Days to set time moving at a fast clip. We'll be dealing with a number of generations in this experiment, and don't want to spend the next 10 years of our lives working on this stupid tutorial.

Plant Limit doesn't matter, since we'll have no plants. Go wild.

Set **Mutation Rate** to Zero. We want to see if we can reproduce evolution through natural selection without the advantages that mutations can give.

Set **Animal Limits** to 200. We don't want to overcrowd the world.

You can set the **Soil and Climate Change** slider anywhere you want, as it won't affect anything in this experiment.

STEP SIX: POPULATION EXPLOSION

Now we'll set our Splatts and Controls loose in the world, using the Populate Window.

In order to have evolution through natural selection, without any mutations, we'll need a good spread of genes in the gene pool. To do this, we'll set loose some Splatts and Controls, then make some modifications to both species' Genome Prototypes, and set some more loose.

If it isn't already paused, pause time now by clicking on the Pause button in the Dashboard.

LET THERE BE SPLATT

Open the Map Window by clicking on the Map Window button in the Dashboard.

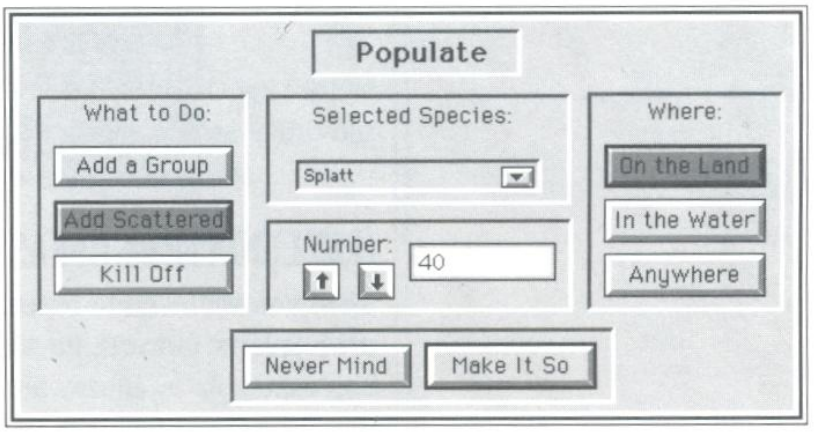
Click on the Populate... button in the Map Window Control Panel.

Click and hold on the down-arrow button in the Selected Species box, drag the cursor to Splatt's icon, then release the mouse button.

Click on Add Scattered, and On the Land.

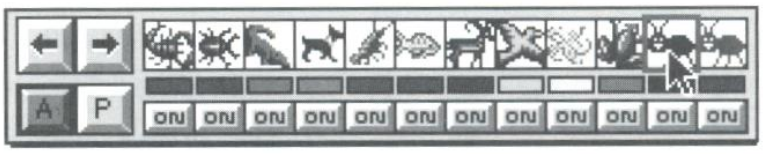
Click or click and hold on the up-arrow button in the Number box until 40 is displayed.

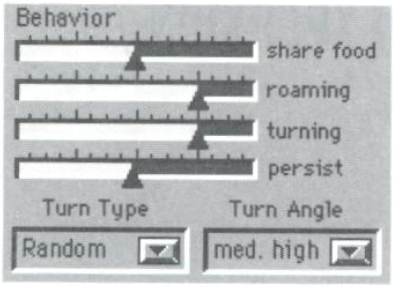
Click on Make It So. 40 new Splatts will be scattered about the world.



LET THERE BE MORE SPLATT

Double-click on the Splatt icon in the Dashboard to open the Biology Lab with Splatt ready to edit.





Click on the Edit Species Prototype Genome button.

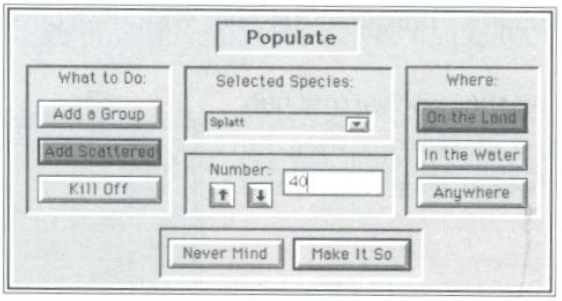
Now make the changes to the Splatt genome as shown above to give us a good spread of turn- and roam-related genes.

Here are the changes to make:

1. Slide the Roaming and Turning genes up to 75%.
2. Change Turn Type to Random.
3. Change Turn Angle to Medium-High.

Click on Make It So, then close the Biology Lab.

Click on the Populate... button in the Map Window Control Panel, then populate the world with another 40 Splatts, scattered on the land.



TAKE CONTROL PLEASE

Now you will need to repeat the same process you just went through with Splatts, but with the Controls.

Briefly, here's how to do it:

1. Open the Populate Window.
2. Set the Selected Species to Control.
3. Set the Number to 40.
4. Click Add Scattered.
5. Click On the Land.
6. Click Make It So.
7. Double-click on the Control icon in the Dashboard.

8. Click on the Edit Species Prototype Genome button.
9. Slide the Roaming and Turning genes up to 75%.
10. Change Turn Type to Random.
11. Change Turn Angle to Medium-High.
12. Click on Make It So.
13. Close the Biology Lab.
14. Click on the Populate... button in the Map Window Control Panel.
15. Click on Make It So.

You should now have 40 each of Splatts and Controls with the low settings for turns and roaming, and 40 of each with the higher settings.

BREAK TIME

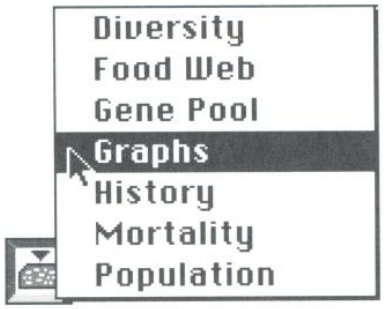
Before going on with the experiment, we need to take a time out and get familiar with a few more SimLife features. First we'll take a quick tour of the many Census Windows, then we'll think about how to record our data, then we'll do an in-depth personal interview with the Gene Pool Window.

Now would be a great time to save the experiment to disk. Open the File Menu and select Save Game. Information on saving games with your computer can be found in the computer-specific addendum.

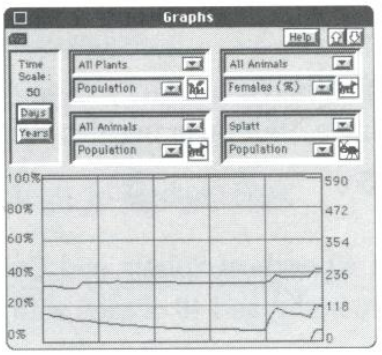
TIME OUT 1: TAKING THE CENSUS

We will now take a few moments to explore the Census Windows, where you can get massive amounts of data about the life and times of your world. These windows show the status and results of all games and experiments.

Click on the Pause button in the Dashboard and let the simulation run for 10 or 20 seconds, then click Pause again. This will give the Census Windows a chance to update and analyze the genes of your new population.



To open any of the Census Windows, click and hold on the Census Window button in the Dashboard to reveal a submenu, then slide the cursor to the window you want to open and release the mouse button. For now, open the Graphs Window.



In the upper-right corner of the window are up and down arrow buttons that let you cycle through all the Census Windows. Go ahead and click on one of the arrows a few times, looking briefly at each window. When you get back to the Graphs Window, stop.

A complete description of each and every button and control of each and every Census Window can be found in the Reference section below.

TIME OUT 2: RECORDING DATA

In this experiment and in any SimLife games or experiments, you will probably want to track the data you find in the Census Windows. There are a number of ways to do this.

If you spent most of your life in a laboratory, you'll probably want to sketch copies of the Census Windows into your beloved and trusty lab notebook. If you're not already following and recording this experiment in the provided SimLife Lab Book (or a copy of it), you may want to start now.

In the back of the Lab Book, we have provided a full complement of data sheets with blank windows for you to copy, fill in and include in any write-ups of SimLife experiments.

If you don't like lab books, you can write up and record your experiments in any word processor.

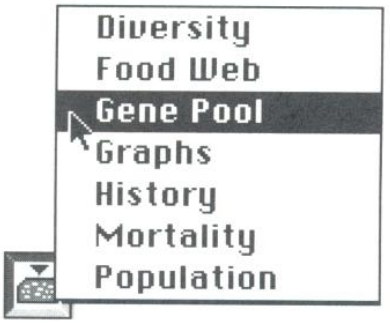
If you have a way to take screenshots of your computer screen and print them out and tape them into a lab book (or place the screenshot files directly into word processor documents), you'll find it very useful. (You may have better luck printing the data if you run SimLife in black and white before taking screenshots.)

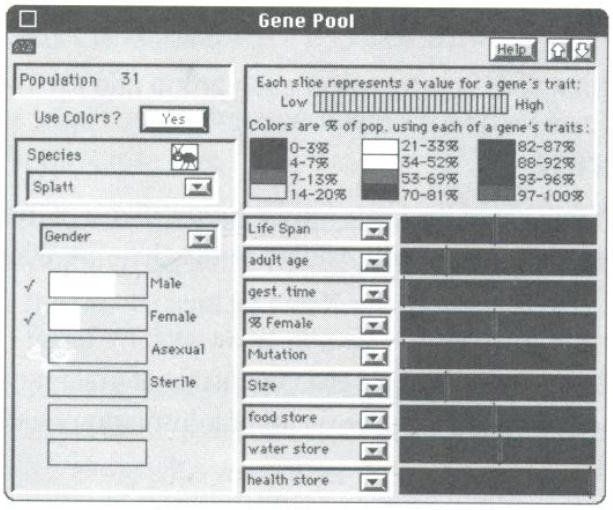
Note: Some versions of SimLife, depending on the computer, have built-in facilities for capturing windows to a clipboard or disk. See your machine-specific addendum for details.

TIME OUT 3: THE GENE POOL WINDOW

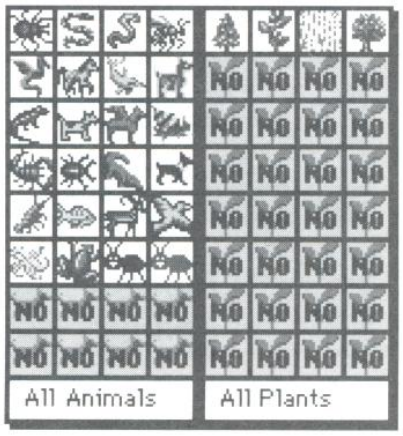
This window is crucial to understanding the results of our experiment. A complete explanation of this window can be found in the Reference section below, but we'll spend a little time here covering the basics.

Open the Gene Pool Window by clicking and holding on the Census Window button in the Dashboard, sliding the cursor to the words Gene Pool and releasing the mouse button.





This window shows the combination of all the genes in the population. At the top-left corner of the window is the Population Box, which shows the total population for the Local Species. The Local Species is selected



just below the Population Box. Click and hold on the down-arrow button to see a pop-up menu of all icons for all plants and animals. (Notice that you can also choose All Plants or All Animals and see all their genes at once.)

To choose a Local Species, slide the cursor to the icon you want, then release the mouse button. For now, select Splatt.

Somewhere around there is a yes/no button for using (or not) color. Don't worry about it for now. Worry about it later.

Be Discrete

Below the Local Species Box is the display area for Discrete Genes, the genes that are set in the Genome Window with buttons.

There are too many of these genes to show in the window at one time, but you can see all of these genes a few (one group) at a time. To change the group, click and hold on the Group Select down-arrow button, slide the cursor to the group you want, then release the mouse button.

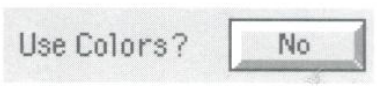
The checkmark(s) on the left of the discrete gene bar graphs indicate the setting(s) of the species Prototype.

Take some time and, in turn, select each group and see the results.

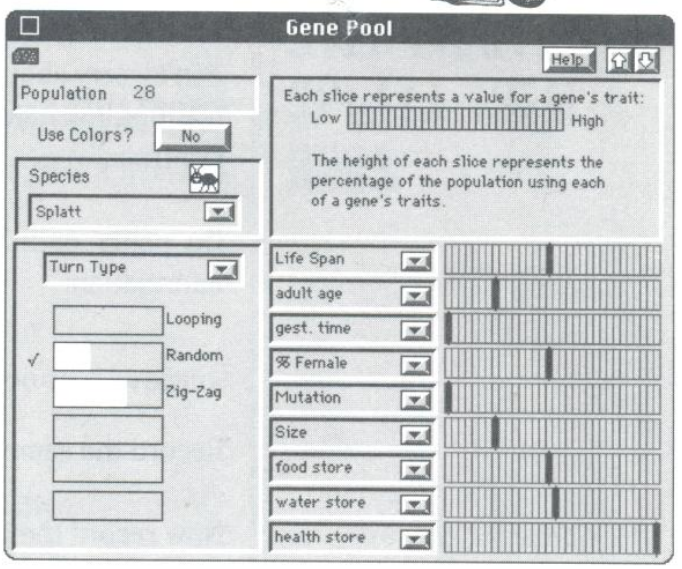
Be Indiscrete

The whole right side of the Gene Pool Window displays the Continuous Genes—those that are set with sliders in the Genome Window.

This section can display the data in two ways: by using colors, or by using black bar graphs. While a little confusing at first, once you get the hang of the color display, it gives a lot of information quickly. Besides, it looks cool.



But alas, for now, click on the button over on the left that sets Use Colors to No.



At the top of this part of the window is a key to help you interpret the data. It changes depending on your choice of color or black and white.

Each of the rectangles (made up of small slices) corresponds to a gene slider in the Genome Window. For one animal, an arrow or a line can mark the value for the gene. But when you need to see the gene values for a large number of animals, it's a little trickier.

We use little bar graphs (or color graphs). Wherever there is a bar, at least one of the animals has that value for the gene. The height of the bar (or the shade of the color) indicates how many of the population have that value.

Only nine continuous genes can be shown at once. You can choose which genes to display by... I bet you can guess how to do it. I have faith in you.

If you are truly daring, switch back to Use Colors (if you have a color monitor), study the key and see if it makes sense to you.

Now it's time to go back to the experiment. Close the Gene Pool Window by clicking in the Close Box.

STEP SEVEN: TAKE STARTING DATA

Time to take our starting data. You can use a piece of paper, your own lab book, or the official SimLife Lab Book (or a copy of it).

Open the Technical submenu in the Simulation Menu and select Set Time to 0 so your experiment starts at Tick 0, Day 0 and Year 0. Be sure to record the time along with your other data.

Next, open the Gene Pool Window. Select Splatt as the Local Species. Chances are that you now have less than 80 each of Splatts and Controls because some died during the 10 seconds that the game was unpaused

to let the Census Windows update. Unless you have less than 20 of each, don't worry about it. If you have less than 20, go to the Edit Window and use the Populate mode of the Life Tool to add more Splatts and/or Controls.

On paper or in the Lab Book, record the following discrete gene information:

1. Population
2. Turn Angle
3. Turn Type

Record the same information for Control.

Now record the information for the following continuous genes:

1. Roaming
2. Turning

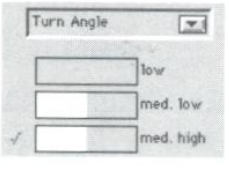
Record the same information for Control.

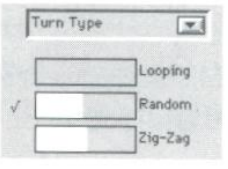
Here's my data:

Tick:	0
Day:	0
Year:	0

Splatt

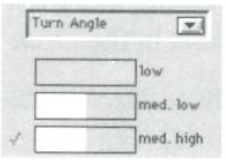
Population: 56

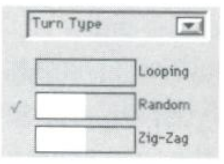




Control

Population: 59





Once the data is recorded, you're ready to start stomping bugs.

STEP EIGHT: SPLATT THEM BUGS

Time to kill bugs.

BUT WHAT'S MY MOTIVATION?

The idea here is to be a predator. You like to kill and eat Splatts. You find it easier to catch the ones that:

1. Stay still too long, or
2. Go in a straight line for a long while.

You won't smite any of the Control species because you are a predator that wants its experiment to work.

You won't kill off so many that you deplete the population.

As you begin smiting, depending on the speed of your computer, it might be far too easy or far too difficult to catch the Splatts. Adjust the speed of the game in the Speed submenu of the Simulation Menu to make time move fairly quickly and to give yourself a little challenge.

One more thing: you may want to turn off the Play Animal Sounds in the Goodies submenu of the Simulation Menu if others are listening, but it is helpful to have the aural feedback whenever there is a birth, death or mating.

LET THE SMITING BEGIN

Click on the Pause button in the Dashboard to start the clock.

Now, smite the wee bugs, and remember:

- Go for the ones that stay in one place too long, and that go in a straight line for a while.
- Avoid smiting the Controls.
- Speed up or slow down the simulation speed as needed.

PROGRESS REPORT

When your population starts to dwindle a little, take some time off (stop smiting, but leave the simulation running) and look through the various Census Windows while the Splatt population builds back up.

WHAT CAN GO WRONG AND HOW TO FIX IT

It's possible that there are so many water holes or food sources that some creatures are trapped and can't move, as opposed to not wanting to move. If so, lower the amount of water holes and food sources.

It's possible that your population could die out, or all the females or males will kick. Go ahead and add some new ones. Ideally this shouldn't happen, and it will set you back a little by diluting the gene pool.

If the Controls start crowding out the Splatts and using up most of the allotted Animal Limit (remember our settings in the Laws of Physics Window?), use the Populate Window to kill off some Controls and give the Splatts a chance.

If you have a slow machine, the bugs may be too easy to catch and you'll kill too many. Try increasing the simulation speed. You can also try holding the cursor over the bug you want to smite and counting to three slowly before pulling the trigger.

Check the Mortality Window—one of the Census Windows—for causes of death. If many of them die from lack of food or water, add more food and water to the world.

STEP NINE: TAKING DATA

After at least five or six generations, pause the simulation, and take down the Tick, Day, Year and Population as well as the same genetic information you took at Time 0.

Smite away for many more generations.

When you've done all the smiting you can stand, pause the simulation and take a complete, final set of data for both species.

STEP TEN: ANALYSIS

This is perhaps the most important part of any experiment. Look over your before, after, and in-between data. And think about it and the following questions.

What does it mean?
Was there evolution?
Did the gene pool change?
Was it by natural selection?
Why or why not?
What went wrong?
What went right?
If you had it to do over again (and you do), would you do it differently?
What would you change?

Write a report with all the answers to all those questions and have it on my desk by 8:00AM tomorrow morning.

EXPERIMENT SUMMARY

Depending on quite a number of factors, your Splatt experiment may or may not have demonstrated evolution in action. Whatever happened, don't be disappointed. We usually learn more when things go wrong than when they go right.

Splatt was a very short, simple experiment, and now that you've been dragged through it, you should have a good idea of the power and flexibility of SimLife.

Happy simulating.

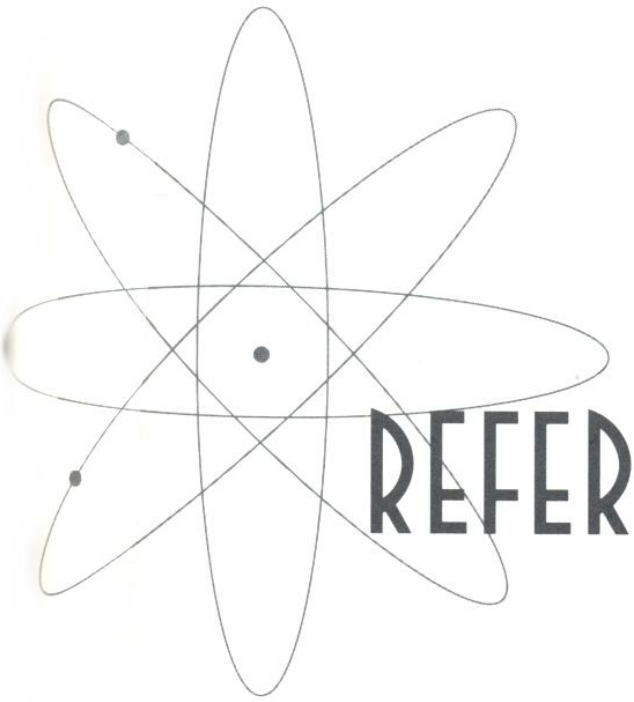
SIMLIFE

TUTORIAL SUMMARY

Well, that's quite enough of a tutorial if you ask me. If you made it all the way through, be proud.

You've been introduced to a lot of information in this tutorial, and it only hinted at the possibilities of this program. Only by playing around, coming up with your own ideas and testing them will you fully master SimLife.

Go. Play. Experiment. The reference section is here if and when you need it. There's another manual section with suggested experiments. There is also a bibliography at the end of this manual to point you to some great books about life, artificial life, biology, evolution, genetics, and other related subjects.



REFERENCE

"I don't need a wife, living the timeless life.
When I need a friend, I just give a wriggle.
Split right down the middle.
And when I look, there's two of me,
Both as handsome as can be."

— Mike Heron
from *A Very Cellular Song*

DOWN-ARROW (TRIANGLE) BUTTONS

Whenever you see a button with a down-arrow, or a triangle pointing down, it means you can click and hold on this button to open a drop-down menu of choices.

Clicking quickly on any down-arrow button will automatically reselect the last selection without opening the drop-down menu.

OPTION KEY OR CONTROL KEY

The Option key, if you have one, is used for a number of shortcuts in SimLife. If you don't have one, use the Control key for the following shortcuts:

In The Dashboard

Option-click on the Animal or Plant display On/Off buttons to turn the display of all animals or plants on or off. This is handy if you want to see, for instance, just one animal: turn them all off at once, then turn the one you want back on.

Option-click on a color in the color submenu under any of the icons to turn all the plants or animals to that color. Use this if you want one animal to stand out in the crowd: turn them all to a single color, then turn the one you want to a different color.

In The Map Window Control Panel

Option-click on the Populate... button to automatically populate the world with a random assortment of plants and animals.

SPECIES NAMING SYSTEM

You can name species anything you want, up to 15 characters. Each species also has a version number attached to its name. (The version number is displayed in the Dashboard when the species is the Selected Species.)

As these species split into new species, the new species will become Version 2, Version 3 and so on. The name will remain the same until and unless you change it.

INDIVIDUAL ORGANISM NAMING SYSTEM

Individual organisms have two-part names: their species name and a number. The numbers are given to individuals in the order they're born and continue to increase during the duration of game. There are no "go-backs" to reuse the numbers of organisms that die. The numbers start at 0 (zero). The biggest number that can be used in an organism's name is 2^{32}-1, or 4,294,967,296. If all the numbers are used, they start over again at 0.

TERMINOLOGY

Selected Species

Within most windows, only one species will be "active" at a time. And when playing SimLife, you usually play with one species at a time, checking it out in one window, spreading it in another, and modifying it in yet another.

Reselecting the species each time you jump to another window would be a hassle, so in *most* windows, when you select a species, it becomes the default or Selected Species for most other windows. The Selected Species stays selected until you pick another one.

Local Species

Selecting a species in some windows does not make that species the "official" Selected Species. The lucky plant or animal you choose in these windows becomes the center of attention **for these windows or parts of windows only**—they are local stars. Since we need to call them something, these are called the Local Species.

Choosing or changing the Local Species in these windows does not change the Selected Species or Local Species in the other windows.

Prototype Genome

Each species in SimLife has a Prototype Genome. This is the genetic starting point for a species: the baseline from which evolution can be measured. Through evolution, individuals will vary from the Prototype Genome. Over time, individuals may vary so much from the prototype that they would no longer be able to successfully mate with it, and by definition become another species.

ABOUT LIFE IN SIMLIFE

LOOKS OF LIFE

As you play SimLife, the different plants and animals will visually appear in a few different ways. None of these ways truly and accurately shows the way these organisms look.

These electronic organisms exist as ones and zeros—energy states in transistor switches in the memory chips of your computer. Assuming that most of the beings that play SimLife are human, and that none of the humans we know can see energy states in transistor switches, we figured we'd better find some way to visually present SimLife-forms in a way that humans can see and understand.

One way they appear is as a series of three "flash cards" as seen in the Biology Lab and Phenotype Window. These flash card pictures were chosen and drawn to express the organisms' physical and behavioral traits in familiar terms. You may not know what the organism looks like, but by looking at combinations of familiar earth plants and animals, you will know how it fits into its world.

Another way the organisms appear is as icons in the Edit Window. These icons are pretty small (16 by 16 pixels) and can't be very fancy. Their main purpose is to help you distinguish one organism from another (and to look pretty).

The last way the organisms appear is as small squares or dots (sometimes a single pixel) in the Map Window. When looking at this window, you can tell that organisms are there and that they're moving (if they are).

PHILOSOPHY OF LIFE

For the purposes of playing with SimLife, we define life as anything that exhibits lifelike behavior, including: adaptive behavior, self-replication and the ability to extract order from the environment.

SimLife-forms easily meet this definition, and more. They metabolize energy from your wall socket. They require the proper environment—the SimLife program—to survive. They react to stimuli in the environment. They evolve.

In a way, they are like viruses and need a host—the computer—to live in and with.

SIMLIFE ON DIFFERENT COMPUTERS

We did our best to keep different SimLife versions as close to each other as possible while staying true to the interface conventions of each type of computer.

All the main features and functions are the same in all versions, but some things have been moved around. The main places where differences are found are in the Dashboard, the Edit Window Control Panel, and the Map Window Control Panel. Check with your machine-specific addendum for details.

SIMLIFE

MENUS

Here is a listing and explanation of all menu items in SimLife. If there are any additions, omissions or differences, they will be explained in the addendum for your computer.

FILE MENU

This menu has the commands for file management and quitting SimLife. There may File Menu items for Page Setup and Printing that are not listed here. See your machine-specific addendum for details.

ABOUT SIMLIFE...

About SimLife... brings up vital and fascinating facts about this game. If your computer has a special menu, like the Macintosh "Apple" menu, this item will be there and not in the File Menu. It may also appear as About Application....

NEW GAME

New Game opens the New Game Window allowing you to choose from the many available game scenarios, or to begin a new world from scratch.

OPEN GAME

Open Game lets you load and play a pre-saved game.

CLOSE

Close removes the current game from memory without quitting SimLife.

SAVE

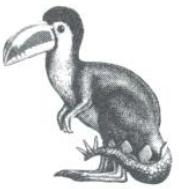
Save is for saving the current game to disk. If the game has not been saved before, you will be prompted for a file name.

SAVE AS...

Save As... is for saving the current game to disk. You will always be prompted for a file name.

QUIT

Quit ends SimLife.



EDIT MENU

The Edit Menu is primarily used in SimLife when you are designing icons to represent plants or animals. For more information, see the section on the Biology Lab below.

Also see your machine-specific addendum for more information (if there is any) on this menu.

UNDO

Undoes the last icon drawing action you made on a plant or animal icon.

COPY ICON

Copies the current icon in the Biology Lab so it can later be pasted into another icon.

PASTE ICON

Pastes the copied icon into the current icon in the Biology Lab.

CLEAR ICON

Clears (erases) the icon currently being edited in the Biology Lab.

SHOW CLIPBOARD

On computers that have a Clipboard, displays the current contents of the clipboard.

SIMULATION MENU

The Simulation Menu is for controlling various game-play options and simulation settings. Each item in this menu opens a submenu. Submenu items are active if they have a checkmark to their left.

SPEED

The Speed submenu lets you adjust the speed at which the simulation runs, which affects the rate at which time passes in your ecosystem. In the DOS and Windows versions, Speed is a full menu, not a submenu.

Pause

Pause stops time in the simulation completely.

Slow

Slow sets the simulation to its slowest speed.

Medium

Medium sets the simulation speed to a nice relaxed rate of time.

Fast

Fast sets the simulation speed to about twice as fast as Medium.

Ultra

Ultra lets the simulation run as fast as possible on your computer.

GOODIES

This submenu lets you customize some of the interface features in SimLife.

Play Music

Play Music toggles the playing of music on and off. The amount and quality of music available to you depends on your computer.

Play Animal Sounds

Play Animal Sounds toggles the animal sound effects on and off. The amount and quality of sound effects available to you depends on your computer. These sounds notify you of animal-related occurrences in your ecosystem, including mating, birth, disease and death.

Play Other Sounds

Play Other Sounds toggles environmental and disaster-related sound effects on and off. The amount and quality of sound effects available to you depends on your computer.

Auto Scroll

Auto Scroll causes the terrain in the Edit Window to automatically scroll when you are placing organisms or modifying the world near the edge of the window, so you don't have to constantly stop and mess with the scroll bars.

Auto Tracking

Auto Tracking scrolls the area in Edit Window to keep the highlighted plant or animal visible.

Display Messages

Display Messages toggles on and off the display of helpful hints and messages during the game.

Update All Windows

Update All Windows toggles between constantly updating all the information in all the windows that are open and only updating the information in the active (front) window. Updating all of the windows will slow the simulation speed.

Populate...

Populate... opens the Populate Window.

Build World...

Build World... opens the World Design Window.

LAYERS

This submenu lets you easily turn on and off many of the layers of data that can be displayed in the Edit and Map Windows. This only affects the display of these layers, and in no way changes or deletes the actual data from the simulation.

Hide All Layers

Hide All Layers turns off the display of all data layers.

Show All Layers

Show All Layers turns on the display of all data layers.

Hide All Animals

Hide All Animals turns off the display of all animals.

Show All Animals

Show All Animals turns on the display of all animals.

Hide All Plants

Hide All Plants turns off the display of all plants.

Show All Plants

Show All Plants turns on the display of all plants.

Show Plague/STD Pink (as "P")

Show Plague/STD Pink (as "P"), when active, turns the display of diseased animals in the Map Window pink on color monitors, and into the letter "P" on monochrome monitors, so you can easily track the spread of disease through the ecosystem.

DIFFICULTY

This submenu lets you adjust a number of factors that affect ease of play. All these adjustments can be seen in the Laws of Physics Window.

Typical changes that affect ease of play are length of day, higher or lower energy value for food, higher or lower energy loss for toxins and injuries, higher or lower health costs and movement costs.

Beginner

Beginner is the easiest setting.

Novice

Novice gives you a little bit of a challenge. Barely.

Average

Average is the difficulty level that provides a good challenge without taxing your innermost brain reserves.

Advanced

Advanced requires a lot of thinking, but not complete mastery of all the ins and outs of the simulation.

Expert

Expert requires complete knowledge of everything to do with the simulation and life and evolution and everything else. And a lot of luck.

Modified

Modified means you've gone into the Laws of Physics Window and changed something so it is no longer in any of the preset difficulty levels. To return to a preset setting, choose any one of the above choices.

You can't choose Modified from this menu. It will be ghosted unless you make changes in the Laws of Physics Window, in which case Modified will be black with a checkmark beside it.

TECHNICAL

This submenu gives you access to a number of advanced simulation manipulation functions.

Set Random Seed...

Set Random Seed... opens a dialog box or requester that lets you modify the seed number from which random numbers are generated. Random numbers are used in a number of places, most notably in world building.

You cannot set the seed to zero.

One use of changing the random seed is to recreate worlds without taking up all the disk space that's needed when saving a complete game.

Here's how to do it:

- Enter a number and write it down.
- Open the World Design Window, write down all your settings and build a world.
- If you like the world you get, you can recreate it at any time with the random seed and World Design settings.
- If you don't like it, recycle the paper you wrote the seed down on.

People who use this method of returning to particular ecosystems receive a free membership in the Save The Seed Not The World Club. Details on this club might be found in some cereal box, but I'm not sure.

Change Physics...

Change Physics... opens a dialog box or requester that lets you modify the physics of the universe in the simulation, including days per year and the energy it takes to climb, fly, walk, etc. These settings can change the

ease of play, or let you experiment with worlds that are very different from ours.

When you make a change in this window, the Difficulty setting is set to Modified.

Locate An Individual...

Locate An Individual... opens a dialog box or requester that lets you locate specific plants or animals in your ecosystem.

World Building Options...

World Building Options... opens a dialog box or requester that lets you modify the way SimLife builds new worlds.

Record All Statistics

Record All Statistics... toggles between the simulation saving statistics for every possible graph and saving all but the "percentage" graphs. When you sacrifice the information in the "percentage" graphs, you gain simulation speed and use less memory.

Set Time To 0

Set Time to 0 resets the Tick, Day and Year to zero. Use this item to reset the clock when you are ready to begin an experiment.

Run Control...

Selecting **Run Control...** opens a dialog box or requester that lets you tell the simulation to pause after a certain amount of time and wait for you.

You can set it to pause after any amount of days or years, depending on your experiment, but the most useful is 50 years. All the graphing, history and census data is only kept in memory for 50 years: if you stop the simulation every 50 years and save it to disk (each time under a different name), you can get continuous data and graphs for the whole experiment.

Data Logging...

Data Logging..., when active, continually saves simulation data to a disk file. When you select this item, it will open a dialog box or requester and let you choose a name and location for this file.

The data log file is in a standard ASCII, tab-delimited format and can be loaded into a number of spreadsheets or databases for charting, graphing and statistical analysis. This is an advanced feature for people who really love to play with spreadsheets and charts and graphs. The format for the data file can be found in your machine-specific addendum.

> *Warning: The data log file can get very big and will fill your drive if you're not careful.*

AutoSpeciate

When **AutoSpeciate** is selected, organisms that diverge so much from their Prototype Genome that they could not successfully mate with the prototype will automatically be reclassified as a new species.

The new species version number will be changed, but it will retain the same icon and name until and unless you change it.

Reconverge Species

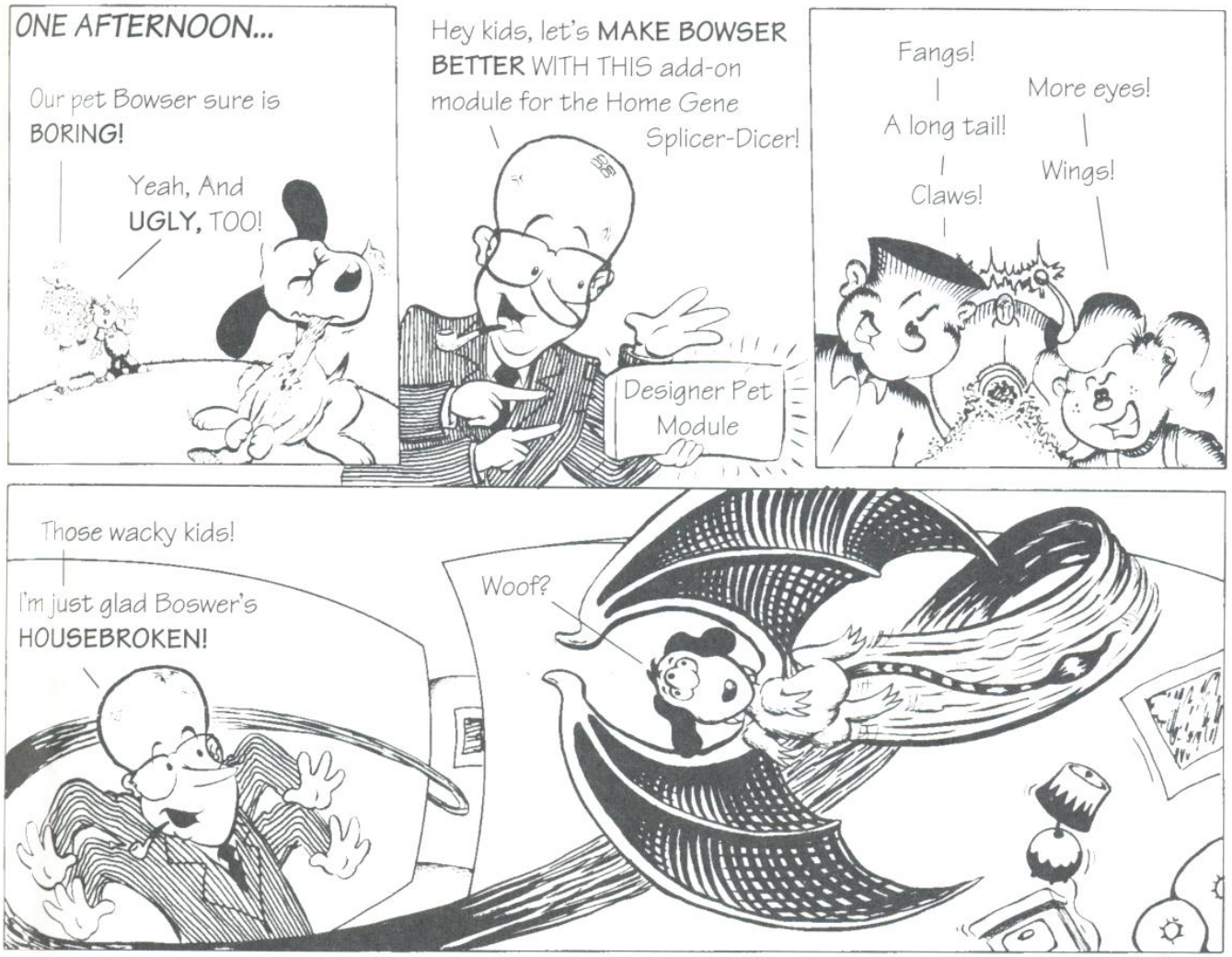
Reconverge Species recombines multiple species into a single species. If you have AutoSpeciate activated, you can end up with a large number of very similar species. Reconverge Species cleans up the clutter, combining a number of almost identical species into one or a few species.

This adds genetic diversity to older, existing species, and makes more room in the ecosystem for new species.

Here's how it works:

1. The total population of each existing species is examined, and all the genes are combined and averaged.
2. The species prototype is changed to match the average genotype

3. Starting with the newest species, each species prototype is compared to the prototype of every other (newer) species.
4. If, when the comparison is made, the two prototypes are able to successfully mate, the populations are combined into one species—into the first of the species to exist.



WINDOWS MENU

This menu is for opening and activating the various windows in SimLife.

DASHBOARD

Dashboard opens or activates the Dashboard.

VARIABLES

Variables opens or activates the Variables Window, which displays information on the highlighted individual plant or animal.

This item can only be chosen when an organism is highlighted.

PHENOTYPE

Phenotype opens or activates the Phenotype Window, which displays the flash card representation of the highlighted plant or animal.

This item can only be chosen when an organism is highlighted.

EVALUATION

Evaluation opens or activates the Evaluation Window.

EDIT

Edit opens or activates the Edit Window.

MAP

Map opens or activates the Map Window.

CLIMATE LAB

Climate Lab opens or activates the Climate Laboratory.

BIOLOGY LAB

Biology Lab opens or activates the Biology Laboratory.

CENSUS

Census opens a submenu that lets you choose from the seven census displays/graphs. Only one census window can be displayed on-screen at a time.

Diversity

Diversity opens or activates the Diversity Window, which shows how many different types of organisms are currently living in the world.

Food Web

Food Web opens or activates the Food Web Window, which graphically shows the predator/prey relationships in your ecosystem.

Gene Pool

Gene Pool opens or activates the Gene Pool Window, where you can see the evidence of evolution.

Graphs

Graphs opens or activates the Graphs Window, which can display, up to four at a time, any of 720 graphs in two time scales.

History

History opens or activates the History Window, which keeps a running record of all events in the world.

Mortality

Mortality opens or activates the Mortality Window, which displays a chart of the reasons for plant and animal death in your ecosystem.

Population

Population opens or activates the Population Window, which shows the relative populations of all plant or all animal species.

DISASTERS MENU

This menu lets you activate a number of disasters that will test the stability and resilience of your ecosystems, as well as show the dire consequences these disasters can produce.

Disasters that are currently in progress are indicated by a checkmark to their left. All disasters that you activate stay active until you select them again in the menu to terminate them.

Disasters will occur randomly in games unless No AutoDisasters is selected. Random disasters will turn themselves off after a while. As disasters turn off, they take a few simulation cycles to finish up and go away, so they don't cause worse problems by stopping abruptly (like beaching fish after a flood). Random disasters and those that occur as part of a scenario can't be turned off. They'll stop when they're good and ready. The length of and destruction caused by disasters depends on the difficulty setting in the Simulation Menu.

PLAGUE

Plague releases a deadly disease into the ecosystem. Plagues are passed from animal to animal. When an infected animal is right next to an uninfected animal, there is a 10% chance of the plague being passed on.

STD

STD releases a sexually transmitted disease into the ecosystem. STDs are passed when animals mate.

HEAT WAVE

Heat Wave causes the temperature all over the ecosystem to increase.

COLD WAVE

Cold Wave causes the temperature all over the ecosystem to decrease.

FLOOD

Flood causes a flood to occur.

DROUGHT

Drought causes a drought to occur.

FIRE

Fire starts a fire in the ecosystem, but only if there are plants.

COMET

Comet causes a large, destructive comet to impact somewhere in the ecosystem.

TELEPORT

Teleport causes many of the plants and animals to be randomly redistributed around the ecosystem.

CIVILIZATION

Civilization allows an invasion of our pristine ecosystem by land developers. Land developers are members of some strange industrial species that bulldozes the land and builds houses. (Humans. Can't take them anywhere.)

NO AUTO-DISASTERS

No Auto-Disasters eliminates random disasters from occurring, but won't stop disasters that occur in scenarios, or disasters you activate yourself. Selecting No Auto-Disasters after a disaster has begun will not stop it or make it end sooner.

SIMLIFE

WINDOWS

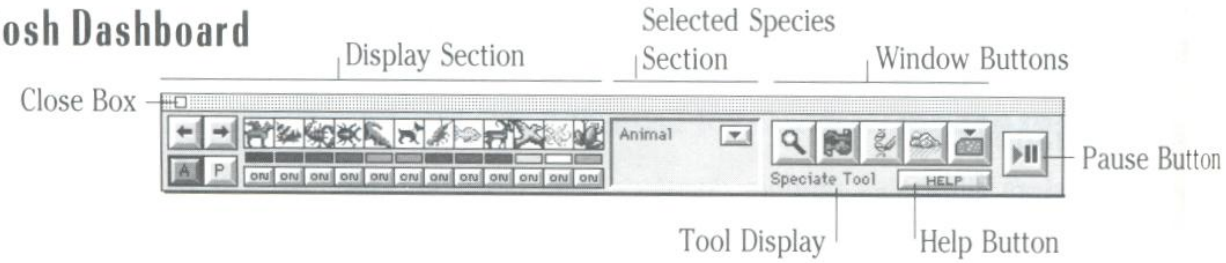
SimLife has a lot of windows. More windows than you can shake a stick at (or throw a stone through). You don't have to use all of them all of the time, so don't panic. They're all there for a reason, and will be more and more useful as you become more familiar with SimLife. Here is an explanation of each and every window, each and every button, slider and feature in each window, and an explanation of what they all do and why you'll want to do it.

DASHBOARD

The Dashboard is a row of buttons that gives you easy control over plant and animal display, access to all the other windows and a simulation pause button.

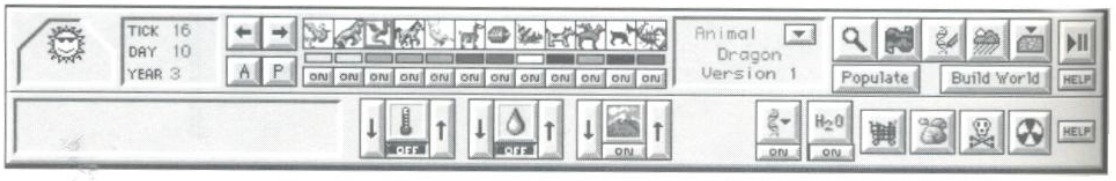
On the Macintosh, the Dashboard is a separate small window at the bottom of the screen, and will be displayed on top of any other window on the screen, with the exception of dialog boxes or requesters that wait for an "OK," "Never Mind," or "Make It So" before you can do anything else.

Macintosh Dashboard



On DOS and Windows computers, the Dashboard is found at the top of the screen, and is a control bar, not a separate window. Also, on these machines, the Edit Window Control Panel and the Map Window Control Panel (one at a time) are displayed as part of the Dashboard. Here's how the Dashboard looks on a DOS or Windows-based computer while combined with the Edit Window Control Panel. For more details and for other computers, check your machine-specific addendum.

Dos/Windows Dashboard



TITLE BAR (MAC VERSION ONLY)

At the top of the Dashboard is the Title Bar. While badly named (since it contains no title), it is still useful.

You can click and drag the Title Bar to move the Dashboard around the screen.

On the left side of the Title Bar is the Close Button. Clicking on the Close Button will make the Dashboard go away. You can bring it back by selecting Dashboard in the Windows menu.

ORGANISM DISPLAY CONTROLS

Below the Title Bar and on the left are the controls for displaying (or not displaying) different plants and animals.

The "A" and "P" buttons choose between dealing with animals and plants respectively.

The animals or plants are displayed in a row. These are the icons that represent the organisms in the Edit Window. Only 12 show at a time. You can use the left and right arrows to scroll through all possible organisms.

If you click on the picture or icon of any organism, it is highlighted and becomes the Selected Species. The name and type (plant or animal) of the organism appears in the center section of the Dashboard. The Selected Species becomes the default choice for use in most windows. For example, if you clicked on the Rose, then went to the Edit Window, the Rose would be the default organism to use with the Populate tool. Then, if you went to the Biology Lab, the Rose would be the default organism to genetically modify.

If you double-click on any organism's icon, the Biology Lab will open with that organism ready for dissection.

Right below the picture of the organism is a colored rectangle. This shows the color of the dot that the organism is represented by in the Map Window.

To change the color, click and hold on the rectangle to reveal a menu of color choices, slide the pointer to the color you want, then release the mouse button.

If you hold down the Option key (or Control key if your keyboard has no Option key) while selecting a color for a plant, then that color will be selected for *all* the plants. If you hold down the Option key (or Control key) while selecting a color for an animal, then that color will be selected for *all* the animals.

Below the color rectangles are the display On/Off buttons for each organism. Clicking them toggles their display on and off. Turning them off does not remove them from the simulation, just from view.

If you hold down the Option key (or Control key if your keyboard has no Option key) while turning a plant on or off, *all* the plants will be turned on or off. If you hold down the Option key (or Control key) while turning an animal on or off, *all* the animals will be turned on or off.

SELECTED SPECIES SECTION

The middle of the Dashboard displays and selects the Selected Species, which is the default organism to be used or manipulated in any of the windows.

The display shows three pieces of information: whether the Selected Species is a plant or an animal, the name of the Selected Species, and the version number of the Selected Species.

The Selected Species can be selected in two ways: click on its icon in the Organism Display Section to the left, or click and hold on the Select button (the one with the down-arrow) to reveal a menu of all possible organisms, then slide the pointer to the one you want and release the mouse button.

WINDOW BUTTONS

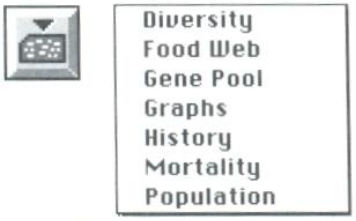
There are five buttons that open or activate different windows:

The Edit button opens or activates the Edit Window.

The Map button opens or activates the Map Window.

The Biology button opens or activates the Biology Lab.

The Climate button opens or activates the Climate Lab.



The Census button opens a submenu (notice the down-arrow) that lets you open or activate any of the six Census Windows. Each of these windows will be described in detail below.

PAUSE BUTTON

The Pause button stops time in the simulation. Click on the Pause button again to resume at the previous speed.

If you wish an experiment to proceed at a very slow, controlled pace, pause the simulation, then hold down the Option key (or control key) and click on the pause button. Time will move forward in a single step of one Tick (one simulation cycle) for each time you click.

EDIT WINDOW TOOL INDICATOR

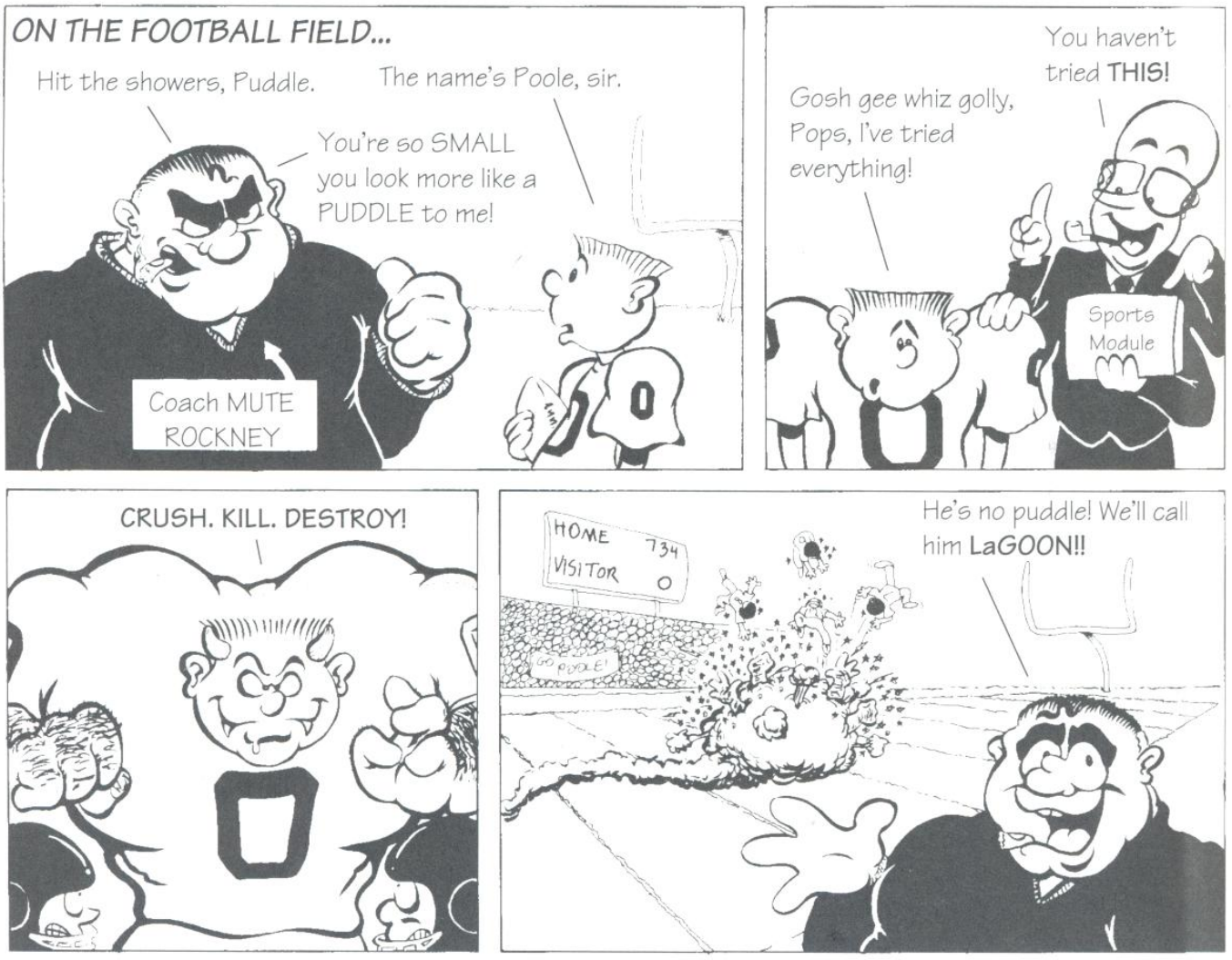
The Dashboard also contains an indicator that tells which tool is active in the Edit Window.

HELP BUTTON

Many windows in SimLife, especially those with many buttons, have a Help button to give you a quick on-screen reminder of what everything does. Click and hold on the Help button to get help.

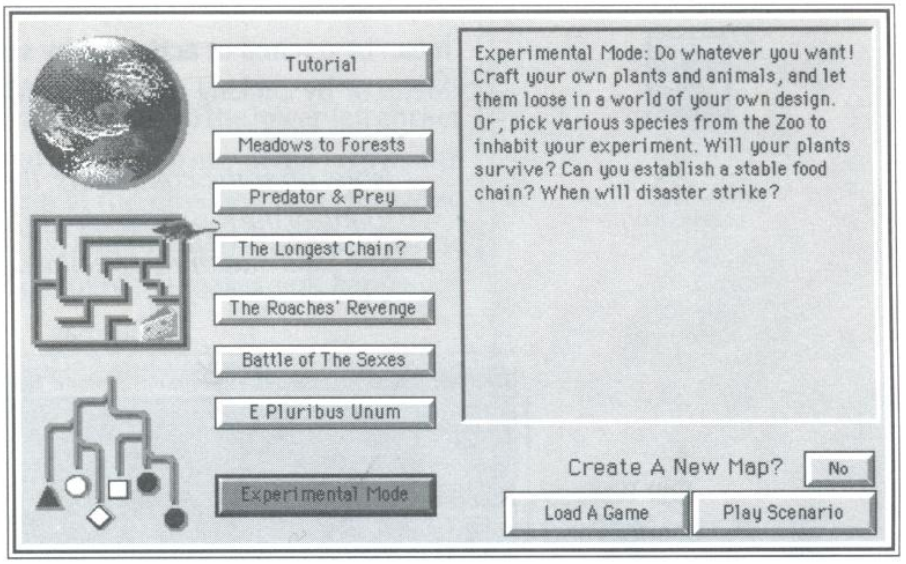
OTHER BUTTONS

On some computers there may be a few other buttons in or near the dashboard, such as Populate... and Build World... which are duplicated from the Map Window Control Panel. See your machine-specific addendum for details.



NEW GAME WINDOW

The **New Game** Window lets you select any of the nine scenarios, or start a new game in Experimental Mode. It opens when you first start SimLife and when you select New from the File Menu.



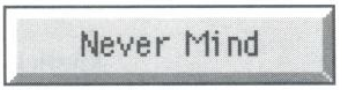
From this window you can start the on-screen tutorial, the scenarios, or Experimental Mode.

The six included scenarios deal with ecosystems and evolution. When you click on a scenario name, it will become highlighted and a brief description of its goals will appear in the upper-right corner of the window.

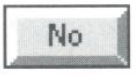
When you choose Experimental Mode, you are free to create your own scenarios and experiments.

Once you have highlighted the Tutorial, Experimental Mode, or the scenario you want to play, click on the Play Scenario button.

When you first start SimLife, you must select either a scenario or Experimental mode. When you first load the game the Never Mind button will not be available. If you open the New Game Window at a later time, you will have the opportunity to leave this window without selecting a scenario by clicking on Never Mind.



The YES/NO button lets you play any scenario in a world of your own design instead of the default world. First, build or load that world, then click this button to say NO, then highlight the scenario and click Play Scenario.



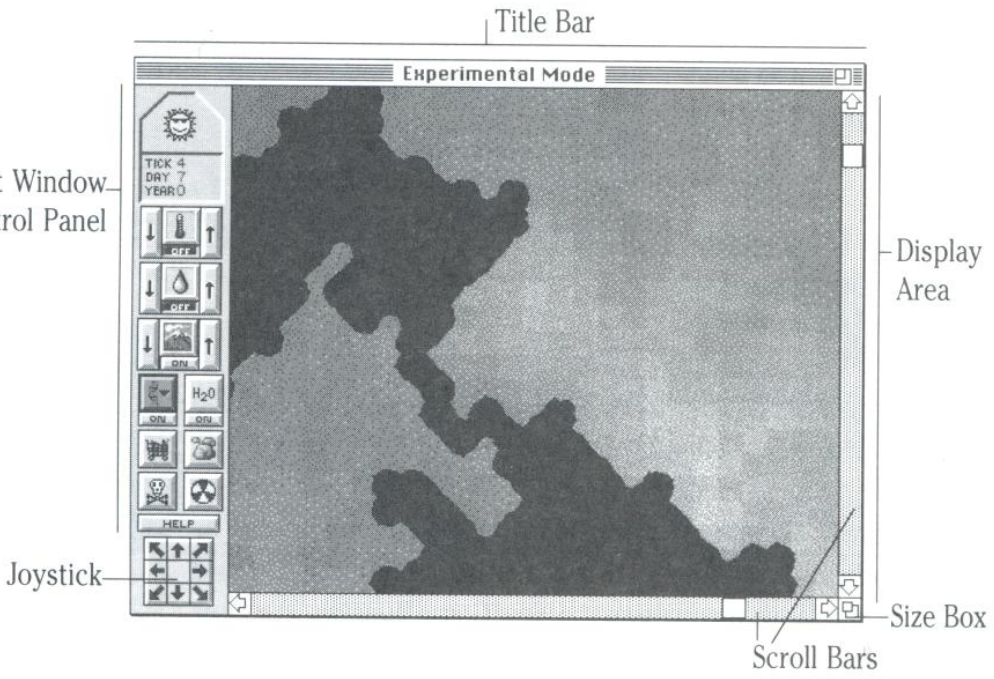
SIMLIFE

EDIT WINDOW

The Edit Window is a close-up view of the world. Here you can modify the terrain and the microclimate, populate the world with plants and animals, and manipulate the environment.

It can be opened or activated by selecting Edit Window in the Windows Menu or by clicking on the Edit Window button in the Dashboard.

Note: on some computers, the Edit Window Control Panel is found at the top of the screen, integrated with the Dashboard. See your machine-specific addendum for details.



EDIT WINDOW TITLE BAR

The Edit Window Title Bar displays the name of the current scenario or game. The Edit Window can be moved around the screen by clicking and dragging the Title Bar.

Clicking on the Grow Box on the right side of the Title Bar expands the window to fill the screen. Clicking on it again shrinks it to its previous size. Depending on your computer, you may or may not be able to close the Edit Window while SimLife is running.

THE DISPLAY AREA

The biggest section of the Edit Window is the display of the world. The world is too big to be shown in its entirety in this window at one time, so there are Scroll Bars, Scroll Arrows and Scroll Boxes to help you navigate to any place in the world.

On some computers there is a scrolling "joystick" in the lower-left corner of the window. Clicking or clicking and holding on any of the arrows will scroll the Display Area over the world in the direction that the arrow points. Clicking on the blank space in the middle where there is no arrow doesn't do anything, but you can click there if it makes you happy.

You can resize the Edit Window by clicking and dragging the Size Box in the lower-right corner of the window.

Things In The Display Area

In the Display Area, you will see: Land (in 16 levels of altitude), Water, Plants, Animals and Artifacts.

Artifacts are special items you can place in the ecosystem such as barriers, Ultra-Food food sources, toxins and mutagens.

Artifacts

Drawing Order

Often more than one "thing" will occupy a place at a time even though only one can be seen at a time. Things are drawn on the screen in the order below, from top to bottom:

1. Temperature or Moisture Layers (only when turned on)
2. Animals
3. Plants
4. Artifacts
5. Water
6. Altitude

Turning off different layers in either the Edit Window Control Panel or the Simulation Menu can help clear the clutter.

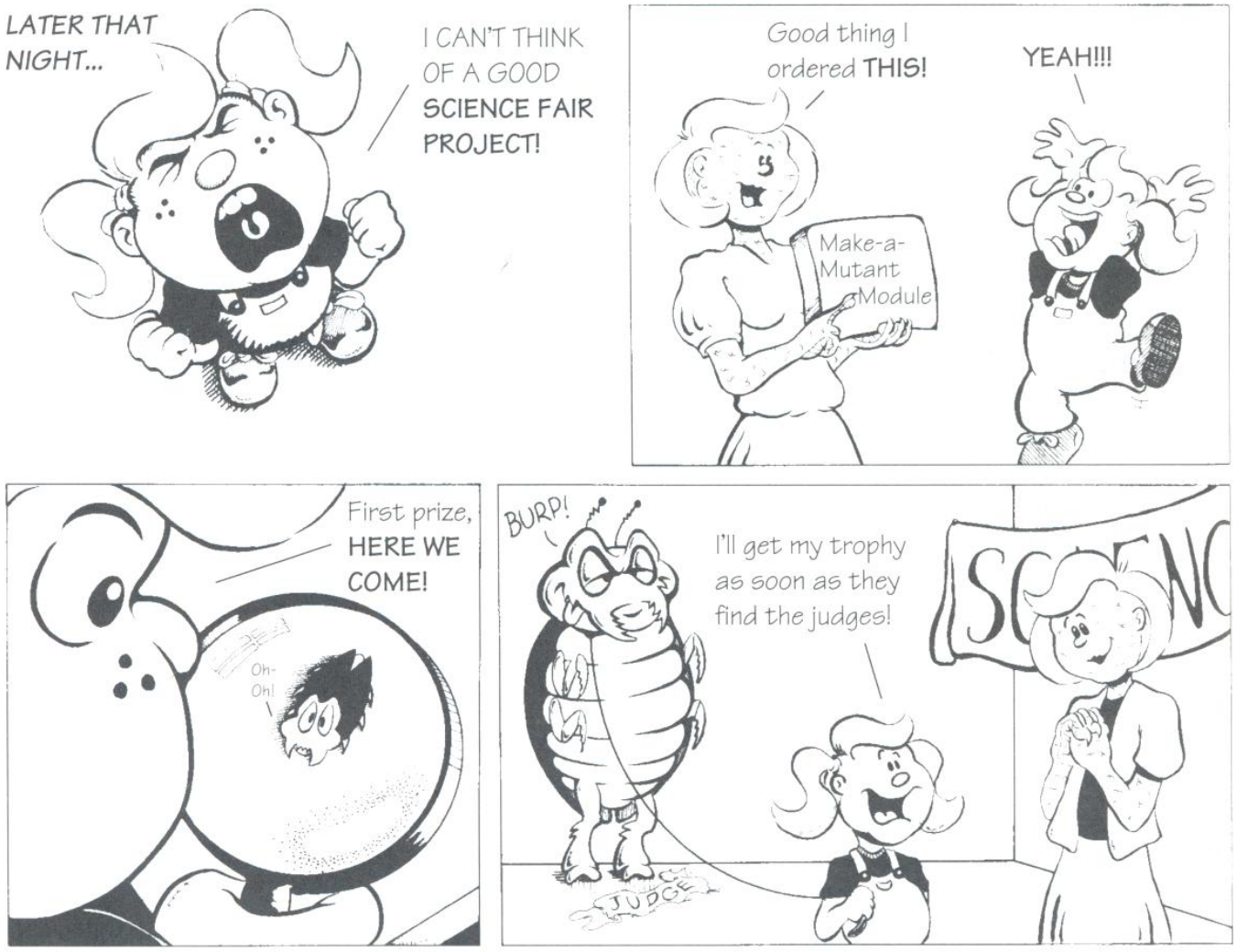
SIMLIFE

THE EDIT WINDOW CONTROL PANEL

This control panel graphically displays the passage of time, controls what data is shown in the Display Area, and provides all the tools you will need to modify the land and environment.

As shown here, it is a vertical panel on the left side of the Edit Window. On some computers it is a horizontal panel at the top of the screen, integrated with the Dashboard.

An indicator that tells which tool is currently active in the Edit Window can be found in the Dashboard.



Time Display

This display shows the passage of time. The sun and moon cycle showing day and night. At the peak of each lunar circle, an icon depicting the current season is displayed.

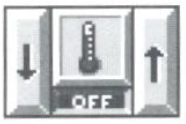
Below the sun and moon is a digital clock that displays the Tick, Day and Year.

A tick is the amount of time it takes your computer to completely calculate one simulation cycle. The actual (real-time) duration of a tick varies with the speed of your computer.

The number of ticks per day and days per year varies with the different scenarios, and can be customized for different experiments.

Each year is divided up into four equally lengthed seasons: summer, fall, winter and spring.

Temperature Tool



The **Temperature** tool controls the display of temperature data in the Edit Window and lets you modify the local temperature.

To toggle the display of the temperature layer in the Edit Window on and off, click anywhere on the button. The words "on" or "off" will appear below the temperature icon, indicating... well, you know.

The temperature is displayed as colored or shaded squares. A color key to help you interpret the temperature can be found in the Map Window Control Panel when the temperature display is active in the Map Window.

Turning off the temperature display does not affect the actual temperature in the simulation, only whether or not it is shown in the Edit Window.

To raise or lower the temperature in a specific area of the ecosystem, click on the up or down arrows on either side of the temperature icon,

then click, click and hold, or click and drag in the display area. After you have adjusted the temperature up or down, it will still vary with the seasons.

If you want to raise or lower the temperature in a very small area (a cell or tile, the size of one plant or animal), hold down the Option key while you click. If your keyboard doesn't have an Option key, use the Control key.

When the cursor is in the Edit Window Display Area and the temperature tool is active, it will appear as a thermometer.

Seeing the temperature display can help you understand your ecosystem's climate and discover reasons why different plants or animals thrive or die in different areas.

Adjusting the temperature directly affects the local plant life and indirectly affects the animals. By raising or lowering the temperature in one (or more) section(s) of a world, you can have two or more ecosystems existing side-by-side for comparison experiments.

If you change the temperature slowly over a period of many years you may be able to track the genetic changes of the local plant life as it adapts to its changing environment.

Moisture Tool

The **Moisture** tool controls the display of moisture data in the Edit Window, and lets you modify the local moisture in the air.

In SimLife, moisture is the combination of humidity and rainfall—all the water that stays in or passes through the atmosphere.

To toggle the display of the Moisture layer in the Edit Window on and off, click anywhere on the button. The words "on" or "off" will appear below the moisture icon, indicating... I'll give you two guesses.

Moisture is displayed as colored or shaded squares. A color key to help you interpret the moisture can be found in the Map Window Control Panel when the moisture display is active in the Map Window.

Turning off the moisture display does not affect the simulation, only whether or not it is shown in the Edit Window.

To raise or lower the moisture in a specific area of the ecosystem, click on the up or down arrows, respectively, to either side of the moisture icon, then click, click and hold, or click and drag in the display area. After you have adjusted the moisture up or down, it will still vary with the seasons.

If you want to raise or lower the moisture in a very small area (a cell or tile, the size of one plant or animal), hold down the Option key while you click. If your keyboard doesn't have an Option key, use the Control key.

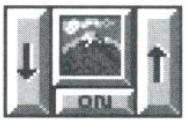
When the cursor is in the Edit Window Display Area and the moisture tool is active, it will appear as a water drop.

Seeing the moisture display can help you understand your ecosystem's climate, and discover reasons why different plants or animals thrive or die in different areas.

Adjusting the moisture directly affects the local plant life and indirectly affects the animals. If you change the moisture slowly over a period of many years you may be able to track the genetic changes of the local plant life as it adapts to its changing environment.

Altitude Tool

The **Altitude** tool controls the display of altitude data in the Edit Window and lets you raise or lower the land.



To toggle the display of the altitude layer in the Edit Window on and off, click anywhere on the button. The words "on" or "off" will appear below the altitude icon, indicating... I'll let you figure it out.

The altitude is displayed as a range of colors or shades, from dark to light as altitude increases. A color key to help you interpret the altitude can be found in the Map Window Control Panel when the altitude display is active in the Map Window.

Turning off the altitude display does not affect the simulation, only whether or not it is shown in the Edit Window.

To raise or lower the land in a specific area of the ecosystem, click on the up or down arrows on either side of the altitude icon, then click, click and hold, or click and drag in the display area.

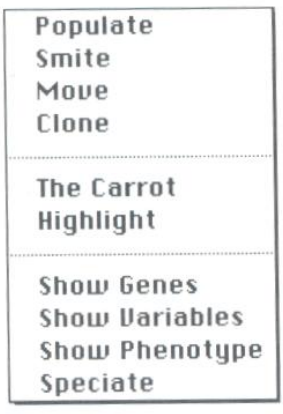
When the cursor is in the Edit Window Display Area and the altitude tool is active, it will appear as a mountain.

Seeing the altitude display can help you understand your ecosystem's climate, and discover reasons why different plants or animals thrive or die in different areas.

Life Tool

The **Life** tool is a multi-function tool that gives you the capabilities of displaying, placing, marking, moving, cloning, smiting and inspecting any organism in the ecosystem.

Click on the small On/Off button below the icon to turn on and off the display of all life in the ecosystem.



Click and hold on the Life icon to see a pop-up menu of all the capabilities of this tool.

Click quickly on the Life icon to reselect the previous submenu choice without opening the submenu.

Populate

Populate lets you add plants or animals to the ecosystem.

When Populate is active, the cursor will appear as a DNA spiral. Clicking or clicking and dragging will place the Selected Species into the ecosystem. To change the Selected Species, see the section on the Dashboard above.

There are places where you cannot place a new organism. You can't place a plant on a plant, or an animal on an animal. Sometimes when you place an organism, you cannot see it any more. That's usually because there is something else in that spot that has drawing priority, i.e., animals are drawn over plants, etc. A complete explanation of drawing order is given in the Edit Window Display Area section above.

Smite

Smite lets you remove individual plants or animals from the world. When Smite is active, the cursor becomes a lightning bolt. Click on any life-form to end its miserable existence (or enjoyable existence, if you want to feel guilty).

To remove an entire species, see the Populate Window below.

Move

Move lets you drag an individual plant or animal to another location. When Move is active, the cursor becomes a hand. Click and drag to move any organism to another place.

When moving an organism, you can't place a plant on a plant or an animal on an animal. If you place an organism and cannot see it any more, it's because something else in that spot has drawing priority, i.e., animals are drawn over plants, etc.

Clone

Clone lets you make a copy of an existing plant or animal. When Clone is active, the cursor becomes a double set of DNA spirals. Click and hold

on any organism, then drag the cursor to a new location and release the mouse button.

If you hold down the Option key (or Control key on computers with no Option key) while cloning, the clone will mutate. For more information on mutations, see the section on Mutation below.

When cloning an organism, you cannot place a plant on a plant or an animal on an animal. If you place an organism and can't see it any more, it's because something else in that spot has drawing priority, i.e., animals are drawn over plants, etc.

The Carrot (Recruit)

The Carrot is for calling individual animals. When the Carrot is active, the cursor will appear as a carrot. While the Carrot is active, and you click and hold (for a while) in the display area, the animals of the Selected Species (the one listed in the middle section of the Dashboard) will try to go to where you click.

To change the Selected Species, see the section on the Dashboard above.

If you hold down the Option key (or Control key if your keyboard has no Option key) and click, only the highlighted animal will be called to your click.

This tool is useful for separating individuals or groups so it is easier to move, clone, relocate or otherwise play with them.

Highlight

Highlight lets you mark a plant or animal. When Highlight is active, the cursor becomes a highlighted box. Click on any organism to highlight it.

When you highlight an organism, it becomes the Selected Species. When Auto Tracking is active in the Goodies submenu of the Simulation Menu, the screen will scroll so the highlighted organism stays in view.

Show Genes

Show Genes allows you to inspect the genes of any individual plant or animal. When Show Genes is active, the cursor will appear as a DNA spiral and pencil. Click on any organism to bring up the Genome Window.

This is the one place in SimLife when you can inspect and modify the genes of one individual organism instead of the species prototype.

The Genome Window is explained in detail below.

Show Variables

Show Variables allows you to inspect the simulation variables of any individual plant or animal. These variables are the non-genetic information that is different for each organism and that changes throughout its life, including health, age, height, weight, etc.

When Show Variables is active, the cursor will appear as a slider control. Click on any organism to bring up the Variables Window. The Variables Window is explained in detail below.

Show Phenotype

Show Phenotype brings up a small window displaying the "flash card" image of any plant or animal. When Show Phenotype is active, the cursor will appear as an eye. Click on any organism to see its flash card picture.

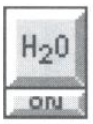
The Phenotype Window is explained in detail below.

Speciate

Speciate lets you grab an individual organism from one species and change it into another species in a number of ways.

When Speciate is active, the cursor will appear as a sort of triangle of three boxes, representing "two descended from one." Click on any organism to open the Speciate Window. The Speciate Window is explained in detail below.

Water Tool



The **Water** tool toggles on and off the display of water in the Edit Window, and lets you add or remove water from the ecosystem.

Click on the small On/Off button below the icon to turn on and off the display of all water in the ecosystem.

When the Water tool is active, the cursor says H_2O. Click or click and drag the cursor on land to turn it into water. Click or click and drag on water to turn it into land.

Use this tool to customize landforms, enlarge or remove lakes and isolate groups of land animals. You can also make islands and moats, and spell your name in a river.

Food Tool

The **Food** tool lets you place or remove Ultra-Food food sources anywhere you want. This food will feed any animal an unlimited supply of whatever it needs to survive. This is especially useful in newer ecosystems that haven't had time for plants to spread, or when the food chain has been broken.

When the Food tool is active, the cursor becomes a shopping cart.

Ultra-Food food sources last forever and provide an unlimited amount of food to all animals that approach them.

Barrier Tool

The Barrier tool lets you put down impenetrable barriers in the ecosystem that only flying organisms can cross.

When the Barrier tool is active, the cursor becomes a pile of rocks. Click anywhere on land or water to place a barrier.

Barriers are useful for dividing populations into isolated groups. You can then expose each group to different environmental pressures and track the divergent evolution in the different groups.

Since flying organisms can cross barriers, to isolate them you'll have to use the altitude tool and make very high mountains.

Toxin Tool

The **Toxin** tool lets you place a deadly poison into the ecosystem. This poison will decrease an organism's health when it is directly adjacent to it.

When the Toxin tool is active, the cursor becomes a skull and crossbones. Click or click and drag in the Edit Window to place toxins.

If you place a toxin on top of a creature, the creature will be drawn on top of the toxin. You may want to temporarily turn off the life layer when placing toxins.

Mutagen Tool

The **Mutagen** tool allows you to place material in the ecosystem that will raise the odds of mutations occurring in nearby plants and animals.

When the Mutagen tool is active, the cursor becomes the radiation symbol. Click or click and drag in the Edit Window to place mutagens.

If you place a mutagen on top of a creature, the creature will be drawn on top of the mutagen. You may want to temporarily turn off the life layer when placing mutagens.

A detailed description of Mutation is found below in the Reference section.

Help

Click and hold on the Help button to see an on-screen reminder of what each button in the Edit Window Control Panel does.

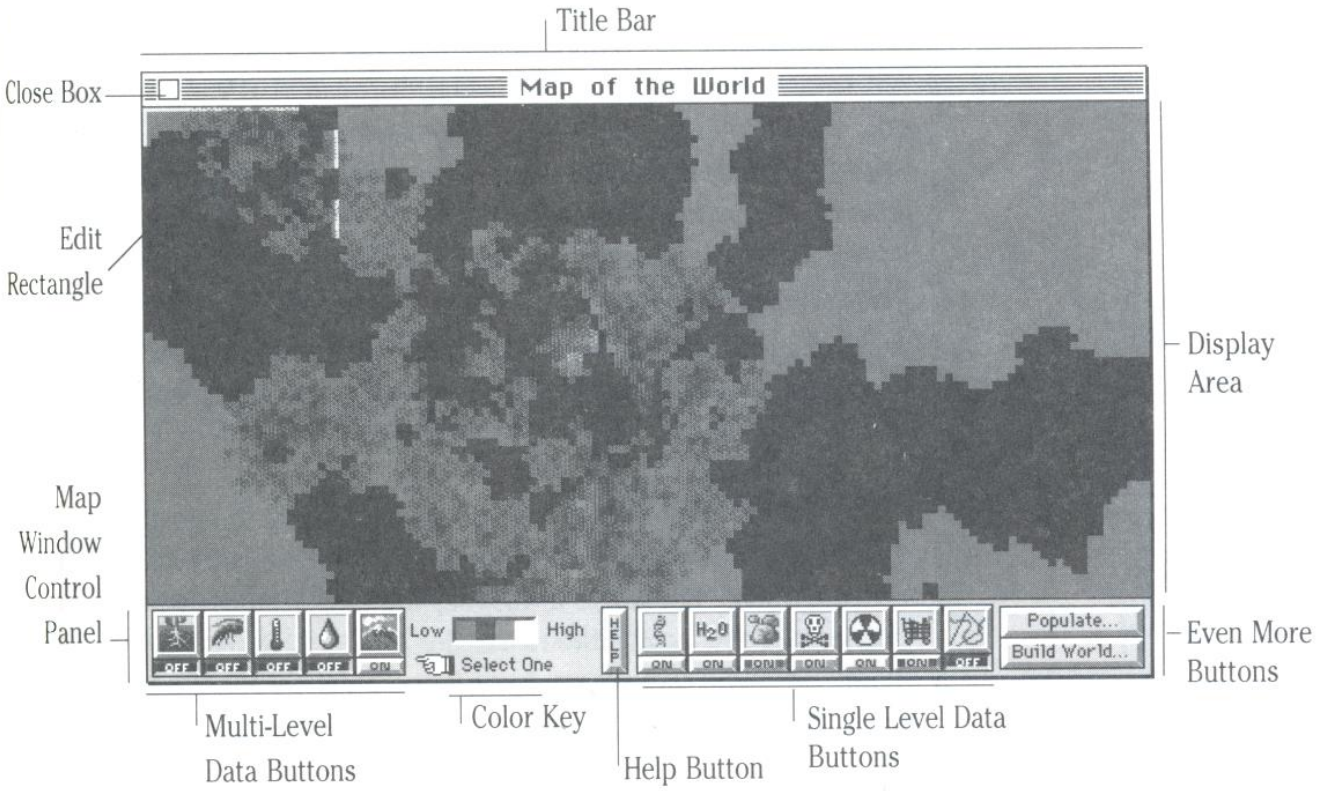
The Joystick

This is a simulated joystick to scroll the area that is displayed in the Edit Window. Clicking or clicking and holding on any of the arrows will scroll the Display Area over the world in the direction the arrow points.

MAP WINDOW

The Map Window is a satellite view of the entire world. It is where you get an overview of the status of your ecosystem, garner information on the environment and soil quality, and check the location of various objects and organisms. It is also the launching site for mass-populating the ecosystem and building new worlds.

The Map Window can be opened or activated by selecting Map in the Windows Menu or by clicking on the Map icon on the Dashboard.



Note: on some computers, the Map Window Control Panel is found at the top of the screen, integrated with the Dashboard. See your machine-specific addendum for details.

MAP WINDOW TITLE BAR

The Map Window Title Bar displays the scenario name, or the world name if you build one of your own.

The Map Window can be moved around the screen by clicking and dragging the Title Bar. Clicking on the Close Box on the left side of the Title Bar makes the Map Window go away.

DISPLAY AREA

The Map Window Display Area is the actual map of your world. Because of the scale of the map, objects, items and organisms in it are tiny and are represented by colored or shaded dots or areas.

Many of the objects can be recognized by the color keys or indicators in the Map Window Control Panel. Organisms can be identified by their color as shown on the Dashboard.

Edit Rectangle

Somewhere in the Map Window Display Area is the Edit Rectangle. This rectangle circumscribes the area of the map that is currently visible in the Edit Window.

Clicking anywhere on the map will cause the Edit Rectangle to center itself around the cursor. You can also click and drag the Edit Rectangle. When the Edit Rectangle is moved, the Edit Window will change to display the new area in the rectangle.

Double-clicking in the Edit Rectangle brings the Edit Window to the front.

THE MAP WINDOW CONTROL PANEL

The Map Window Control Panel is filled with buttons that control what is viewed in the map. The display controls do not affect the world or the simulation in any way, just what you see at a particular time.

There are two different types of display controls: multi-level displays—only one (or none) of which can be displayed at a time, and single level

displays—any or all of which can be displayed at a time. When applicable, a color key will appear near the middle of the Map Window Control Panel to help you interpret the multi-level data.

There are also two buttons that open the related Populate and World Design Windows.

Soil Depth

Soil Depth shows the depth, and therefore (in SimLife at least), the quality of the soil. It is a multi-level display, and cannot be displayed at the same time as any other multi-level display.

A color/shade key to help you interpret soil depth will appear near the middle of the Map Window Control Panel.

The deeper the soil, the better the conditions and the more nutrients there are for plants. New worlds will have shallow soil, but as plants grow and die, they increase the depth. There will always be at least *some* good soil in new worlds, especially near water sources.

Soil will erode if there are no plants on it.

Filter Feeder Food

Filter Feeder Food shows the amount of food available for the filter-feeding animals such as crustaceans and whales in the ocean, and spiders, insect-eating birds and anteaters on the land. It is a multi-level display, and cannot be displayed at the same time as any other multi-level display.

Filter food consists of plants and animals in the ocean, the soil and the air that range from microscopic size to the size of large insects. Filter food is at the bottom of the food chain.

Filter food concentrates in shallow water and on shorelines, where it can get nutrients from the nearby soil yet still receive sunlight. Since it requires sunlight, the amount of filter feeder food will vary with the seasons.

A color/shade key to help you interpret the available filter feeder food will appear near the middle of the Map Window Control Panel.

Temperature

Temperature shows the air temperature in the world. It is a multi-level display, and cannot be displayed at the same time as any other multi-level display.

A color/shade key to help you interpret the temperature will appear near the middle of the Map Window Control Panel.

Temperature changes with the seasons and directly affects plants and indirectly affects animals.

Moisture

Moisture shows the amount of moisture in the world. It is a multi-level display, and cannot be displayed at the same time as any other multi-level display.

A color/shade key to help you interpret humidity will appear near the middle of the Map Window Control Panel.

Moisture includes both humidity in the air and precipitation, and changes with the seasons. The presence of plants increases moisture. As moisture increases, plant-growing conditions improve so more plants can grow. This in turn attracts and feeds more animals and increases soil depth.

Altitude

Altitude shows the height of the land in the world. It is a multi-level display, and cannot be displayed at the same time as any other multi-level display.

A color/shade key to help you interpret altitude will appear near the middle of the Map Window Control Panel.

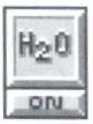
The altitude of a new world affects the climate. (See *The World Building Process* in Miscellaneous Simstuff at the end of this section for more info.) Also, only animals with climbing capability can move up or down steep slopes.

Life

Life toggles on and off the display of plants and animals on the map. This is a single-level display, and can be viewed along with one of the multi-level displays and any or all of the other single-level displays.

See the Dashboard to find out what colors represent which organisms.

Water



Water toggles on and off the display of all water on the map. This is a single-level display, and can be viewed along with one of the multi-level displays and any or all of the other single-level displays.

Barriers

Barriers toggles on and off the display of any barriers on the map. This is a single-level display, and can be viewed along with one of the multi-level displays and any or all of the other single-level displays.

Toxins

Toxins toggles on and off the display of any toxin deposits on the map. This is a single-level display, and can be viewed along with one of the multi-level displays and any or all of the other single-level displays.

Mutagens

Mutagens toggles on and off the display of mutation-causing agents on the map. This is a single-level display, and can be viewed along with one of the multi-level displays and any or all of the other single-level displays.

Food Sources

Food Sources toggles on and off the display of any Ultra-Food food sources on the map. This is a single-level display, and can be viewed along with one of the multi-level displays and any or all of the other single-level displays.

Trails

Trails toggles on and off the display of the trails that animals follow on the map, so their foraging movements can be observed. This is a single-level display, and can be viewed along with one of the multi-level displays and any or all of the other single-level displays.

Trails, like all other data layers, exist even when their display is turned off. Trails are used by animals to find or avoid each other for eating or mating, or because of genetic attraction or avoidance.

Animals can sense and follow other animals' trails. This is the SimLife equivalent to vision and is controlled by the vision gene.

Help

Click and hold on the Help button to see an on-screen reminder of what each button in the Map Window Control Panel does.

Populate Button

Populate... opens the Populate Window so you can add plants or animals to the world. A complete explanation of the Populate Window can be found below.

You can hold down the Option key (or the Control Key if your keyboard has no Option key) while clicking on the Populate button to randomly populate the world with plants and animals.

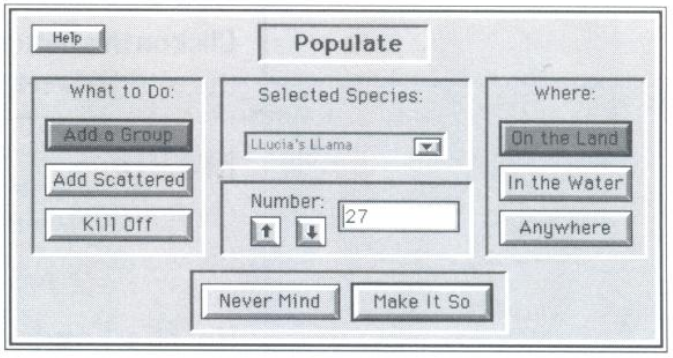
Build World Button

Build World... opens the World Design Window so you can create a new world. A complete explanation of the World Design Window can be found below.

POPULATE WINDOW

The Populate Window lets you add or delete plants and animals to or from the world in large numbers, as opposed to the Edit Window, where you can only add or remove one organism at a time.

The Populate Window can be reached through the Populate button in the Map Window Control Panel, and through the Goodies submenu in the Simulation Menu.



The basic process of populating the world is to first select a species (or group of species), and pick a number of organisms to be added or deleted. Next, choose whether to add the species (either as a group or scattered all over the world) or delete the species. Then decide whether the organisms should be put on the land or in the water or both. And last, instruct the computer to "Make It So."

Selected Species

The Selected Species is the type of plant or animal you want to add or remove. It will default to the Selected Species in the Dashboard.

To change the Selected Species, click and hold on the arrow button to open a submenu of all available plants and animals, then slide the cursor to the one you want. In addition to individual species, you can also select either All Plants or All Animals.

When you change the Selected Species in the Populate Window, it will also change in the Dashboard.

Number

This is the number of organisms to be added or deleted. If you have chosen All Plants or All Animals as the Selected Species, then this number of *each* species will be added.

To adjust the number, click or click and hold on the up or down arrows, or highlight the number and type in a new one.

Add A Group

Click on this button if you want the Selected Species to be added to the world in a group.

Add Scattered

Click on this button if you want the Selected Species to be spread all over the world when it is added.

Kill Off

Click on this button if you want the Selected Species to be removed from the world.

On The Land

Click on this button if you want the Selected Species to be placed on dry land when it is added to the world.

In The Water

Click on this button if you want the Selected Species to be placed in the water when it is added to the world.

Anywhere

Click on this button if you want the Selected Species to be placed randomly on both land and water when it is added to the world.

Never Mind

Click on this button if you wish to leave the Populate Window without adding or deleting any organisms.

Make It So

Click on this button when you are happy with all the settings above. The Selected Species will be added or deleted and the Populate Window will close.

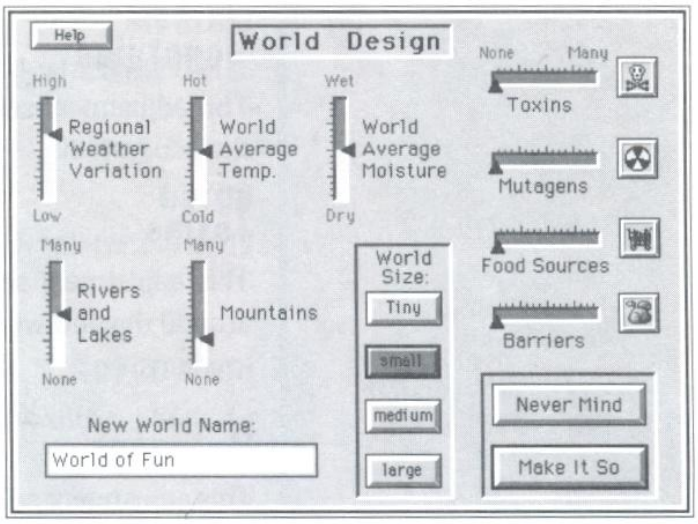
Help

Click and hold on the Help button to see on-screen help for this window.

WORLD DESIGN WINDOW

The World Design Window lets you create new worlds to suit your whims or the needs of your experiments. It can be reached through the Build World button in the Map Window Control Panel, and through the Goodies submenu in the Simulation Menu.

The basic process of world design is to first choose settings for climate, rivers and mountains, then decide which and how many artifacts you want in the world, then pick a size for the world, name it and "Make It So."



Most of the settings involve slider controls. To adjust them, click and drag the arrows.

There are four possible world sizes. When choosing world sizes, keep in mind the speed of your computer (larger worlds run slower), the amount of RAM you have (larger worlds take more memory), and the particular experiment you are designing. Larger world sizes are not available on some computers while in black and white mode.

Regional Weather Variation

This adjustment controls the variations in temperature and moisture in your ecosystem's climate. When set to high, the seasonal changes in both temperature and moisture will be high. When set to low, the ecosystem will have very little difference between seasons.

World Average Temperature

This adjustment sets the average, or center point around which the seasonal temperature variations vary.

World Average Moisture

This adjustment sets the average, or center point around which the seasonal moisture variations vary.

Rivers And Lakes

This adjustment sets the amount of the ecosystem that is covered by water. It ranges from none to many, which will cover the entire world except for the highest mountain peaks. If you set Rivers and Lakes to many and Mountains to none in the adjustment below, you can create an ocean-only ecosystem.

Mountains

This adjustment sets the amount of mountains that will be generated in the ecosystem.

Toxins

This adjustment sets the amount of toxins that will appear scattered around the new world when it is generated. These can be set from none to many.

Mutagens

This adjustment sets the amount of mutagens that will appear scattered around the new world when it is generated. These can be set from none to many.

Food Sources

This adjustment sets the amount of Ultra-Food Food Sources that will appear scattered around the new world when it is generated. These can be set from none to many.

Barriers

This adjustment sets the amount of Barriers that will appear scattered around the new world when it is generated. These can be set from none to many.

New World Name

This is where you enter the name for the new world.

Tiny

Click on this button to generate a tiny world, which will be 32 x 64 tiles.

Small

Click on this button to generate a small world, which will be 64 x 128 tiles.

Medium

Click on this button to generate a medium-sized world, which will be 128 x 256 tiles.

Large

Click on this button to generate a large world, which will be 256 x 512 tiles.

Never Mind

Click here if you want to exit the World Design Window without building a new world.

Make It So

Click here when you are satisfied with all the settings and want to exit this window and proceed with building a new world.

Help

Click and hold on the Help button to see on-screen help for this window.

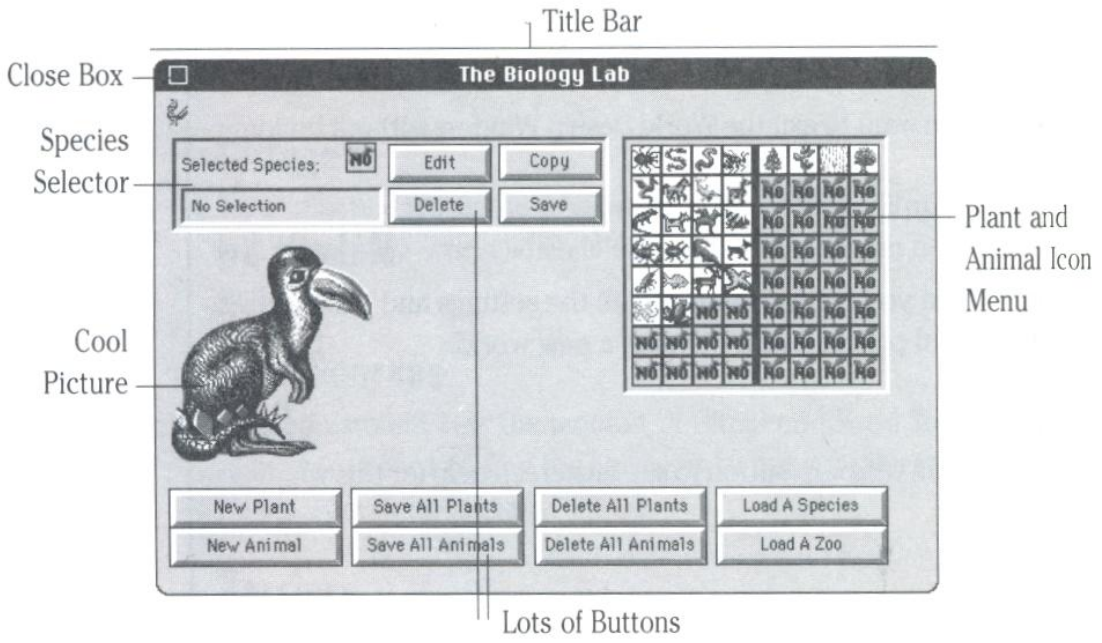
SIMLIFE

BIOLOGY LAB

The Biology Lab is a multi-level window for inspecting and modifying existing plant and animal species, and designing and creating new ones. It can be reached either through the Biology Lab item in the Windows Menu or through the Biology Lab icon in the Dashboard. You can also open the Biology Lab directly to the second (edit) level by double-clicking on an organism's icon in the Dashboard.

The Biology Lab can be moved around the screen by clicking and dragging the Title Bar. It will go away if you click in the Close Box.

Biology Lab at Select Level



The first level of the Biology Lab is for selecting an organism to work with. The second level is for editing, where you modify the organism and/or its icon. From the second level you can open the Genome Window and inspect or manipulate the organism's genetic code.

PROTOTYPES AND INDIVIDUALS

In the Biology Lab, you can only edit the Prototype (the genetic starting point) of a species.

To edit the genes of an individual organism, you will have to select the individual in the Edit Window with the Show Genes function of the Life Tool and do the editing in the Genome Window.

SELECT LEVEL

Here you select an existing species to edit, copy, delete or save. You can also create a new plant or animal species, or load in previously saved species, individually or in groups (zoos). Once you have gone from here to the Edit Level and modified a species, return here to save your changes.

Selected Species

This is the species that is ready for editing, copying, etc. Icons of all possible species are displayed on the right side of the window. To select a new Selected Species, click its icon. Changing the Selected Species here changes it in all windows.

Edit

Click here to move to the Edit level of the Biology Lab so you can inspect or modify the Selected Species.

Copy

Click here to make a copy of the Selected Species that you can then edit and save.

Delete

Click here to remove the Selected Species from the current world. Deleting a species will not remove it from the disk or prevent you from using it in another world.

Save

Click here to save your edited species to disk for later use.

Warning: If you edit any of the plants and animals that come with SimLife, you should save them under different names or in different folders or directories than the originals so you can go back to the originals at a later time. Whatever you do, don't save over the original plants and animals on the original disks. Protect your Zoo!

New Plant

Click here to go to the Edit Level of the Biology Lab to create a new plant.

New Animal

Click here to go to the Edit Level of the Biology Lab to create a new animal.

Save All Plants

Click here to save all the currently defined plants to disk in a single file. These plants can all be loaded in at once by using the Load A Zoo button.

Save All Animals

Click here to save all currently defined animal species to disk in a single file. These animals can all be loaded in at once by using the Load A Zoo button.

Delete All Plants

Click here to remove all plants from the world. This only removes them from the current world in the current experiment or scenario; it does not remove them from the disk or prevent them from being used in other worlds or scenarios.

Delete All Animals

Click here to remove all animals from the world. This only removes them from the current world in the current experiment or scenario; it does not remove them from the disk or prevent them from being used in other worlds or scenarios.

Load A Species

Click here to open a dialog box or requester to load in a previously saved plant or animal.

Load A Zoo

Click here to open a dialog box or requester to load in a previously saved Zoo file. A Zoo is a group of plants or animals saved together by using the Save All Plants or Save All Animals buttons.

EDIT LEVEL

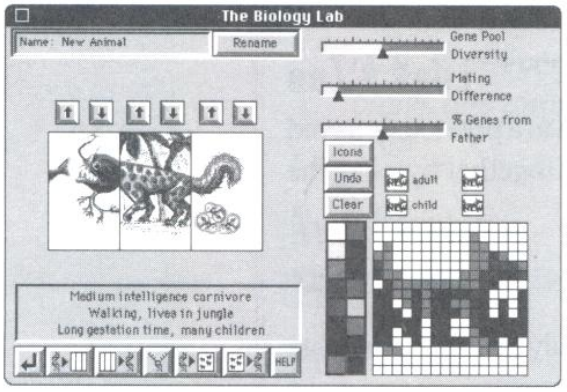
The Edit Level of the Biology Lab lets you easily modify or design organisms, as well as draw or change icons for the organisms and make a few basic genetic manipulations.

When you edit at the Edit Level, you can never edit one individual member of a species. You can only edit the prototype of the species.

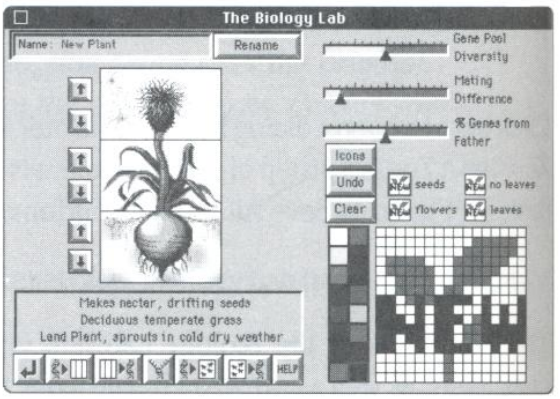
You can get to the Edit Level from the Select Level by selecting a species from the icons and then clicking the Edit button, by double-clicking on a Select Level plant or animal icon, or by clicking either the New Plant or New Animal buttons.

You can also edit a species by double-clicking on the species' icon on the Dashboard. Whenever you start a new plant or animal, you will be editing the entire species.

The Edit Level of the Biology Lab is slightly different for animals and plants.



Edit Level for Animal



Edit Level for Plant

Name

This is a display of the name of the Selected Species.

Rename

Click here to open a dialog box or requester that allows you to rename the current species.

Flash Cards

The flash cards give you a simple way to modify or design an organism.

These flash card pictures are not actually representative of how the organism looks. SimLife organisms are electronic and look like a matrix of ones and zeros manifested as energy levels in transistor switches in the memory of your computer. Since we humans can't see energy levels in transistors, we've put these flash cards into SimLife as a pictorial analogy: a way to think of these organisms in familiar terms, to relate them to combinations of plants and animals we are familiar with.

The pictures on the flash cards were chosen and drawn to help you understand how the animal fits into the environment. Looking at these pictures, it is fairly easy to figure out the organism's food, brain size, method of movement, etc.

Each SimLife organism is represented by a combination of three pictures. Each of the pictures represents at least two genetic factors. To change the pictures, click on the up or down arrows above or to the left of the pictures.

As you "flip" through the flash cards, a text description of the organism will appear below the pictures.

Designing organisms through the flash cards is somewhat limited. These creatures will only have one food source, one type of seed, one method of motion, etc. To add abilities to your creature, you can enter the Genome Window and fine-tune its genetic code.

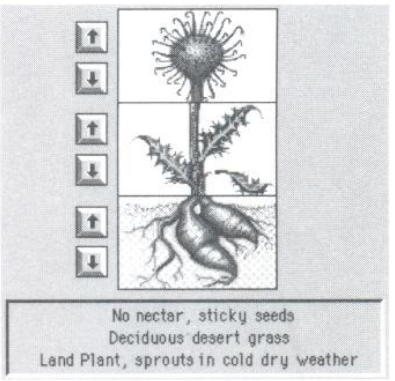
> *Note: You can flip through the flash cards all you want without messing up your organism. The changes you make to the flash cards don't actually affect the organism until you click on the Change Prototype Genome to Match Picture button, as explained below.*

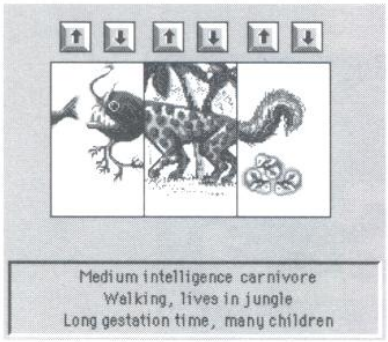
The flash cards for plants are arranged vertically.

The top card has eight possible pictures, which represent two factors: the presence or absence of nectar and the four seed types (sticky, dropping, drifting or fruit).

The middle card has 18 possible pictures, which represent three factors: deciduous or evergreen, evaporation rate (dry, normal or humid) and structure (grass, tree or shrub).

The bottom card has eight possible pictures, which represent three factors, all of which deal with the plant's germination: floating or non-floating seeds, sprouting temperature (high or low) and sprouting moisture (high or low).





The flash cards for animals are arranged horizontally.

The left card, the front of the animal, has 18 possible pictures, which represent two factors: the food source (nectar, plants, animals, fruit, filter or seeds) and the intelligence (large, medium or small).

The middle card has 20 possible pictures, which represent two factors: method of movement (walk, climb, swim or fly) and preferred environment (ocean, jungle, plains, mountain or desert).

The right card, the rear of the animal, has six possible pictures, which represent two factors: gestation size and time (small, medium or large) and litter size (1–2 or 4–8).

Gene Pool Diversity

This slider sets the genetic spread—the amount of variance in the genes—of a species when you add it to the world through the Populate Window or with the Populate function of the Life Tool in the Edit Window. From then on, genetic diversity is in the hands of natural selection and the species' genetic algorithm.

Mating Difference

This slider control sets the limits on how different the genetic code of two individuals of two species can be, while still allowing them to mate.

% Genes From Father

This slider controls the amount of genes the offspring receives from the father. The rest of the genes come from the mother. This slider has no effect in asexual species.

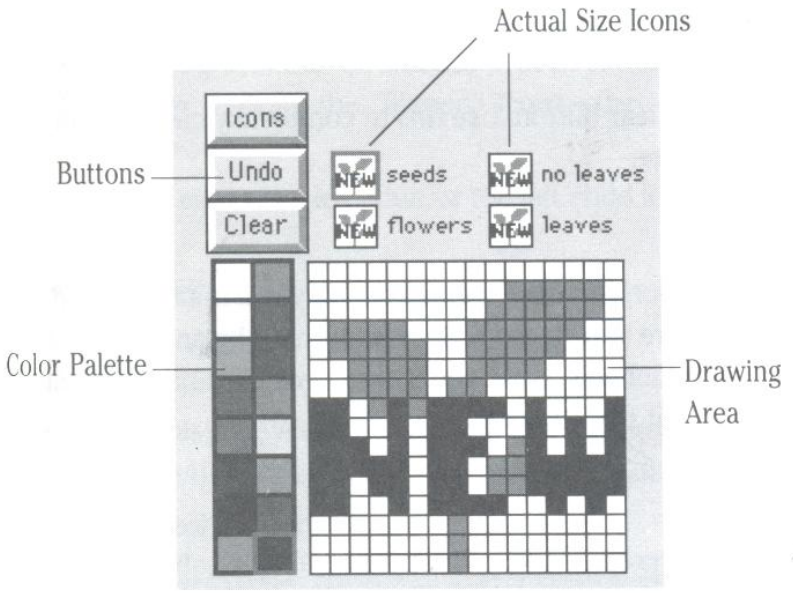
Icon Section

Here you can change or edit the icons that represent the existing creatures, and choose or create new icons for new creatures.

There are differences in the icon section for plants and animals.

Plant Icons

Each plant needs four icons that represent the four stages of plant life: seed, with flowers, with leaves (but no flowers) and with no leaves. You can either choose from the included icons or draw your own. You can also choose icons, then edit them yourself.



To choose a set of plant icons, click and hold on the Icons button to open a submenu of 32 predrawn plants, then slide the cursor to the one you want and release the mouse button.

The submenu only shows one of the icons—leaves, no flowers—but all four icons are there.

The icon drawing process is simple:

- Choose the icon you want to draw or change, then click on it.
- Click on the color in the palette you want to draw with.
- Click or click and drag in the drawing area.

If you make a mistake, you can undo your last drawing action by clicking on the Undo button, or selecting Undo in the Edit Menu.

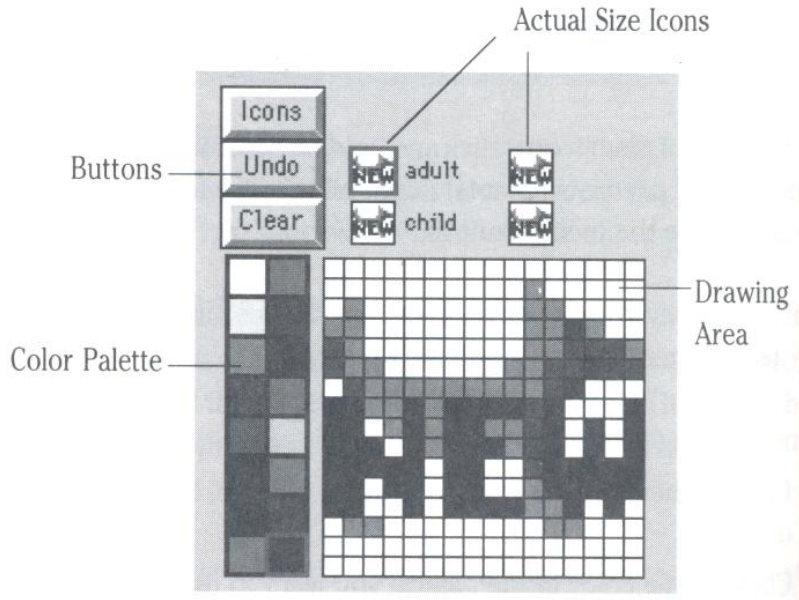
Since different stages of the plant's life may look very similar, you can:

- Draw one stage.
- Select the Copy Icon item in the Edit Menu.
- Click on another icon.
- Select the Paste Icon item in the Edit Menu.
- Make any changes as necessary.

There is also a Clear button. Use this to completely clear an icon if you want to start over.

Animal Icons

There are four icons for each animal, but only two that you can draw or change. There are two stages of life represented by animal icons: child and adult. Since animals move, you'll need two child and two adult icons facing in different directions.



You can either choose from the included icons or draw your own. You can also choose icons, then edit them yourself.

To choose a set of animal icons, click and hold on the Icons button to open a submenu of 64 predrawn animals, then slide the cursor to the one you want and release the mouse button.

The submenu only shows the adult icons in one direction, but all four icons are there.

The icon drawing process for animals is even simpler than for plants: you don't have to draw the "flipped" icons—they are automatically generated for you.

- Choose either the left adult or the left child icon and click on it.
- Click on the color in the pallette you want to draw with.
- Click or click and drag in the drawing area.

If you make a mistake, you can undo your last drawing action by clicking on the Undo button, or by selecting Undo in the Edit Menu.

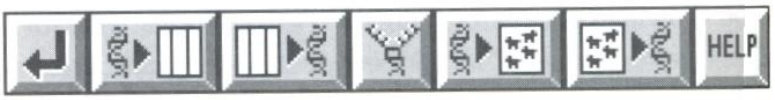
Since the two stages of the animal's life may look very similar, you can:

- Draw one stage.
- Select the Copy Icon item in the Edit Menu.
- Click on another icon.
- Select the Paste Icon item in the Edit Menu.
- Make any changes as necessary.

There is also a Clear button. Use this to completely clear an icon if you want to start over.

Biology Lab Buttons

At the lower-left corner of the Biology Lab are seven buttons. Many of these buttons are very powerful and can drastically alter the gene pool of an entire species, so a warning message will appear to give you a chance to back out.



Return to Select Level

Click here to return to the Select Level so you can save the current species and/or edit another.

Change Picture to Match Prototype Genome

Click here to update the picture to match any changes you have made to the species prototype in the Genome Window.

Change Prototype Genome to Match Picture

Click here to change the genetic code for the prototype species to match the flash card picture. You can flip through the flash cards all you want, and it won't affect the genetic code until you click on this button.

Edit Species Genome

Click this button to open the Genome Window for the Selected Species.

Make Population Match Prototype Genome

Click here to update the genetic code of the entire population of the Selected Species to match the genetic code of the currently selected species' Prototype.

This is a deceptively powerful button that goes way beyond the capabilities of today's biological science. In the world we live in, you can make changes to an organism's genetic code, but the changes won't be noticeable until a future generation—the organism won't re-form itself to match the new code.

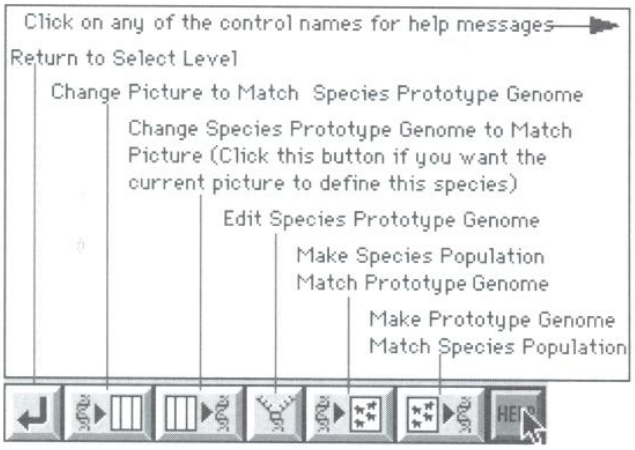
This tool in SimLife not only changes the genetic code of a whole population of organisms, it instantly updates the population physically, mentally or whateverly to match its new genetic code. If you add the ability to fly to the Prototype and push this button, the whole population of this species will instantly grow wings.

Make Prototype Genome Match Population

Click here to change the Prototype of the organism being edited to match the current population of that species.

Help

Click and hold on the Help button to see an on-screen reminder of what each button in the Biology Lab does.



GENOME WINDOWS

There are actually two Genome Windows: one for animals and one for plants. These windows display the entire genetic code for any species or individual organism and allow you to change, modify, manipulate or redesign the organisms at the genetic level.

The Genome Windows can be opened from the Biology Lab by clicking on the Edit Species Genome button or from the Edit Window by using the Life Tool in Show Genes mode and clicking on an organism.

When you enter the Genome Window through the Biology Lab you will be looking at the prototype genome for the whole species. When you enter from the Edit Window you will be looking at the genome for the individual organism that you clicked on.

The Genome Windows both consist of a number of slider controls, on/off switches and drop-down menu choices. Designing or modifying organisms at the genetic level is actually a lot easier than it looks—once you understand what each of the genes does.

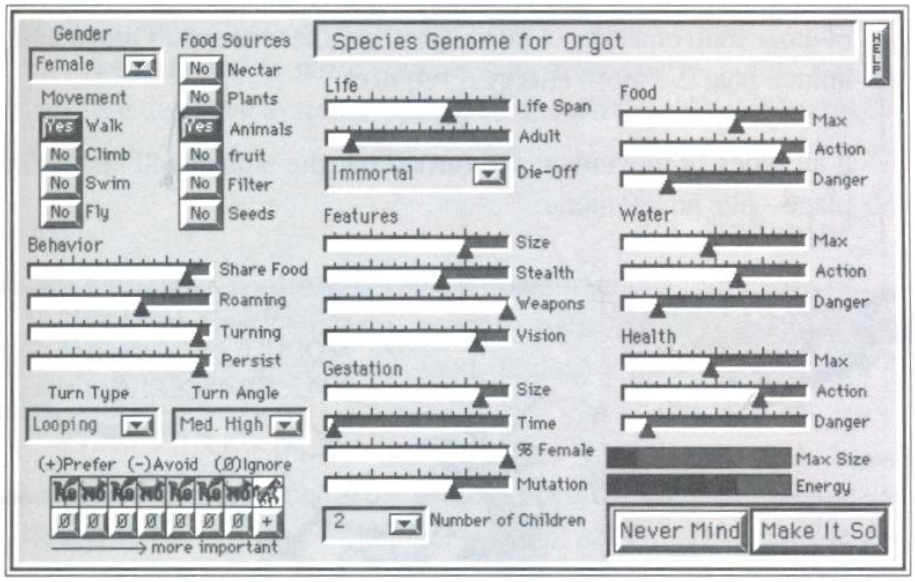
Perhaps the most important thing to keep in mind when designing an organism is this: *There is no free lunch.* Even in SimLife. The price you pay is in energy consumption. If you create an animal that can climb and swim and fly, and it's large and fast and strong and has sharp vision and powerful weapons, it will require so much energy to survive that it probably couldn't eat enough fast enough to stay alive even if it lived in a supermarket. As you design or modify an organism, keep an eye on the Energy Requirement Bar near the lower-right corner of the window. (It will be explained in detail below.)

The genome only contains the potentials for the animal. There are a number of factors or variables for each individual animal that change with time. These variables include current health, weight, age, current food and water storage, etc., and can be found in the Variables Window as described below.

HELP

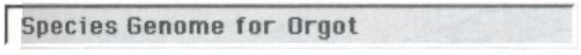
At any time in this window you can click and hold on the name of any gene or group of genes for a pop-up explanation of what the gene does.

THE ANIMAL GENOME



Title Section

This part of the Genome Window displays the name of the species or individual organism currently being edited. If it is an individual organism, it will have a number as part of its name.



Gender

There are four possible settings for Gender: Female, Male, Asexual and Sterile. Click and hold the down-arrow button to reveal the Gender submenu, then slide the cursor to the gender (or lack thereof) of your choice.

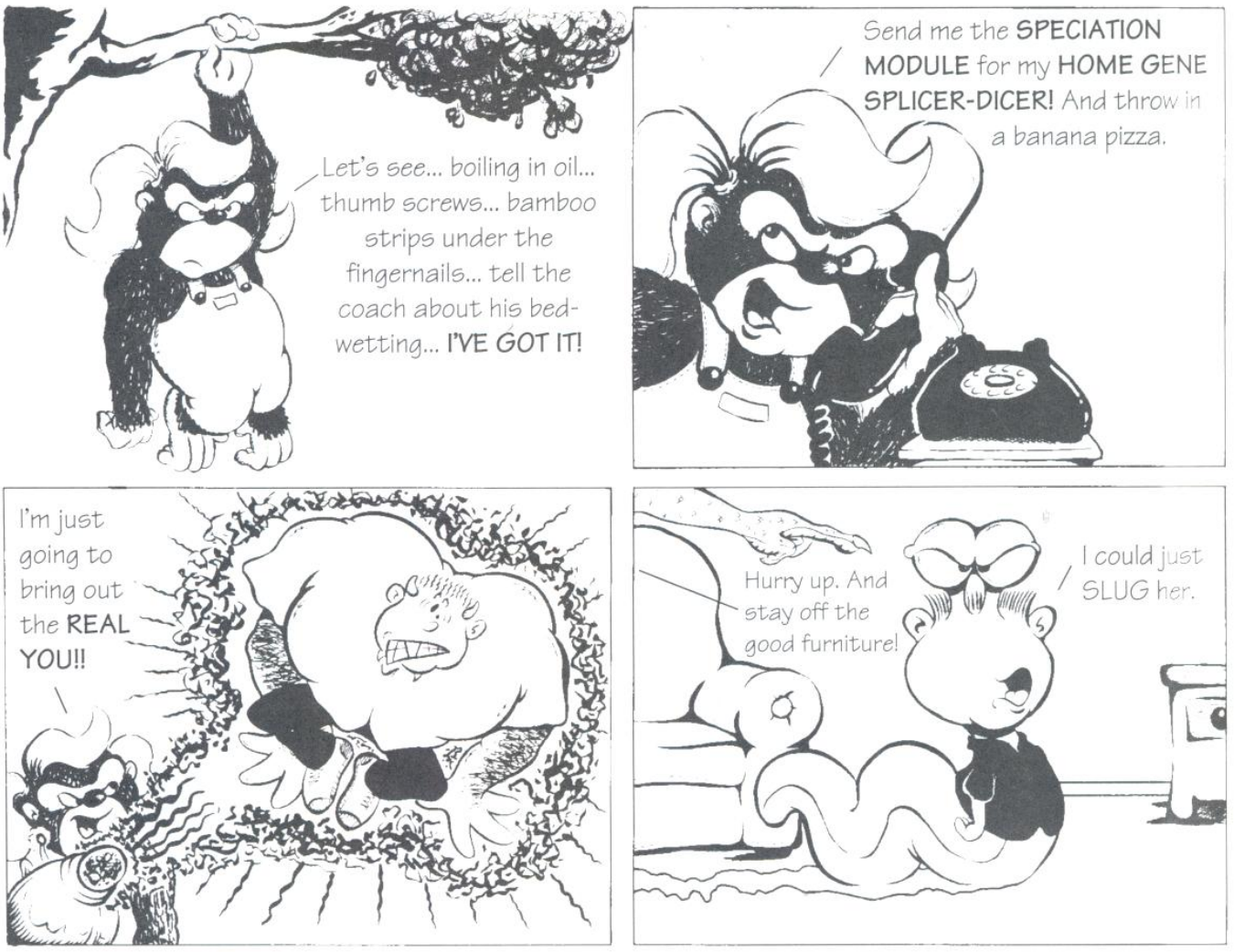
Movement

There are four ways animals can move. They can walk, climb, swim or fly. The different methods of movement require differing amounts of energy:

swimming takes the least, flying takes the most and walking and climbing are somewhere in the middle. Of course, you can go to the Laws of Physics Window (see below) and change the energy it takes to do these things.

Clicking on the button to the left of each method of movement toggles it on and off for the animal being edited. Animals can be made capable of more than one type of movement, but the more skills and abilities an animal has, the more energy it requires.

If all types of movement are turned off, the animal will just sit in one place—like an anemone.



Food Sources

In addition to Ultra-Food, there are six food sources that animals can eat: nectar, plants, animals, fruit, filter food (plankton and near-microscopic plants and animals in the sea, soil and air) and seeds.

Clicking on the button to the left of each food source toggles it on and off for the animal being edited. Animals can be made capable of eating more than one type of food, but more sources take more energy due to the more versatile digestive system required to absorb the different materials.

Behavior

There are four slider controls, two drop-down menus and a series of icons and buttons that define the animal's behavior. In SimLife, all behavior is geared to foraging for food, finding a mate and fleeing enemies.

The **Share Food** slider deals with the social aspects of eating. If the slider is all the way to the left, then the animal will hunt and eat alone, like the tiger. If the slider is all the way to the right, then the animal has highly developed social graces when it comes to food. These species will hunt or gather together and share food with any member of their species.

The **Roaming** slider adjusts how often the animal will move when it doesn't absolutely need to find food or water right away.

The **Turning** slider adjusts the number and severity of directional changes the animal makes while moving.

The **Persist** slider controls how long a creature will follow a trail before giving up and trying something else.

Turn Type is a pull-down menu that lets you choose between three types of turning behaviors: zig-zag, looping and random.

Turn Angle is a pull-down menu that lets you choose between four severities of turns that the animal can make: low, medium-low, medium-

high and high. A high turn angle helps an animal thoroughly explore a small area, while a low turn angle allows an animal to hastily cover a larger territory.

The **Prefer/Avoid/Ignore** controls set what types of plants or animals your current animal will be attracted to or repelled by.

You can choose up to eight organisms and set whether they attract or repel your animal:

- Click on any of the buttons below the icons to toggle between Prefer (+), Avoid (-) or Ignore (Ø).
- Click and hold on the icon above to reveal a submenu of all life-forms.
- Slide the cursor to the plant or animal you want, then release the mouse button.

Hint: It is a good idea not to have your animal be attracted to another animal that will eat it.

Icons to the right take precedence in behavior conflicts, i.e., if an animal comes into contact with one thing that it is attracted to and another thing it is repelled by at the same time, it will react to the one whose icon is farthest to the right.

Life

This section of the genetic code consists of two sliders and one pull-down menu that deal with the animal's maturation rate and length of life.

Life Span is a slider control for adjusting the maximum life span of the animal. This maximum life span is a percentage of the maximum life span in the Laws of Physics Window.

Adult is the age, or point in the life span, where the animal reaches maturity. Animals grow in size until they reach adult age.

Die-off is a pull-down menu with three choices for death age (die-off is superceded by death due to starvation, dehydration or predation): immortal, live to old age and live to medium age. Click and hold on the down-arrow button to see the menu, then slide the cursor to your choice.

When the setting is immortal, the animal will not die of natural causes. When the setting is old age, the animal will live out its maximum life span. When the setting is medium age, the animal will die somewhere between maturity and maximum life span.

Features

This section of the Genome Window consists of four slider controls that deal with physical survival features, which require a lot of energy.

The **Size** slider controls the maximum size of the animal.

The **Stealth** slider controls the animal's ability to move silently and avoid predators.

The **Weapons** slider controls the power of the animal's weapons (claws, teeth, poisons, etc.).

The **Vision** slider controls the animal's visual acuity.

Gestation

This section of the Genome Window consists of four sliders and one pull-down menu that deal with the animal's reproductive system.

The **Size** slider controls the amount that the animal gains in size during gestation, which directly relates to how much food/energy the animal needs to reproduce.

The **Time** slider controls the amount of time the animal takes to produce offspring.

The **% Female** slider controls the percentage of offspring that are female.

The **Mutation** slider controls the likelihood of the animal's offspring having a mutation.

Number of Children is a pull-down menu that controls the number of offspring the animal has each litter. Click and hold on the down-arrow

button to reveal the menu, then slide the cursor to the number you want. The choices are 1, 2, 4 and 8 children per litter.

Food

This section of the Genome Window deals with the animal's food/energy stores. The current values for food for any individual animal can be seen in the Variables Window.

The **Max** slider adjusts the maximum food the animal can store in its body. A high max setting allows stocking up of energy when it is plentiful, but increases the animal's weight and slows it down.

The **Action** slider sets the food storage level that provokes the animal to start looking for food.

The **Danger** slider sets the food storage level for when the animal does nothing else but look for food.

Water

This section of the Genome Window deals with the animal's water stores. The current water values for any animal can be seen in the Variables Window.

The **Max** slider adjusts the maximum water the animal can store in its body. A high max setting allows stocking up of water when it is plentiful, but increases the animal's weight and slows it down.

The **Action** slider sets the water storage level that provokes the animal to start looking for water.

The **Danger** slider sets the water storage level for when the animal does nothing else but look for water.

Health

This section of the Genome Window deals with the animal's overall health. The current values for health for any animal can be seen in the Variables Window.

The **Max** slider adjusts the maximum health level the animal can reach.

The **Action** slider sets the health level that causes the animal to start resting to replenish its health.

The **Danger** slider sets the food storage level for when the animal does nothing but sit still and save energy.

Maximum Size Bar

As you design or modify an animal in this window, the Maximum Size Bar will indicate how big your animal will have to be to hold all the features and capabilities you are programming into it.

Energy Requirement Bar

As you design or modify an animal in this window, the Energy Requirement Bar will indicate how much energy your animal will require to survive with all the features and capabilities you are programming into it.

The farther to the right this bar is, the more energy the animal needs to survive. Try to keep this bar at 3/4 or less. If this bar gets all the way to the right, the animal will need so much food to live it could starve in the middle of dinner.

Never Mind

Click this button to leave the Genome Window without changes taking place.

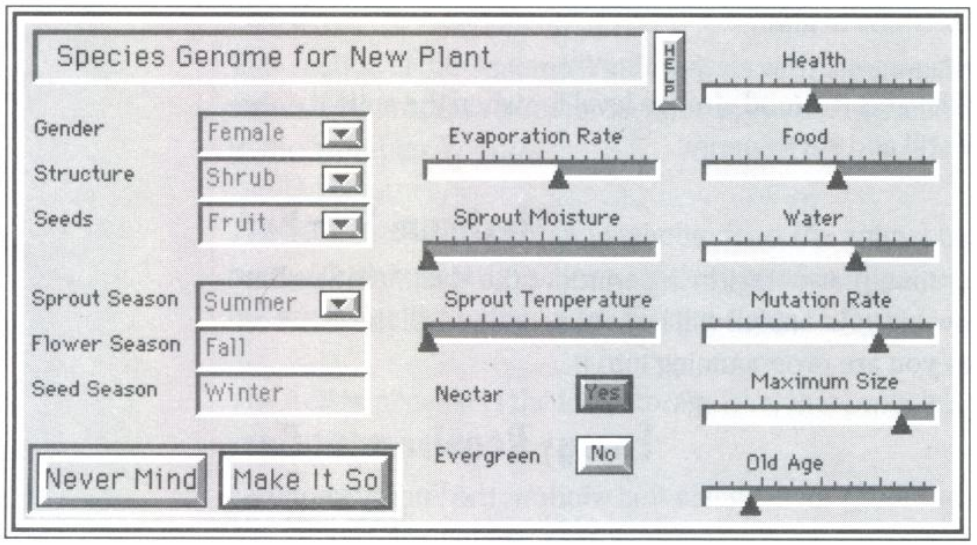
Make It So

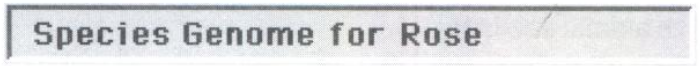
Click this button when you are happy with all the settings. All your changes will be activated and the window will close.

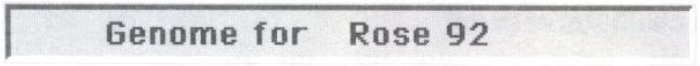
Help

At any time you can click and hold on the Help button or on any of the labels or gene names to see on-screen help.

THE PLANT GENOME







Title Section

This part of the Genome Window displays the name of the species or individual plant currently being edited. If it is an individual organism, it will have a number as part of its name.

Gender

Gender is a pull-down menu with four choices for plants: Male, Female, Both and Asexual. Click and hold on the down-arrow button to open the menu, then slide the cursor to your choice and release the mouse button.

Structure

Structure is a pull-down menu with four choices for basic plant structure: Tree, Shrub, Grass and Floating. Click and hold on the down-arrow button to open the menu, then slide the cursor to your choice and release the mouse button.

Seeds

Seeds is a pull-down menu with four choices for types of seeds your plant can have: Sticky, Dropping, Drifting and Fruit. Click and hold on the down-arrow button to open the menu, then slide the cursor to your choice and release the mouse button.

Seasons

Sprout Season is a pull-down menu with your choice of four seasons in which your plant can sprout: Spring, Summer, Fall and Winter. Click and hold on the down-arrow button to open the menu, then slide the cursor to your choice and release the mouse button.

Flower Season will always be the season immediately following Sprout Season.

Seed Season will always be the season immediately following Flower Season.

Sliders

There are nine slider controls for adjusting various genetic characteristics of your plant. All adjustments get higher as the slider moves from left to right.

The **Evaporation Rate** slider controls the rate at which the plant loses water to the atmosphere. The higher the evaporation rate, the faster it loses water and the more water it needs to survive. Also, the higher the evaporation rate, the faster the plant will grow.

The **Sprout Moisture** slider controls the amount of moisture required for the plant's seeds to sprout.

The **Sprout Temperature** slider controls the temperature that must be reached in sprouting season before the seed will sprout.

The **Health** slider sets the maximum health level for the plant. The higher the health, the more resistant it is to toxins and the better it can survive after being partially eaten by animals.

The **Food** slider sets the maximum amount of food the plant can store.

The **Water** slider sets the maximum amount of water the plant can store.

The **Mutation Rate** slider controls the odds on how often mutations will occur in new generations of this plant.

The **Maximum Size** slider controls the size limitations of the plant.

The **Old Age** slider controls how long the plant can live (barring accident, predation or disaster) before it loses the ability to reproduce.

Buttons

The **Nectar** button is a yes/no toggle that controls whether or not the plant produces nectar.

The **Evergreen** button is a yes/no toggle that controls whether or not the plant is an evergreen.

Click on **Never Mind** if you want to leave the Plant Genome Window without any changes taking place.

Click on **Make It So** when you are happy with all your settings. All your changes will be activated and the window will close.

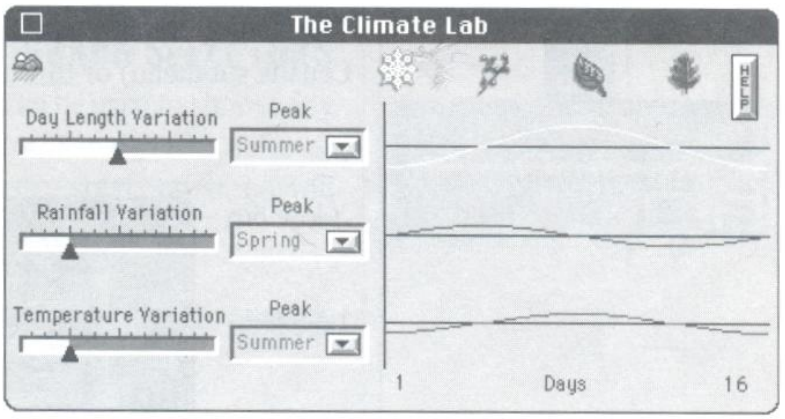
Help

Click and hold on the Help button or on any slider or control names for on-screen help.

CLIMATE LAB

The Climate Lab lets you make changes to the climate of the current world. It can be reached through the Climate Lab item in the Windows Menu or through the Climate Lab button in the Dashboard.

The Climate Lab can be moved around the screen by clicking and dragging the Title Bar. It'll go away if you click in the Close Box.



Each of the three adjustable climatic aspects deal with variation throughout the year and have two controls: a slider to set the amount of variation and a drop-down menu to set the season where the variation reaches its peak.

Adjust the sliders by clicking and dragging the pointer. The variation increases from left to right. To set the Peak Season, click and hold on the down-arrow buttons to open a pull-down menu of the seasons, then slide the cursor to the season of your choice and release the mouse button.

The right side of the window has a graph to visually depict the seasonal variations for each setting.

Day Length Variation

This setting controls how much the amount of daylight per day changes throughout the year. This affects the amount of sunlight plants get.

Rainfall Variation

This setting controls the seasonal changes in rainfall (which is included under the Humidity heading in the graphs and in most other windows).

Temperature Variation

This setting controls the seasonal changes in temperature.

Help

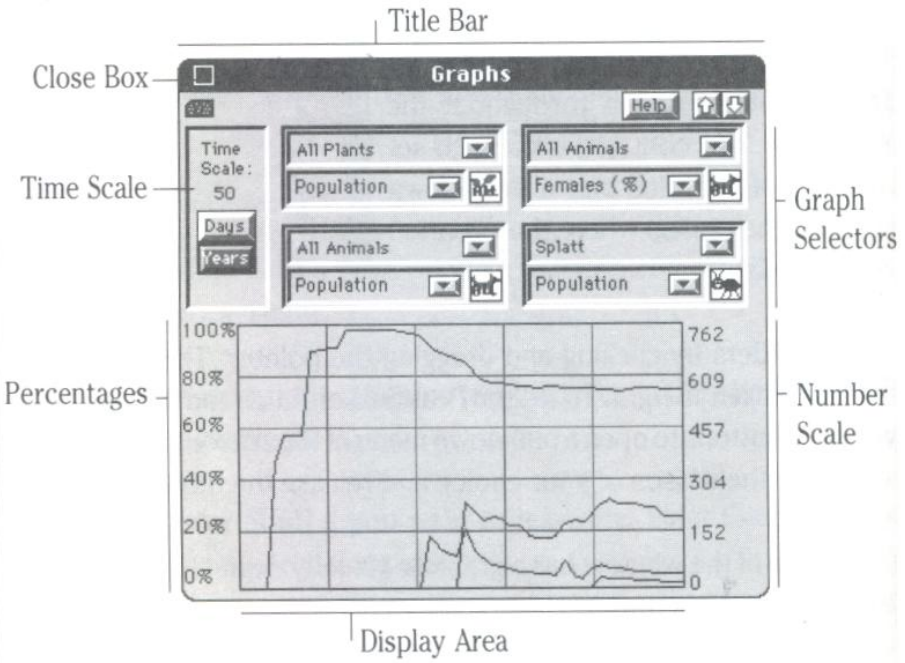
You can get on-screen help by clicking on the Help button.

SIMLIFE

GRAPHS WINDOW

The Graphs Window is a very versatile tool for extracting information from the simulation. It can display 720 graphs in either of two time scales. Four graphs can be displayed at a time.

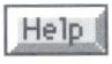
The Graphs Window can be opened from the Windows Menu (it's in the Census submenu) or through the Census button on the Dashboard.



The Graphs Window can be moved around the screen by clicking and dragging the Title Bar. It will go away if you click in the Close Box.

Just below the Close Box is a "punch card" that marks the Graphs Window as a Census Window.

Near the upper-right corner of the window are up and down arrow buttons. You can click on these arrows to cycle forwards and backwards through all the Census Windows.

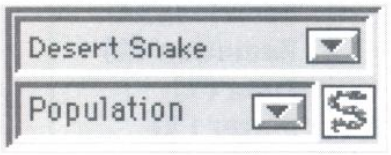


To the left of the up and down arrows is the Help button. Click and hold on this button to see a brief explanation of what this window does and how it works.

TIME SCALE

There are two available time scales in which the graphs can be displayed, 50 years or 50 days. Click on the Days or Years buttons to change time scales.

GRAPH SELECTORS

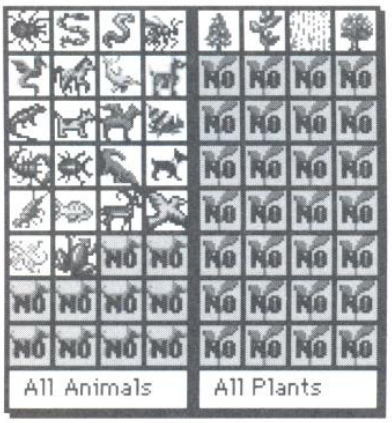


There are four graph selectors, each of which can be used to choose any graph—or no graph—to display. Each selector is assigned a color or shade. The words in the selector and the corresponding graph will appear in this color or shade.

Selecting a graph to display is a two-step process: first select a species, then select the information.

The Local Species

The Local Species of the graph is the plant or animal whose information is graphed. The Local Species can be any plant or animal, or all plants or all animals at once. When this species is selected, it is active in the Graphs Window only—it does not become the Selected Species in the Dashboard.



To select a Local Species, click and hold on the upper down-arrow button to reveal a submenu of all possible choices, then slide the cursor to your choice and release the mouse button. An icon representing your choice will appear below the arrow.

If you hold down the Option key (or the Control key if your keyboard has no Option key) while selecting a Local Species, that species will be the subject for all four selectors.

The Information

The information is the data to be graphed about the above subject.

To select the information to be displayed, click and hold on the lower down-arrow button to reveal a submenu of all possible choices, then slide the cursor to your choice and release the mouse button. If you hold down the Option key (or the Control key if your keyboard has no Option key) while selecting the information, that information will be selected for all four selectors. (The last sentence was a selected selection for our select audience.) The possible choices of information to display are:

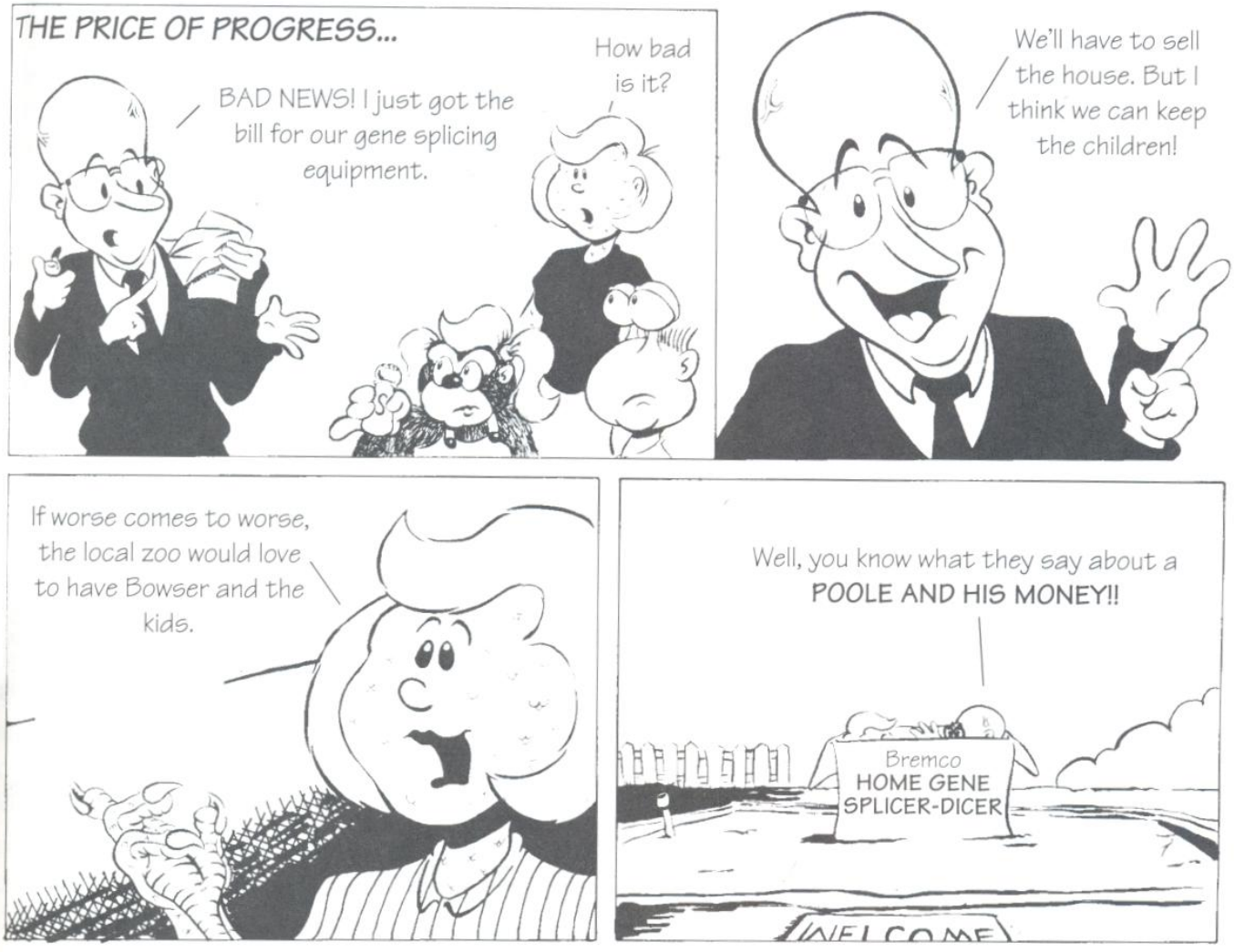
No Graph — displays nothing for this Graph Selector.
Population — displays the changes in the subject's population.
Births — displays the changes in the subject's births.
Deaths — displays the changes in the subject's deaths.
Age (% of Max) — displays the changes in how long the subject lives as a percentage of its maximum possible age.
Size (% of Max) — displays the changes in the subject's size as a percentage of its maximum possible size.
Females (%) — displays the changes in the percentage of the subjects that are female.
Radiation (%) — displays the cumulative radiation dose the subject has received as a percentage of the maximum dose.
Food (%) — displays the changes in the percentage of maximum food the subject has stored.
Water (%) — displays the changes in the percentage of maximum water the subject has stored.
Health (%) — displays the changes in the subject's health rating, as a percentage of maximum health.
% of Biomass — displays the amount of the biomass that is represented by the subject. If the subject is an animal species, the graph will show its percentage of the total animal biomass. If the subject is a plant species, the graph will show its percentage of the total plant biomass. If the subject is All Plants or All Animals, the graph will show its percentage of combined plant and animal biomass.
Ecology Score — displays an ongoing score of the ecological soundness of the current world. This score is actually a rating of how well you are

doing as master of this ecosystem. It is easy to get high ecology scores for short periods of time—the challenge is to keep a constant high score.

Note: If you have deselected Record All Statistics in the Technical submenu of the Simulation Menu, the percentage-based graphs and the ecology score will not be available.

DISPLAY AREA

The bottom section of the Graphs Window is where the graphs are displayed. When relevant, numbers will appear along the right side and/or percentages will appear along the left side to provide a scale for interpreting the graphs.

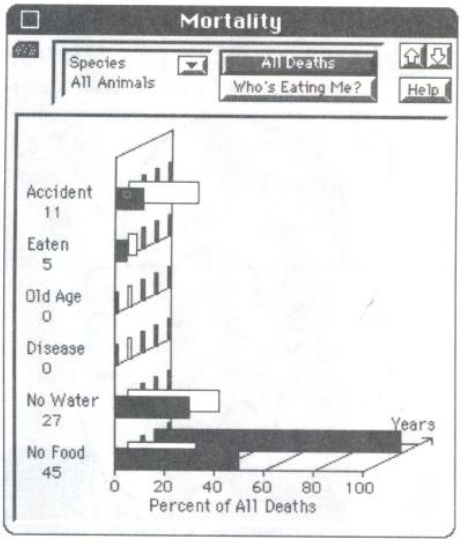


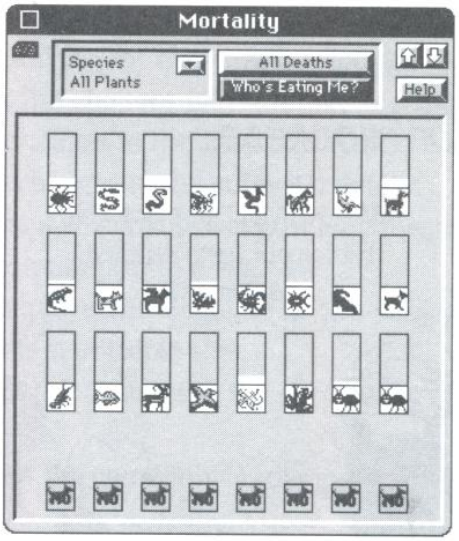
SIMLIFE

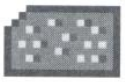
MORTALITY WINDOW

The Mortality Window is a graphic display of the causes of death in the ecosystem. It also displays the predators (if any) that are responsible for the deaths. It can be opened from the Windows Menu (it's in the Census submenu) or through the Census button on the Dashboard.

The Mortality Window can be moved around the screen by clicking and dragging the Title Bar. It will go away if you click in the Close Box.







Just below the Close Box is a "punch card" that marks the Mortality Window as a Census Window.

Near the upper-right corner of the window are up and down arrow buttons. You can click on these arrows to cycle forward and backward through all the Census Windows.

Below the up and down arrows is the Help button. Click and hold on this button to see a brief explanation of what this window does and how it works.

LOCAL SPECIES

Mortality information can be shown for any individual species, or for All Plants or All Animals as a group. To select the Local Species whose mortality graph you want to see, click and hold on the down-arrow button to open the submenu of choices, slide the cursor to the species of your mortal desire and release the mouse button.

The species selected here does not affect the Selected Species in the Dashboard or any of the other windows.

ALL DEATHS

The default display is a graph of all causes of death for the previous five years.

The agents of death are listed along the left side of the display from top to bottom. The number of deaths in the current year from each cause is displayed below the name of each agent.

The percentages are represented as bars that increase from left to right.

WHO'S EATING ME?

If you click on the Who's Eating Me? button, you will see a display of all the predators with bar graphs showing how many of the Local Species they have eaten.

Click on the All Deaths button to return to the default display.

CAUSES OF DEATH

For the most part, the causes of death are self-explanatory: Eaten, Old Age, Disease, No Water and No Food are easy to figure out. The only ambiguous one is Accident, which covers everything that doesn't fit into any of the above categories. Deaths listed as Accidents include human-caused death by: Smiting, Plant and Animal Limits in the Laws of Physics Window, and Populating land plants or animals in the water. It also covers real accidents like water animals stranded on land during a drought. Also, when animals have children, their litters spread out in all directions. If a litter occurs near water, some infants can drown.

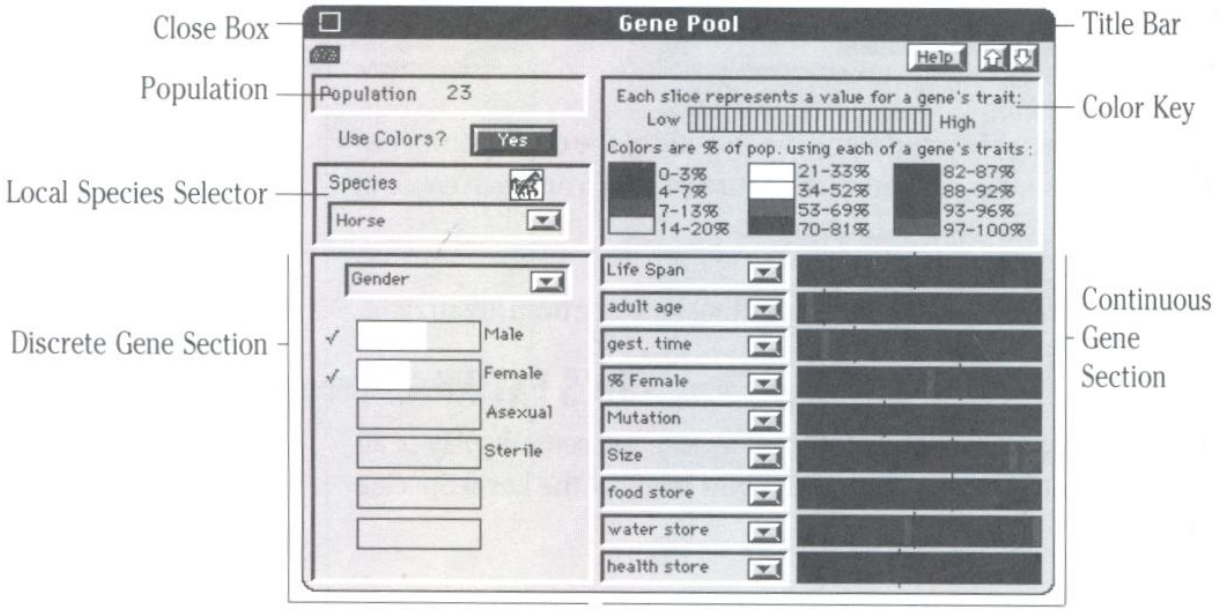
SIMLIFE

GENE POOL WINDOW

The Gene Pool Window is a graphic display of evolution in action. It shows the frequency and spread of genes for any single species at a time, or All Plants or All Animals at once.

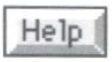
It can be opened from the Windows Menu (it's in the Census submenu) or through the Census button on the Dashboard.

The Gene Pool Window can be moved around the screen by clicking and dragging the Title Bar. It will go away if you click in the Close Box.



Just below the Close Box is a "punch card" that marks the Gene Pool Window as a Census Window.

Near the upper-right corner of the window are up and down arrow buttons. You can click on these arrows to cycle forward and backward through all the Census Windows.



Next to the up and down arrows is the Help button. Click and hold on this button to see a brief explanation of what this window does and how it works.

TYPES OF GENES

To understand this window, keep in mind that creatures in SimLife have two types of genes: discrete and continuous.

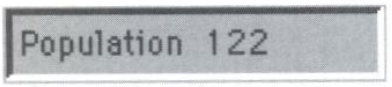
Discrete genes are like yes/no or multiple-choice genes. They have one value. For instance, as far as animal movement genes go, either the individual animal walks or it doesn't; it flies or it doesn't. Yes or no. Relating to gender, either an animal is male, female, asexual or sterile. Pick one and only one: multiple choice. Discrete genes are shown and adjusted in the Genome Window as on/off buttons.

Continuous genes are those that can have a wide range of values, for example, the life span or the mutation probability genes. Each of these genes is a number somewhere on a continuum from 0 to 256. They are shown and adjusted in the Genome Window as slider controls.

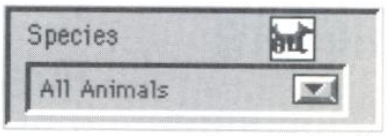
In a sense, you can think of the discrete genes as digital—yes or no, on or off—and the continuous genes as analog with a continuous range of possible values. (Technically, in SimLife, the continuous genes are stored and computed digitally and actually have a number of discrete values, but there are enough available values in the continuum for them to appear analog for all practical and experimental purposes.)

POPULATION

This section of the Gene Pool Window displays the total population of the Local Species, whether the Local Species is a plant, an animal, or All Plants or All Animals.



This window always displays information on a species population—all the members of that species that are currently alive in the world. The only way you can see the gene pool information for one organism is if there is only one alive, or if you put one organism into its own species with the Speciate function. Of course, one organism is not a very good gene pool.



LOCAL SPECIES

This section of the Gene Pool Window both displays and allows you to select the Local Species. Click and hold on the down-arrow button to reveal the submenu of all possible choices, then slide the cursor to your choice and release the mouse button. Both the name of the Local Species and its icon will be displayed.

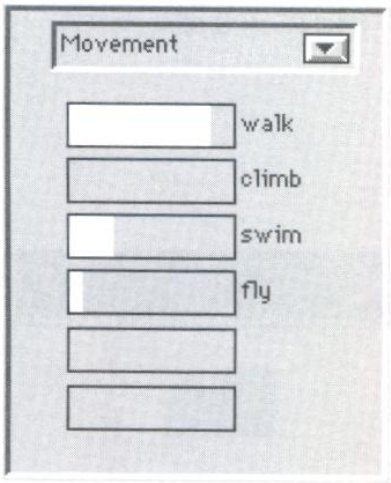
The species selected here does not affect the Selected Species in the Dashboard or any of the other windows.

USE COLORS BUTTON

This button toggles between displaying the continuous gene section of this window using colors to represent percentages or using small bar graphs to represent percentages. This will be explained below.

This button may not appear on computers with monochrome monitors.

DISCRETE GENES



This section of the Gene Pool Window displays all the information on the discrete genes of the Local Species.

The genes are arranged into groups of related genes. The group name is displayed at the top of this section, and the individual genes are listed below with a bar chart showing what percentage of the population has this gene. The bar charts range from 0% on the left to 100% on the right. Since individual organisms can have more than one food source or method of movement, the bar charts can add up to more than 100%.

Group Selection

One group of genes can be selected at a time. Click and hold on the down-arrow button to reveal a submenu of the choices, slide the cursor to your choice and release the mouse button.

Groups And Individual Genes

Since the genes in plants and animals are different, so are the groups as displayed in this section of this window.

Gender
Structure
Seeds
Sprout Season
Nectar
Evergreen

Plant Gene Groups

Plant Gene Groups

Gender: Asexual, Male, Female, Both

Structure: Floating, Grass, Shrub, Tree

Seeds: Sticky, Dropping, Drifting, Fruit

Sprout Season: Summer, Fall, Winter, Spring

Nectar: Yes, No

Evergreen: Yes, No

Gender
Movement
Food Sources
Die-Off
Children
Attracted to...
Tries to Avoid...
Turn Angle
Turn Type

Animal Gene Groups

Animal Gene Groups

Gender: Male, Female, Asexual, Sterile

Movement: Walk, Climb, Swim, Fly

Food Sources: Nectar, Fruit, Filter, Plants, Animals, Seeds

Die-Off: Immortal, Old Age, Middle Age

 # Children: 1, 2, 4, 8

Attracted to: There are no "set" choice displays for Attracted to.... Icons representing the six most common attractants for the Local Species will be displayed to the right of its bar charts.

Tries to Avoid: There are no "set" choice displays for Tries to Avoid.... Icons representing the six most common repellants for the Local Species will be displayed to the right of its bar charts.

Turn Angle: Low, Med-Low, Med-High, High

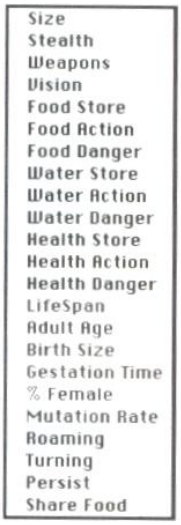
Turn Type: Looping, Random, Zig-Zag

CONTINUOUS GENES

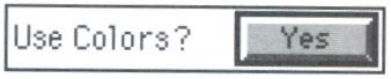
This section of the Gene Pool Window displays all the information on the continuous genes of the Local Species.

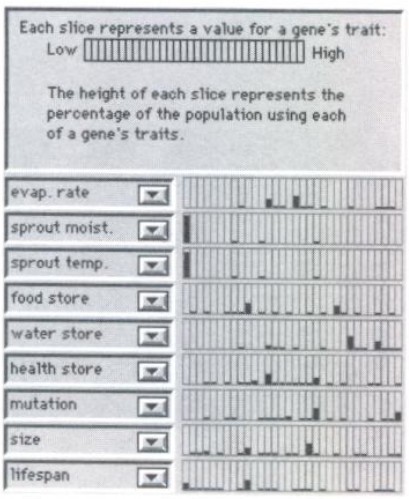
There are 23 different continuous genes that can be displayed for animals and nine for plants.

Plant Continuous Genes



Animal Continuous Genes





Gene Selection

Along the left side of this section is a list of the continuous genes being displayed. Nine genes can be displayed at once, so all plant genes can be viewed simultaneously.

To view all the animal genes or change the order of display for plants, click and hold on the down-arrow to the right of the gene name to open a submenu of all available choices, slide the cursor to your choice, then release the mouse button.

Warning: Tricky Graphs

The Continuous Gene display is a little tricky, but understanding it is very important to interpreting changes in the Gene Pool, which is needed in many scenarios and experiments.

To make it easier to understand, there are two different ways to look at the information: using colors and using bar graphs.

The two types of displays are chosen by clicking on the Use Colors? button. A color or monochrome key will appear to help you interpret the data in this section of the window.

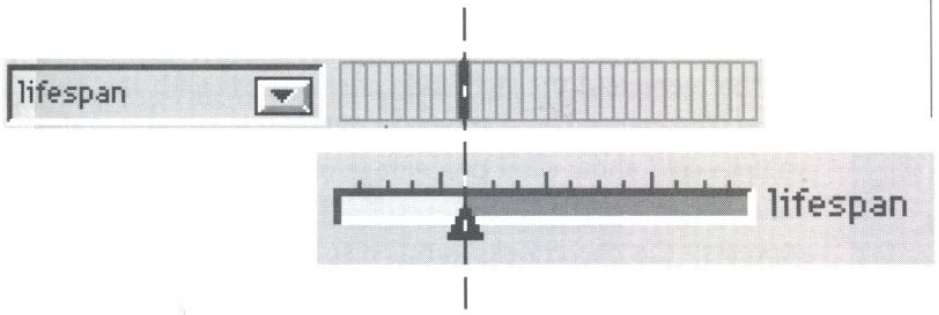
On some computers with monochrome-only screens, the Use Colors? button and/or the color key and/or color display may not be available.

Continuous Gene Display -- Monochrome

When the Use Colors? button is set to "No," the continuous genes will be displayed using small black bar graphs. The key at the top will help you understand the display.

Each of these partitioned rectangles represents one continuous gene. The left end of this rectangle corresponds with the lowest value for that gene and the right side corresponds with the highest value. The bars appear at different locations—different values—and show what percentage of the population has that value for the particular gene. The higher the bar, the higher the percentage of the population with that value.

Each of these lines matches a slider in the Genome Window. For example, the life span gene.



Above is shown the Gene Pool Window life span gene display for one animal, and that animal's life span gene from the Genome Window. Notice how the bar's and arrow's locations match.

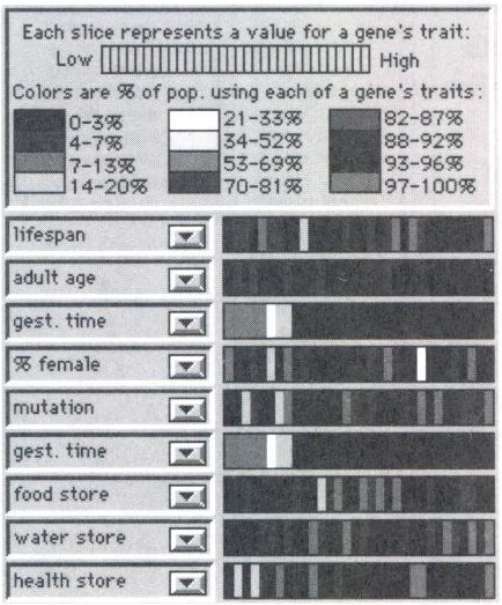
To be really useful, the gene pool must show the combined genes for a whole population, not just one organism. Each animal in the population will have a value for life span, but not all of them will have the exact same value.

When there is a spread of values for a gene, this is shown using multiple black bars at different locations. The higher the bar, the more of the population has that value for the gene.

In addition, if the Local Species is a single species (not All Plants or All Animals), there will be a thin pink or black line somewhere in the display. This line marks the value of this gene for the Prototype of the species. You can look at the prototype value as the "starting position" for each gene. When the black bars drift away from the Prototype, they represent the change in the gene pool—the evolution of the genes through natural selection and mutation.

If All Plants or All Animals is selected there will be no Prototype lines.

Continuous Gene Display -- Color



When the Use Colors? button is set to "Yes," the continuous genes will be displayed using a special color display. The key at the top will help you understand the display.

Each of these black rectangles represents one continuous gene. The left side of the rectangle corresponds with the lowest value for that gene and the right side corresponds with the highest value. The colored bars appear at different locations—different values—and show what percentage of the population has that value for this gene. Instead of using the height of the bar to represent the percentage, in this display we use color. The key above will show you what colors represent what percentages.

The gene pool is the combined genes for a whole population. Each organism in the population will have a value for each gene, but not all of them will have the exact same value.

Each rectangle displays all the values of all the organisms for one gene. When there is a spread of values for a gene, this is shown using multiple colored bars at different locations.

Part of the reason for using this type of display is because it looks very much like the Gel Electrophoresis analysis of actual DNA in a biology laboratory.

In addition, if the Local Species is a single species (not All Plants or All Animals), there will be a thin pink or black line somewhere in the display. This line marks the value of this gene for the Prototype of the species. You can look at the prototype value as the "starting position" for each gene. When the colored bars drift away from the Prototype, they represent the change in the gene pool—the evolution of the genes through natural selection and mutation.

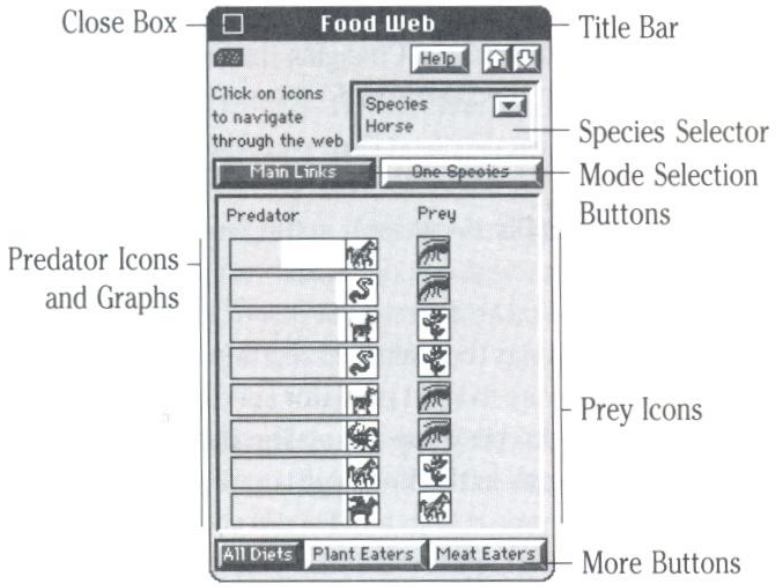
If All Plants or All Animals is selected there will be no Prototype lines.

FOOD WEB WINDOW

This window shows the predator/prey relationships between different organisms in the ecosystem.

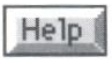
The Food Web Window can be opened from the Windows Menu (in the Census submenu) or through the Census button on the Dashboard.

The Food Web Window can be moved around the screen by clicking and dragging the Title Bar and it will go away if you click in the Close Box.



Just below the Close Box is a "punch card" which marks the Food Web Window as a Census Window.

Near the upper-right corner of the window are up and down arrow buttons. You can click on these arrows to cycle forward and backward through all the Census Windows.



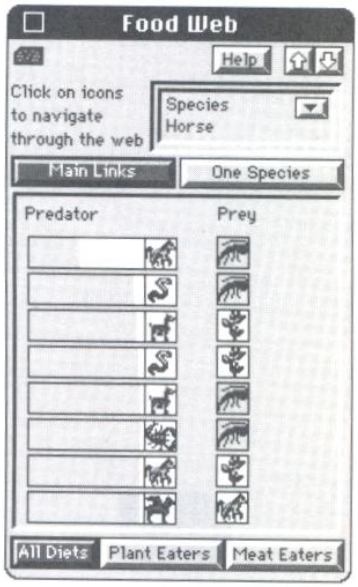
Next to the up and down arrows is the Help button. Click and hold on this button to see a brief explanation of what this window does and how it works.

Note: Plants can be eaten but not necessarily killed, which can technically be called parasitism *as opposed to predation, but they're shown here as prey.*

SPECIES

This is the display of the Local Species: the species whose food web information is shown below. To change the Local Species, click and hold on the down-arrow to reveal a submenu of all available choices, then slide the cursor to your choice and release the mouse button.

In this window you can only select a single species at a time; you cannot choose All Plants or All Animals. Changing this species does not affect the Selected Species in the Dashboard.



MAIN LINKS

The Main Links display is the default setting for this window, and is shown above.

Press this button to display the main links in the food web for the current ecosystem. It will show up to eight predator species on the left and their associated eight favorite prey species on the right. These are the top eight energy transactions in the food web.

To the left of the predator icons is a bar graph showing the relative activity of the predators.

If you click on any of shown predators or preys, they'll pop to the center and become the Local Species and this window will enter One Species mode (see below).

ONE SPECIES

Press this button to display the food web centered around the Local Species.

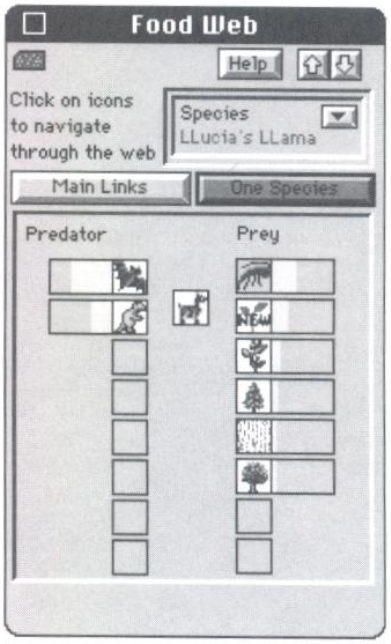
The Local Species will appear in the middle. Any and all predators will be listed along the left. These are the animals (if any) that eat the Local Species.

The eight most common food sources, including prey (those who are eaten by the Local Species) will appear along the right (if any—plants have no prey).

To the right of the prey icons is a bar graph showing how many of each prey were caught and eaten by the Local Species.

If the Local Species is a plant, no prey will be displayed because plants don't go around hunting and eating things they catch. (Well, other than the big plant in my office that likes to munch on editors that take liberties with my writing, if you can take a hint.)

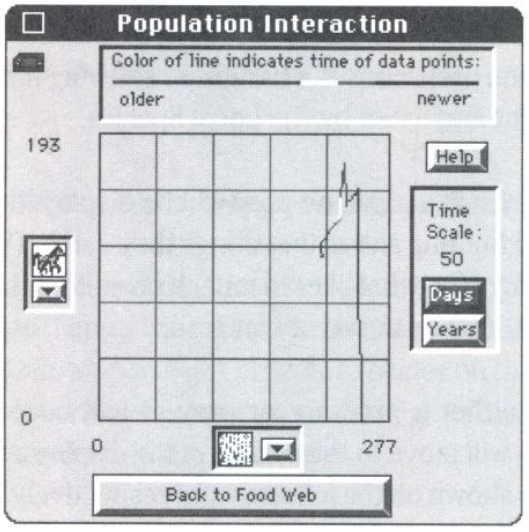
If you click on either a predator or prey, it will become the Subject Species. Its icon will move to the middle of the display and its predators and prey will be shown on the left and right respectively. In this way you can move up and down the food chain and get a complete overview.



POPULATION INTERACTION WINDOW

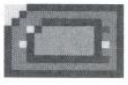
The Population Interaction Window displays a special type of graph of the predator/prey relationships between different organisms in the ecosystem. Unlike the graphs in the Graphs Window, which map a single population against time, this graph maps the ratios of two populations (predator and prey) against each other over time.

To open the Population Interaction Window, first open the Food Web Window in Main Links mode, then hold down the Option key (or Control key if your keyboard has no Option key) and click on one of the predator icons.

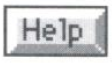


Note: This graph only shows the relationship between plant and animal predation, and will not work when the prey is filter food.

This window can be moved around the screen by clicking and dragging the Title Bar and it will go away if you click in the Close Box.



Just below the Close Box is a punch card within a punch card that marks the Population Interaction Window as a decendant of a Census Window.



Over on the right side of the window is the Help button. Click and hold on this button to see a brief explanation of what this window does and how it works.

TIME SCALE

Click on the Days or Years buttons to choose between displaying data for the last 50 days or the last 50 years.

DISPLAY AREA

This part of the window is a grid where the graph is displayed. The predator is shown along the left (Y axis), the prey along the bottom (X axis). The lower-left corner is zero population for both species. The number of living predators is shown on the upper-left side of the grid, the number of living prey is shown at the lower-right.

Above the display area is a color key that lets you know which of the data points are older, and which are newer.

CHANGING SPECIES

Once this window is open, you can change the two species being graphed to any two species currently loaded into the simulation. Click and hold on the down arrow button next to either species' icon, then select the new species of your choice.

INTERPRETING THE GRAPH

If all the data points are clustered together in a small bunch, then both the predator and prey populations are stable. If the line is circular, then you have a predator/prey "cycle," where the two populations directly affect each other. If the line travels horizontally from right to left, the predator is killing off the prey faster than they can reproduce.

In a long-lasting ecosystem, this graph will show various repeating, ever-changing shapes and patterns that point out the chaotic nature of ecosystems.

BACK TO FOOD WEB

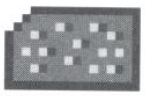
Clicking on this button returns you to the Food Web Window.

SIMLIFE

POPULATION WINDOW

The Population Window is a graphic display of the relative populations of all organisms in the ecosystem. It can be opened from the Windows Menu (in the Census submenu) or through the Dashboard Census button.

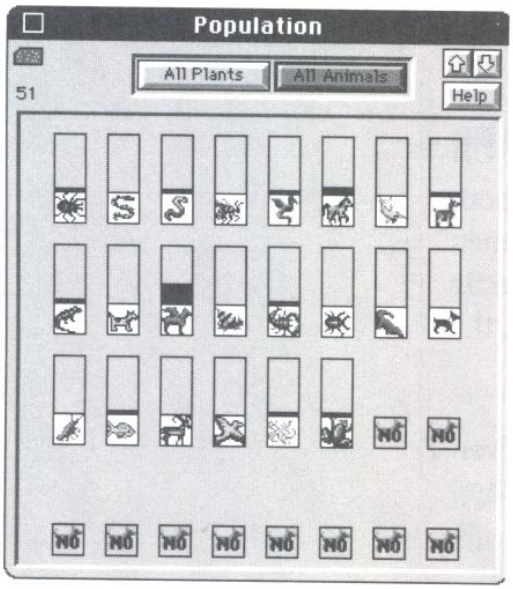
The Population Window can be moved around the screen by clicking and dragging the Title Bar. It will go away if you click in the Close Box.



Just below the Close Box is a "punch card" that marks the Population Window as a Census Window.

Near the upper-right corner of the window are up and down arrow buttons. You can click on these arrows to cycle forward and backward through all the Census Windows.

Below the arrows is the Help button. Click and hold on this button to see a brief explanation of what this window does and how it works.



ALL PLANTS

Click on **All Plants** to see the population display of the plants. The total plant population is displayed to the left of the All Plants button, and icons representing all the plants are displayed below.

Bars will appear above the icons representing the relative populations of each plant. The higher the bar, the greater the population. If there is no bar, then there are no representatives of that species in the ecosystem at the current time.

ALL ANIMALS

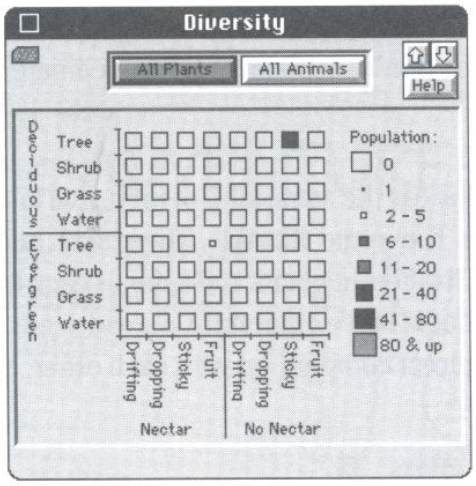
Click on **All Animals** to see the population display of the animals. The total animal population is displayed to the left of the All Plants button and icons representing all the animals are displayed below.

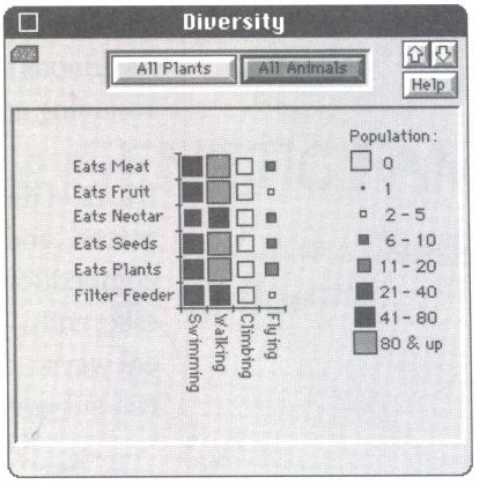
Bars will appear above the icons representing the relative populations of each animal. The higher the bar, the greater the population. If there is no bar, then there are no representatives of that species in the ecosystem at the current time.

DIVERSITY WINDOW

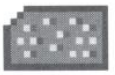
The Diversity Window is a graphic display of which ecological niches are being exploited by the current population of plants and animals.

The Diversity Window can be opened from the Windows Menu (it's in the Census submenu) or through the Census button on the Dashboard. It can be moved around the screen by clicking and dragging the Title Bar. It will go away if you click in the Close Box.

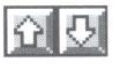




Just below the Close Box is a "punch card" which marks the Diversity Window as a Census Window.



Near the upper-right corner of the window are up and down arrow buttons. You can click on these arrows to cycle forward and backward through all the Census Windows.



Below the arrows is the Help button. Click and hold on this button to see a brief explanation of what this window does and how it works.

MAKING A LIVING

To survive in an ecosystem, plants and animals must "exploit a niche," or make a living. Ecologically speaking, making a living is finding a way to survive—finding food, avoiding becoming food and reproducing.

For animals, the most important parts of making a living are their type(s) of movement and kind(s) of food they can eat.

Plants don't move, so their strategies are a little different. Different sizes and structures of plants (trees, shrubs, water plants, etc.) are better adapted to different environments. Different ways of spreading seeds (fruit, dropping, sticky, etc.) and energy-saving strategies (evergreen vs. deciduous) work better (or don't) depending on the climate and surrounding animal life.

If a lot of different organisms eat the same kind of food, live in the same places, and generally live the same lifestyle, there will be a lot of competition for resources. If different plants and animals each live a little differently—eat different foods, move differently, spread seeds in different ways—they are not in direct competition with each other, and more can survive.

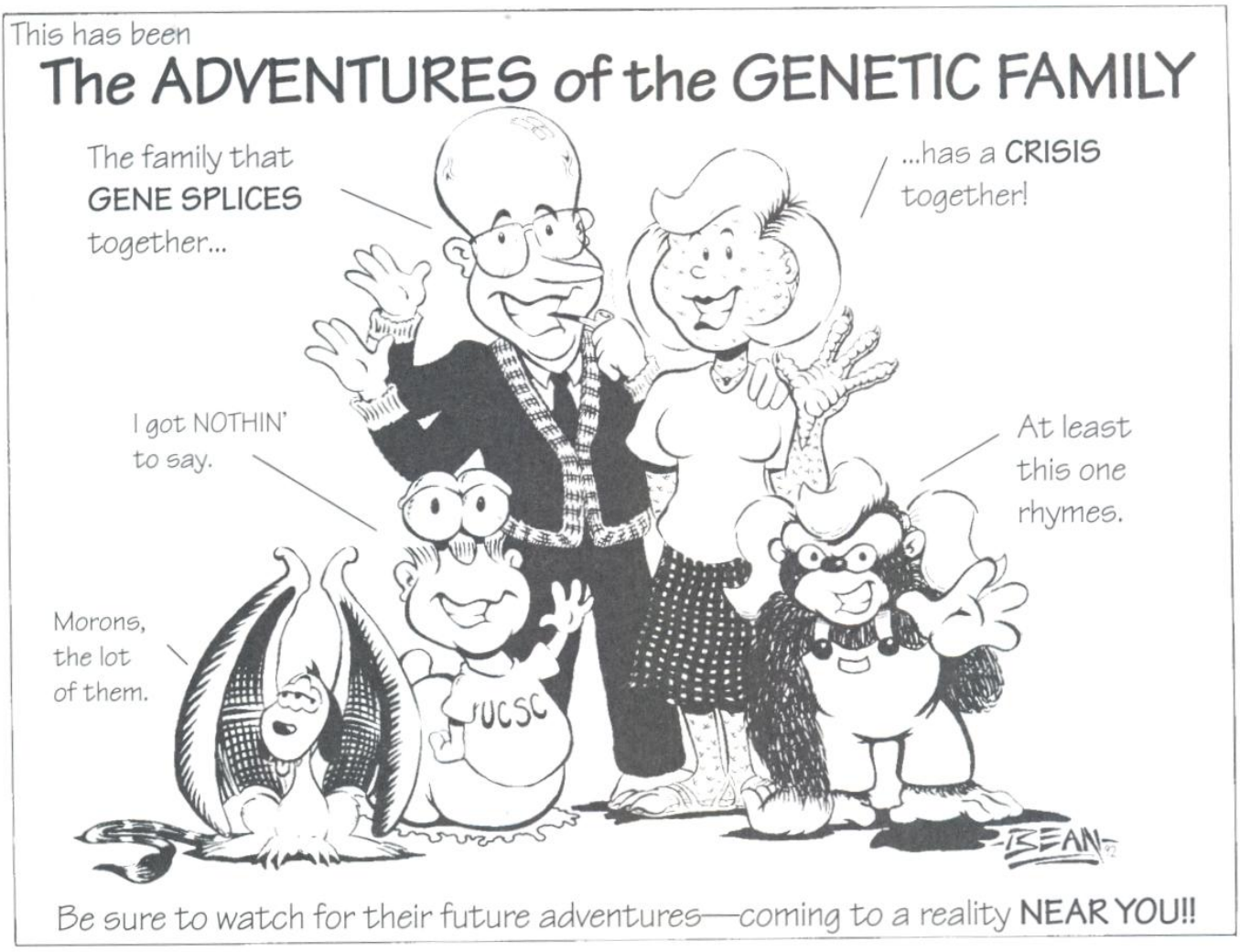
Beyond non-competition, a lot of different types of plants and animals living together, each in a different niche, become more than the sum of the individual organisms. They become an interrelated food web, a community, an ecosystem. A healthy long-lasting ecosystem will have plants and animals in many diverse niches.

ALL ANIMALS

Click on **All Animals** to see the diversity display of the animals. The display is a gridlike graph with food sources on the left (the Y axis) and types of movement on the bottom (X axis). There is a box at each grid intersection point of the X and Y axes. The number of animals at each intersection (Z axis) is shown by the size and shade of the box. A key to interpreting the boxes and the numbers they represent is provided on the right side of the window.

ALL PLANTS

Click on **All Plants** to see the diversity display of the plants. The display is a gridlike graph with types of trees on the left (the Y axis) and seed and nectar information on the bottom (X axis). There is a box at each grid intersection point of the X and Y axes. The number of plants at each intersection (Z axis) is shown by the size and shade of the box. A key to interpreting the boxes and the numbers they represent is provided on the right side of the window.



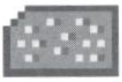
SIMLIFE

HISTORY WINDOW

This window tracks and lists the important historical events that have happened in the ecosystem during the present game or experiment.

The History Window can be opened from the Windows Menu (in the Census submenu) or through the Census button on the Dashboard.

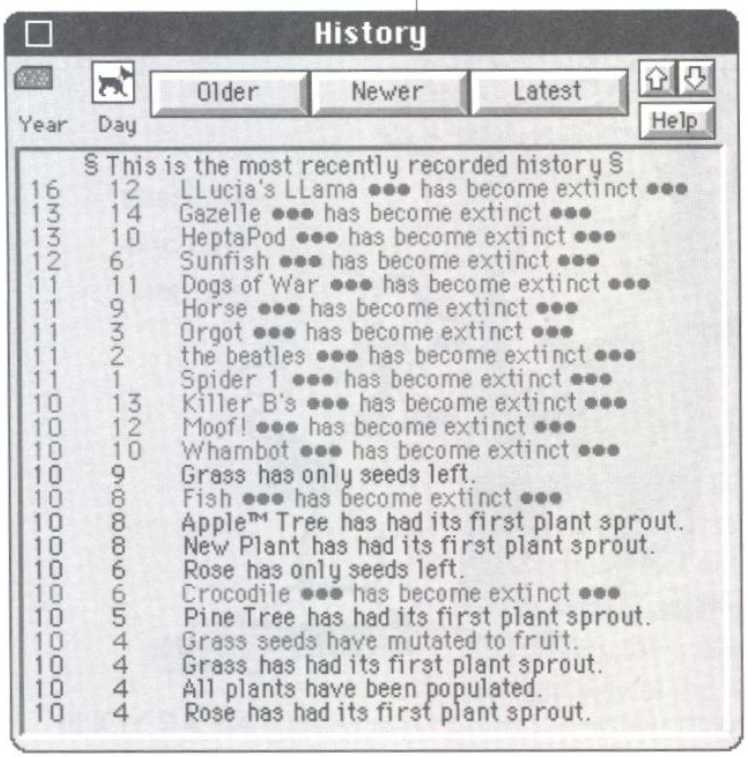
The History Window can be moved around the screen by clicking and dragging the Title Bar and it will go away if you click in the Close Box.



Just below the Close Box is a "punch card" that marks the History Window as a Census Window.

Near the upper-right corner of the window are up and down arrow buttons. You can click on these arrows to cycle forward and backward through all the Census Windows.

Below the arrows is the Help button. Click and hold on this button to see a brief explanation of what this window does and how it works.



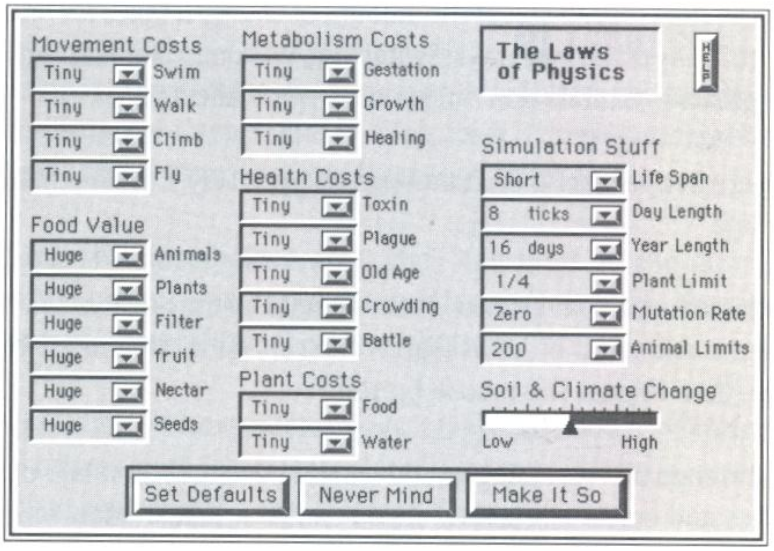
If you click on any of the events, the icon that represents the organism in the event will appear next to the punch card.

The main area of the window displays the year and day of each event along with text messages describing them. The events that are listed here include mutations, extinctions, species danger (hunger, thirst, no males left, no females left), new species creations, etc.

To scroll through the list of historical events, click on the Older or Newer buttons. To view the latest occurrences, click on Latest.

LAWS OF PHYSICS

The Laws of Physics Window gives you the power to change the physical laws and properties that deal with time and energy in your world. It can be opened with the Change Physics... item in the Technical submenu of the Simulation Menu.



Besides feeding one's ego by supplying such awesome power, this window actually has very practical experimental uses. For example, changing the amount of energy it takes to move, such as a setting of very little energy to fly and a lot to walk, could simulate a low-gravity world. Raising the energy it takes to swim could simulate a world with a very viscous ocean.

Depending on your experiment, changing the physics of time can help your efficiency. If you are interested in the behavior of one generation, make the days and years as long as possible and increase the life span of organisms. If you are interested in the genetic drift over many generations, shortening the length of days and years could save you hours or days of computer time.

Many of the settings below have a range of possible values that goes from Tiny to Low to Medium to High to Huge. Each value is twice the previous value, i.e., Low is twice as high as Tiny, Medium is twice as high as Low, etc.

HELP

At any time in this window you can click and hold on the Help button or on the name of any control for a pop-up explanation of what it does.

MOVEMENT COSTS

This is where you can adjust the amount of energy it takes for an animal to move in any of the four ways: Swimming, Walking, Climbing and Flying. Since plants in SimLife don't move, this won't affect them.

There are five values for each movement type: Tiny, Low, Medium, High and Huge.

To change the movement cost, click and hold on the down-arrow button to open a submenu of all available choices, slide the cursor to your choice, then release the mouse button.

As mentioned above, changing movement costs can simulate different gravities and ocean viscosities. If you use your imagination with these settings you can come up with some interesting worlds.

FOOD VALUE

By adjusting the amount of food value—energy—supplied by each type of food, you directly control how much food animals need and indirectly affect their behavior by controlling how much time they must spend looking for food and how much time they have for other pastimes, such as looking for a mate.

There are six food sources: Animals, Plants, Filter Food, Fruit, Nectar and Seeds. Each of these foods can be assigned a value: Tiny, Low, Medium, High, or Huge.

To change the food value cost, click and hold on the down-arrow button to open a submenu of all available choices, slide the cursor to your choice, then release the mouse button.

Changes in Food Values do not directly affect plants, but indirectly they will affect how many of them will be eaten—more if their food value is low, less if their food value is high.

These settings do not affect the Ultra-Food food sources.

METABOLISM COSTS

This section adjusts how much energy is required for metabolic processes: Gestation, Growth and Healing. Each of these processes can be assigned a value: Tiny, Low, Medium, High or Huge.

To change the metabolism cost, click and hold on the down-arrow button to open a submenu of all available choices, slide the cursor to your choice, then release the mouse button.

Gestation controls how much energy it takes to produce offspring. With a high energy cost for gestation, only a very well-fed organism can "afford" to reproduce.

Growth controls how much energy it takes for an organism to reach full size.

Healing controls how much energy it takes to recover from injury, plagues and toxins.

HEALTH COSTS

This section adjusts how much energy is lost by health-related processes and issues. These issues are: Toxins, Plague, Old Age, Crowding and Battle. Each of these items can be assigned a value: Tiny, Low, Medium, High or Huge.

To change the health cost, click and hold on the down-arrow button to open a submenu of all available choices, slide the cursor to your choice, then release the mouse button.

PLANT COSTS

This section controls how much energy is required by plants to "make their living." Plants need energy for getting food and water, growing and making nectar, fruit, and seeds. The energy cost for food and water can be set to a value: Tiny, Low, Medium, High, or Huge.

To change the plant costs, click and hold on the down-arrow button to open a submenu of all available choices, slide the cursor to your choice, then release the mouse button.

SIMULATION STUFF

This section controls seven simulation factors including time. Six factors are adjusted with a pop-up menu, the seventh with a slider bar.

Life Span

This setting adjusts the average life span for organisms in the world.

This setting is a "master control" for individual species' life spans as set in their genetic code. This setting sets a general life span length. The species' genes set the percentage of this general life span they are capable of living.

The five possible life span settings are: Brief, Short, Medium, Long and Methuselan. To change the life span, click and hold on the down-arrow button to open a submenu of all available choices, slide the cursor to your choice, then release the mouse button.

Day Length

This control sets how many Ticks (simulation cycles) constitute one day. The possible day lengths are 8, 16, 32, 64, 128 and 256 Ticks.

To change the Ticks per day, click and hold on the down-arrow button to open a submenu of all available choices, slide the cursor to your choice, then release the mouse button.

You will want long days for behavioral experiments and short days for long-term, many-generation experiments.

Year Length

This control sets how many days constitute one year. The possible year lengths are 16, 32, 64, 128 and 256 days.

To change the days per year, click and hold on the down-arrow button to open a submenu of all available choices, slide the cursor to your choice, then release the mouse button.

Plant Limit

This control lets you put limits on the number of plants that can exist in the world at any one time. Since the simulation runs slower with more organisms, you can limit the number of plants to: Unlimited, 1/2 maximum, 1/4 maximum, 1/8 maximum, 1/16 maximum, 1/32 maximum, 1/64 maximum and 1/128 maximum. The maximum is the total number of cells in the world, and depends on world size.

To change the Plant Limit, click and hold on the down-arrow button to open a submenu of all available choices, slide the cursor to your choice, then release the mouse button.

Mutation Rate

This adjustment controls the overall Mutation Rate in the world, overriding an individual species' mutation rate as set in its genetic code. This setting sets a general rate, and the species' genes set an individual rate as a percentage of this general rate.

To change the Mutation Rate, click and hold on the down-arrow button to open a submenu of all available choices, slide the cursor to your choice, then release the mouse button.

Animal Limits

This adjustment sets the maximum number of animals that can occupy the world at any one time. The setting is for all living species combined. The more animals there are, the slower the simulation runs. Setting a limit keeps animals from running amok and taking over all your computer's processing time.

The maximum available animals that you can set are: Unlimited, 50, 100, 200, 400, 800 and 1600.

To change the maximum animals per species, click and hold on the down-arrow button to open a submenu of all available choices, slide the cursor to your choice, then release the mouse button.

Soil And Climate Change

This adjustment controls how much the soil and climate will change over time. If you want a very stable climate with little or no erosion for your experiments, set this slider low. If you want your ecosystem to be subjected to wide swings in climatic conditions with erosion, set it high.

Buttons

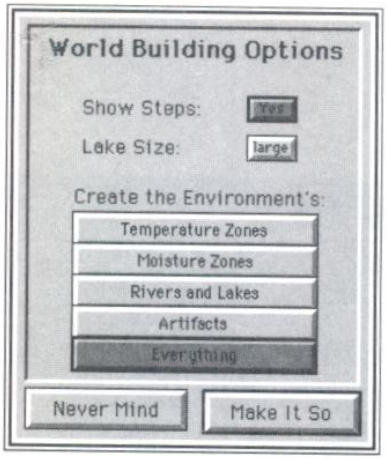
At the bottom of the window are three buttons.

Click **Set Defaults** if you want to make the current settings in this window the default conditions henceforth and forevermore (well, at least until you make changes and set new defaults).

Click **Never Mind** if you want to make this window go away without making any changes.

Click **Make It So** if you are happy with the current settings and want them to be activated. The new settings will immediately take control of the world, but the default settings will not be changed.

WORLD BUILDING OPTIONS



The World Building Options Window lets you set options that the simulation uses when creating a new world. It also lets you rebuild one aspect, or data layer, of a world without changing anything else.

It can be opened with the World Building Options... item in the Technical submenu of the Simulation Menu.

Show Steps toggles on and off the display of each data layer as the world is built. When the steps are shown, it takes a little longer to build the world, but it looks so cool that it seems to go faster.

Lake Size lets you choose to have large or small lakes in the world. If you aren't interested in water-dwelling creatures, making small lakes leaves you more room for your landlubbers.

Temperature Zones, when selected, causes only the temperature zones to be rebuilt the next time you build a world. This is especially useful when you have changed a world's altitude in the Edit Window and want to update the temperature data to the new landform.

Moisture Zones, when selected, causes only the moisture zones to be rebuilt the next time you build a world. This is especially useful when you have changed a world's altitude in the Edit Window and want to update the moisture data to the new landform.

Rivers and Lakes, when selected, causes only the rivers and lakes to be rebuilt the next time you build a world.

Artifacts, when selected, causes only the artifact placement to be rebuilt the next time you build a world.

Everything, when selected, causes every aspect of a world to be rebuilt next time you build a world. This is the default setting.

Never Mind makes this window go away without making any changes.

Make It So activates the current settings and closes the window.

SIMLIFE

VARIABLES WINDOW

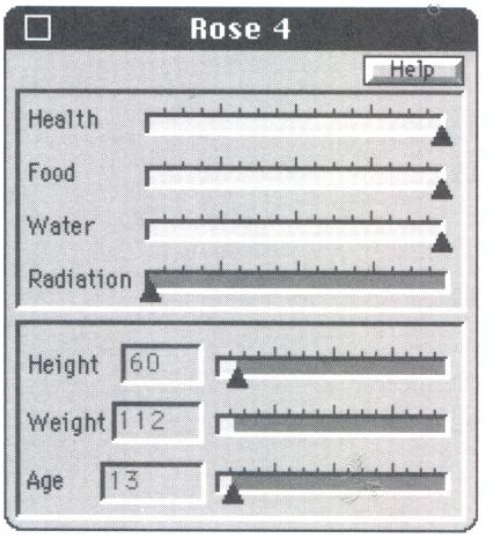
The Variables Window shows and lets you change the current status of any *individual* organism. The information in this window is not contained in the genetic code; it is a display of the results of the genes and environment.

This window shows the things that change during an organism's life, like health, age, height, weight, etc., that are constantly variable. (Constantly variable is the SimLife oxymoron of the week.) When you make changes in this window, the changes in the organism take place immediately.

The Variables Window can be opened in two ways. From the Windows Menu—if and only if there is currently an organism highlighted in the Edit Window—or directly from the Edit Window by using the Life Tool in Show Variables mode and clicking on an organism.

The Variables Window treats plants and animals differently—not because of prejudice, but because it recognizes the true differences between the two types of organisms and appreciates them both for what they are.

The Title Bar contains the name of the individual, which consists of the species name and the individual's number. The window can be moved around the screen by clicking and dragging the Title Bar. The window will go away if you click in the Close Box. The window will also go away if the organism whose variables you are inspecting dies, so it is a good idea to pause the simulation while inspecting variables.



PLANT VARIABLES

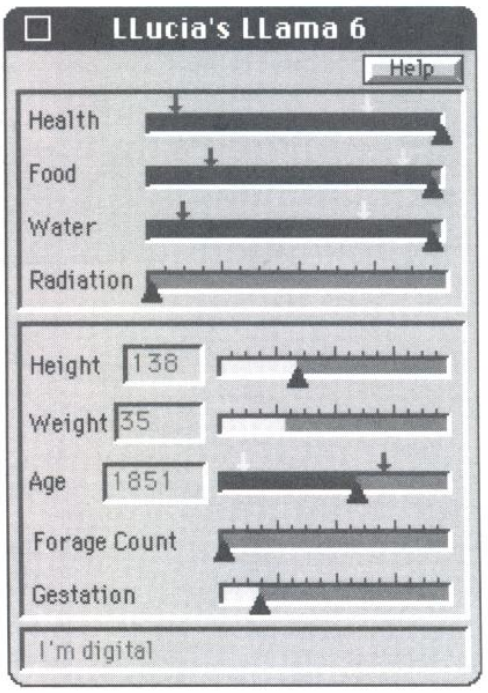
There are two sections to this window. The top section displays the individual plant's current status for Health, Food supply, Water and Radiation exposure.

Each display is a bar graph, with low on the left, high on the right. You can change (manipulate, heal, feed, starve, etc.) the plant by dragging the black arrows under each of the bars.

The bottom section displays the Height, Weight and Age of the plant, both numerically and with a bar. You can change the Height and Age by dragging the black arrows under their bars, but Weight changes automatically in relation to Height and other variables.

Note: If you age a seed, it will not instantly turn into a full grown tree, or even sprout—it will become a very old seed. Old seeds die.

ANIMAL VARIABLES



The Animal Variables Window has three sections.

The top section is very similar to the top plant section. It shows the current status for Health, Food, Water and Radiation. In addition, it has marker arrows over Health, Food and Water to show where on the bar the animal takes action (the arrow on the right), or is in danger (the arrow on the left). The action and danger levels are set in the animal's genome.

The middle section gives numerical and graphic representation of the animal's Height, Weight and Age. The Age bar has arrows to mark the action level (arrow on the left) and danger level (arrow on the right). This section also contains a display for Forage Count and Gestation.

Forage Count increases as an animal looks for food, and resets when food is found. If the count reaches a certain number (depending on the Persistence gene), the animal will try another foraging strategy.

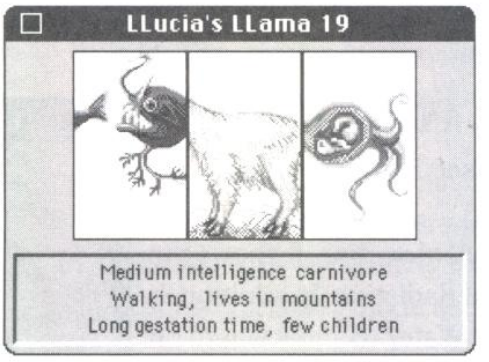
For males, Gestation is blanked out. For females, Gestation gives the current pregnancy status. If she is not pregnant, Gestation will be all the way to the left. When the arrow reaches the right side of the slider, birth occurs. Dragging the arrow all the way to the right causes the birth to occur instantly: the SimCesarean.

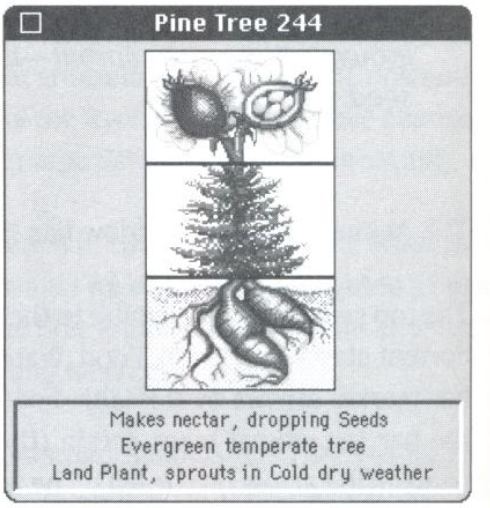
The bottom section of this window is the Brain Box. Whatever the animal is currently thinking will appear here.

SIMLIFE

PHENOTYPE WINDOW

The Phenotype Window displays any organism's "flash card" image, as seen in the Biology Lab.



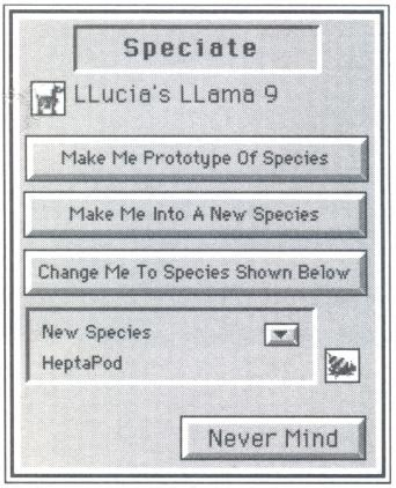


The Phenotype Window can be opened in two ways: from the Windows Menu if and only if there is currently an organism highlighted in the Edit Window, or directly from the Edit Window by using the Life Tool in Show Phenotype mode and clicking on an organism.

The image in this window does not represent the actual appearance of the organism: Its purpose is to give you some insight into the organism's size, structure, eating habits, etc.

We constructed these images of SimLife organisms out of parts of familiar earth animals that should have some meaning for most of us. For instance, looking at a phenotype of any animal, you can easily see what it eats, how it moves and how many children it has per litter. And as mammals, we like to think that if the picture of the head looks like a mammal it has a larger brain than something with an insect's head. (Chauvinism? Maybe—but if any insects out there feel slighted you can program your own darn game.)

SPECIATE WINDOW



The Speciate Window lets you change a chosen individual organism into another species in a few different ways.

The Speciate Window can only be opened from the Edit Window by setting the Life Tool to Speciate and clicking on any organism.

SPECIES NAME

This is the display of the current individual organism (the Subject) that is being speciated. Since it is an individual, it will have a number after the species name.

MAKE ME PROTOTYPE OF SPECIES

Clicking this button will change the genotypes of all the organisms in the Subject's species to exactly match the Subject.

You might want to use this button if you have located one individual in a species that has developed an advantageous genetic trait that you want to share with the whole family.

MAKE ME INTO A NEW SPECIES

Click this button if you want to use the Subject as the starting point for beginning a new species. After you click on this button, the Biology Lab will open set to the Subject's genotype. You can rename it and save it as a new species. Before saving, you can modify the icon and the genome (either with the flash cards or in the Genome Window).

CHANGE ME TO SPECIES SHOWN BELOW

Click this button to transform the Subject into another species. You can choose the new species in the New Species box below.

If you try to turn a plant into an animal or an animal into a plant you'll receive a caustic message proving that programmers can be just as big of smart alecs as manual writers.

NEW SPECIES

This is a display of the species the Subject will be changed into if you click on the Change Me To Species Shown Below button above.

To change this species, click and hold on the down-arrow to reveal a submenu of all available choices, slide the cursor to your choice and release the mouse button.

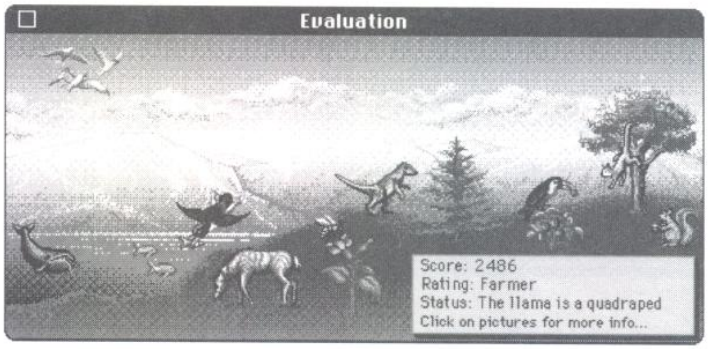
NEVER MIND

Click this button to close the Speciate Window without doing anything you might regret later.

EVALUATION WINDOW

The Evaluation Window gives you feedback on how well you are doing as an ecological experimenter. It visually shows the diversity of life in your ecosystem and gives you a numerical score, a personal rating and a status report.

The Evaluation Window can be reached through the Evaluation item in the Windows Menu. It can be moved around the screen by clicking and dragging the Title Bar. It will go away if you click in the Close Box.



THE MAIN DISPLAY

The main area of this window is a scenic view of a potential ecosystem. There will be pictures of plants and/or animals that represent different ecological niches that are currently filled. The more life-forms you have, the more diversity you have, and the better your ecosystem's chances of survival. Click on any displayed pictures of plants or animals for more information on the types and numbers of organisms they represent.

SCORE

This gives you numerical feedback on your skills and progress. The score is based on the ecology score (which is a factor of a whole bunch of things going on in the ecosystem), with diversity of species, the number of years the game has been in progress and the difficulty level factored in. It's easy to get a high score for a short time, but keeping a high score for a long time is very hard.

RATING

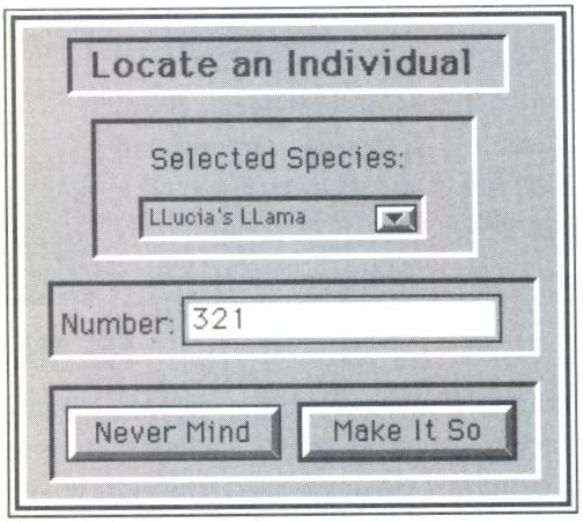
Rating gives you a title that describes your skill. There are 21 ratings ranging from Parking Lot Builder to... you'll have to find out for yourself.

STATUS

Status is a one-line description of the current ecosystem. It might point out a problem or need, mention something nice, give you useful information or even compliment you.

LOCATE AN INDIVIDUAL WINDOW

The Locate an Individual Window lets you find any currently living *individual* organism. It can be opened from the Technical submenu in the Simulation Menu.



SELECTED SPECIES

Click and hold on the down-arrow button to see a submenu of all available species. While holding the mouse button down, slide the cursor to the species you want, and release.

NUMBER

Highlight and type in the number of the individual you want to locate.

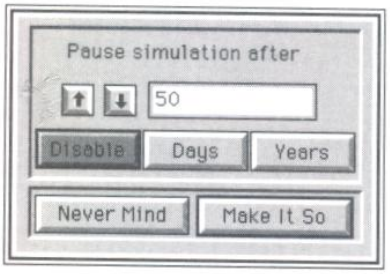
NEVER MIND

Click this button to close the Locate An Individual Window without locating anything.

MAKE IT SO

Click on this button when you have chosen the species and number above. The individual, if living, will be located, highlighted and visible in the Edit Window. If it isn't living, you will be returned to the Locate An Individual Window for another try.

RUN CONTROL WINDOW



The Run Control Window lets you tell the simulation to pause and wait for you after a certain amount of time. It can be opened fron the Technical submenu of the Simulation Menu. Use this window when you want to check data at certain times without sitting at the computer, waiting and watching, ready to dive for the pause button.

You can set it to pause after any amount of days or years, depending on your experiment, but the most useful is 50 years. All the graphing, history and census data is only kept in memory for 50 years: if you stop the simulation every 50 years and save it to disk (each time under a different name), you can get continuous data and graphs for the whole experiment.

Note: Run Control will stay active until you disable it.

NUMBER

Use the up- and down-arrows or type in the number of days or years you want the simulation to run before pausing.

DISABLE

Click this button to disable Run Control.

DAYS

Click this button to activate Run Control and make it pause after a number of days.

YEARS

Click this button to activate Run Control and make it pause after a number of years.

NEVER MIND

Click this button to close the Run Control Window without activating it.

MAKE IT SO

Click on this button when you have set the amount of time you want the simulation to run before pausing.

SIMLIFE

SAMPLE EXPERIMENTS

There are an unlimited number of experiments you can design and run with SimLife. Here are just a few ideas to work with.

SEED-EATERS AND PLANTS

Design an experiment to see if, on the whole, seed-eaters do more damage or good to plant populations.

Keep in mind:

- Many seeds don't sprout if they don't have the right genes for sprouting temperature and moisture.
- Seeds that don't sprout take up room that could otherwise be exploited by seeds that can sprout.
- Seeds that are eaten never sprout.

THE BATTLE OF THE SEXLESS

Design an experiment that shows whether or not sexual reproduction (as opposed to asexual reproduction) provided an advantage to a species.

Keep in mind:

- The vast majority of species on earth use sex during reproduction to expand their gene pool.
- Sexual reproduction requires the large energy expense of finding and courting a mate that could otherwise be used to find food or directly increase the population.
- What is there in the real world that's missing from SimLife that might make your experimental outcome different?

OTHER WORLDS

A Food Web that is successful in earthlike surroundings might not do so well if transplanted to another planet with different gravity, different ocean viscosity, and/or different energy returns from food sources.

Design an experiment (or 10) that simulate(s) other worlds, set loose some life, and see what happens. Then determine the genetic changes that would allow the life to better survive in the new surroundings.

Keep in mind:

- Different types of worlds can be designed in the Laws of Physics Window.
- It will be easier to start with Food Webs that have been proven survivors in an earthlike setting.

GALAPAGOS

The Galapagos Islands contain the best known examples of divergent evolution because of isolation.

Design an experiment where two populations (one on the mainland, one on an island) are isolated from each other, and see if and how the paths that evolution takes in the two populations differ.

Keep in mind:

- To get the full effect, and to have different evolutionary pressures, make the mainland large, and the island small.

  You'll have better luck with this one if you use a fairly large world.
- Barriers over land or water will block walkers, but not flyers. To keep flying creatures from crossing the ocean, spreading their genes and messing up the experiment, have the island as far from the mainland as possible, and set the energy requirement for flying so high that an animal will starve to death before it can cross the ocean.

PIG OUT

Sometimes colonists bring animals from their old homes to new lands. Unfortunately, these animals always escape, and often don't have any natural enemies to keep their population down. A classic case is the pig in Hawaii. It not only has no natural enemies, but also eats many of the native plants down to the roots, killing them.

Design an experiment to simulate the destruction done by pigs in Hawaii, and try to come up with a solution for the problem.

Keep in mind:

- Setting the food value of plants to low in the Laws of Physics Window will cause herbivores to eat the entire plant and not just graze on the leaves.
- Sometimes solutions to problems cause their own, worse problems.

CRY WOLF

Fans of the Farley Mowat book *Never Cry Wolf* (or the Disney movie based on the book) know of the importance of the balance between the populations of wolves and caribou.

Design an experiment with a stable cyclic balance between wolves (carnivores) and caribou (herbivores), then go hunting and drastically reduce the wolf population. See if reducing the predators is better or worse for the prey.

Keep in mind:

- Watch the Population Interaction Window first for establishing the stable wolf/caribou relationship, then to see the results when the wolf population drops.
- If you haven't read the book or seen the movie, I recommend both.

INBREEDING

What happens when there is not enough genetic diversity within a species' gene pool? An April 1992 *National Geographic* article told of the modern-day woes of lions living in the Ngorongoro Crater in Tanzania with just this problem.

Design an experiment where a species with very little genetic diversity faces a new environmental pressure such as dwindling food source, climate change, or new predator.

THE CALIFORNIA WATER RUSH

For the past five years, California has been suffering from a drought. Yet farmers still grow crops that require huge amounts of water and homeowners want large green (thirsty) lawns.

Design an experiment where you have many water-hungry plants flourishing in a wet environment, then slowly start to dry things up. See if you can develop new strains of the old plants that require less water, or come up with new plants that will meet the same needs without needing the same water.

MISCELLANEOUS SIM-STUFF

CONSERVING MEMORY

SimLife can be a memory hog. If you have limited memory, you may want to do the following:

- Use the smaller-sized worlds: the smaller the world, the less memory the simulation needs.
- Use the Plant and Animal Limits in the Laws of Physics Window.
- Turn off Record All Statistics in the Technical submenu of the Simulation Menu.

MAKING THE SIMULATION RUN FASTER

Aside from setting the actual simulation speed in the Speed submenu of the Simulation Menu, there are two basic ways to make the simulation run faster: limiting memory use and limiting screen redraws.

The more information in memory, the more data the simulation has to check and recalculate every cycle. Ways to limit memory usage are:

- Use the smaller-sized worlds: the smaller the world, the less memory the simulation needs.
- Use the Plant and Animal Limits in the Laws of Physics Window.
- Turn off Record All Statistics in the Technical submenu of the Simulation Menu.

Dealing with graphics and redrawing the screen is very processor-intensive. Ways to limit redraws are:

- Limit the number of windows you have open at a time.
- Keep the Edit Window small.
- Turn off Auto Tracking in the Goodies submenu of the Simulation Menu. When on, Auto Tracking can cause frequent screen redraws, which slow things down.
- Turn off Update All Windows in the Goodies submenu of the Simulation Menu.

In addition, turning off sounds and music in the Goodies submenu of the Simulation Menu will free up the processor a little, and will increase speed just a little.

You can also change the day and year length in the Laws of Physics Window, but this only changes the rate time passes, and doesn't actually make the simulation run any faster.

THE WORLD BUILDING PROCESS

When building a new world, the simulation follows these steps:

1. Draw fractal lines to make the upper ridges and peaks of mountain ranges.
2. Use Cellular Automaton techniques to gradually and randomly bring the peaks of the mountains down to the plains.
3. Pick points at mountain peaks and start rivers flowing down.
4. Let rivers wind downhill until they hit the plains.
5. Once on the plains, flood the rivers out into lakes.
6. Create the moistures zones: starting along the left edge of the screen, the wind blows the moisture from west to east. Air picks up moisture as it goes over lakes, loses it over plains, drops moisture on west side of mountains and is drier on the east side. Since air loses moisture going across plains, a long plain will turn into a desert without nearby water.
7. Create the temperature zones: start on left. Begin with a random but smooth distribution of temperatures, and sweep to the right. As you go over water, temperature becomes more moderate. As you go up in altitude, it gets colder. On flat ground, it gets hotter (desert effect). If you have few mountains and lakes you get a desert.
8. Build the soil layer. The best soil is under water and in moist zones. The soil gets worse as you go up in altitude. If you add water, it will not make the soil better. If you expose previously underwater soil, it will be good, but will start to erode immediately.

9. Add the filter food. Filter food follows the moisture: moist areas and lakes have the most. Filter food changes with the seasons: more when it's warm with long days; wetness helps, too.

DATA FILE TYPES

SimLife uses a number of different types of data files to save plants, animals, and games. Here is a listing and explanation of each of the types. If there are variations for your particular computer, they will be covered in the machine-specific addendum.

GAME DATA FILE

Depending on world size and population, the Game file can range from 50KB to 500KB. The Game file does not save any of the census information.

Included information:

- The map
- All species prototypes
- All organisms and their locations on the map
- The state of all windows and menu settings.

INDIVIDUAL ANIMAL DATA FILE

This file holds the species prototype for an animal, and is approximately 1KB in size. It is created from the Select Level of the Biology Lab when you click on the Save button.

INDIVIDUAL PLANT DATA FILE

This file holds the species prototype for a plant, and is approximately 1KB in size. It is created from the Select Level of the Biology Lab when you click on the Save button.

PLANT ZOO FILE

This file holds the species prototypes for a group of plants. It is created from the Biology Lab using the Save All Plants button. Its size is approximately 1KB per plant.

ANIMAL ZOO FILE

This file holds the species prototypes for a group of animals. It is created from the Biology Lab using the Save All Animals button. Its size is approximately 1KB per animal.

DATA LOG FILE

Data Log files are created when you activate the Data Logging option in the Technical submenu of the Simulation Menu. When active, once a day all the simulation memory that is viewable in the Graph Census Window is dumped to disk.

It is in a standard ASCII tab-delimited file format and can be loaded into most spreadsheets and databases for charting, graphing and statistical analysis.

The size of this file depends on the number of species and length of the game, and is approximately 1KB per day. This file is appendable: you can log data during a game or experiment, stop for a while, and come back to the game at a later time and continue logging to the same Data Log file.

The Data Log file also contains genetic descriptions of each animal that lives during a game, plus enough genealogy info to eventually recreate the family trees of animals in your experiments.

For more information and for the file format, see your machine-specific addendum.

SIMLIFE GLOSSARY

The SimLife manual provides many game-specific definitions for terms that are working definitions relevant to gameplay. Many of the following glossary definitions are more broad, formal denotations of terms.

Adaptive Behavior — Responses—often genetically controlled—of an individual, group or species to the environment that aid survival and reproduction.

Artificial Life — The study of and attempt to simulate life and lifelike processes in artificial media, including software (computer simulations), hardware (robotics), and wetware (organic material).

Asexual — Involving or reproducing by reproductive processes (as cell division, spore formation, fission, or budding) that do not involve the union of individuals or germ cells; lacking sex or functional sex organs.

Carnivore — An organism that feeds on animals; a flesh-eating animal.

Census — A usually complete enumeration of a population; specifically, a periodic governmental population count.

Chromosome — A filamentous, threadlike structure in the cell nucleus (in eukaryotic cells), along which the genes are located.

Deciduous — Falling off or shed seasonally or at a certain stage of development in the life cycle; shedding leaves each year.

Diversity — Represented by a broad band of distinct elements or qualities; characterized by variety, difference and deep range.

DNA — Any of various nucleic acids that are localized especially in cell nuclei that are the molecular basis of heredity in many organisms, and are constructed of a double helix held together by hydrogen bonds between purine and pyrimidine bases, which project inward from two chains containing alternate links of deoxyribose and phosphate.

Ecology — A branch of science concerned with the interrelationship of organisms and their environments.

Ecosystem — The sum total of physical features and organisms occurring in a given area.

Environment — The complex of physical, chemical and biotic factors (as climate, soil, and living things) that act upon an organism or an ecological community and ultimately determine its form and survival.

Evergreen — Having foliage that remains green and functional through more than one growing season.

Evolution — Change in the genetic makeup of a population with time; a theory that the various types of animals and plants have their origin in other preexisting types and that the distinguishable differences are due to modifications in successive generations.

Extinct — No longer active or existing.

Filter Food — Organic matter or minute organisms often found in water currents that provide a source of nutrition for certain animals.

Food Chain — the sequence of organisms, including producers, consumers, and decomposers, through which energy and materials are made and consumed in a community; an order of predation in which organisms use the next usually lower member as a food source.

Foraging — A browsing, grazing or wandering search for food or provisions.

Gene — A sequence of DNA nucleotides that codes for a particular polypeptide or an RNA molecule. Genes provide information for structure and function in organisms and are passed on in reproduction.

Genealogy — An account of the descent of a person, family, or group from an ancestry or from older forms.

Genetic Drift — Change in the gene pool purely as a result of chance, and not as a result of selection, mutation, or migration.

Genetics — A branch of biology that deals with the heredity and variation of organisms; the genetic makeup and phenomena of an organism, type, group, or condition.

Genome — The total genetic information in an organism's nucleus.

Germination — Sprouting or developing; coming into being or beginning to grow.

Gestation — The carrying of young in the uterus and the concomitant developmental stages.

Herbivore — An animal that eats plants.

Humidity — Degree of wetness, especially atmospheric moisture.

Intelligence — Ability to learn or understand or to deal with new or trying situations; the ability to apply knowledge to manipulate one's environment.

Mutation — Any relatively stable heritable change in the genetic material.

Natural Selection — Differential reproduction in nature, leading to an increase in the frequency of some genes or gene combinations and to a decrease in the frequency of others.

Nectar — A sweet liquid that is secreted by the nectaries of a plant, sometimes a nutritional source for animals.

Niche — The functional role and position of an organism in the ecosystem.

Phenotype — The physical manifestation of a genetic trait; the features of form, function, and behavior of an organism; an expression of interaction between genotype and environment.

Precipitation — A deposit on the earth of hail, mist, rain, sleet, or snow; the quantity of water deposited.

Predator — One that preys, destroys or devours; often a consumer of living tissue.

Prey — An animal taken by a predator as food.

Prototype — An individual that exhibits the essential features of a later type; an original model on which something is patterned.

Recombination — The formation by the processes of crossing-over and independent assortment of new combinations of genes in progeny that did not occur in the parents.

Speciation — The process of the formation of new species.

Species — A category of biological classification ranking immediately below the genus or subgenus, comprising related organisms or populations potentially capable of interbreeding.

Toxin — A poisonous substance that is a specific product of the metabolic activities of a living organism and is usually very unstable, notably toxic when introduced into the tissues, and typically capable of inducing antibody formation.

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INDEX

A - C

D - F

G - L

M - P

Q - S

T - Z

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