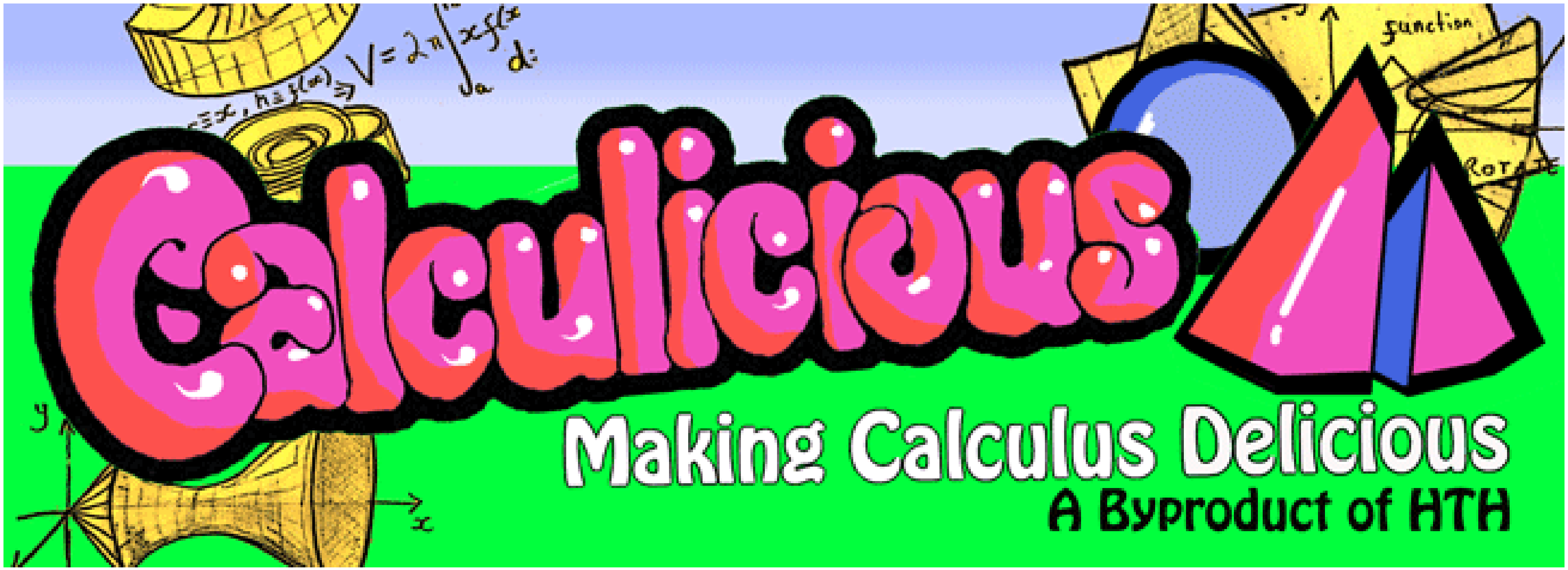
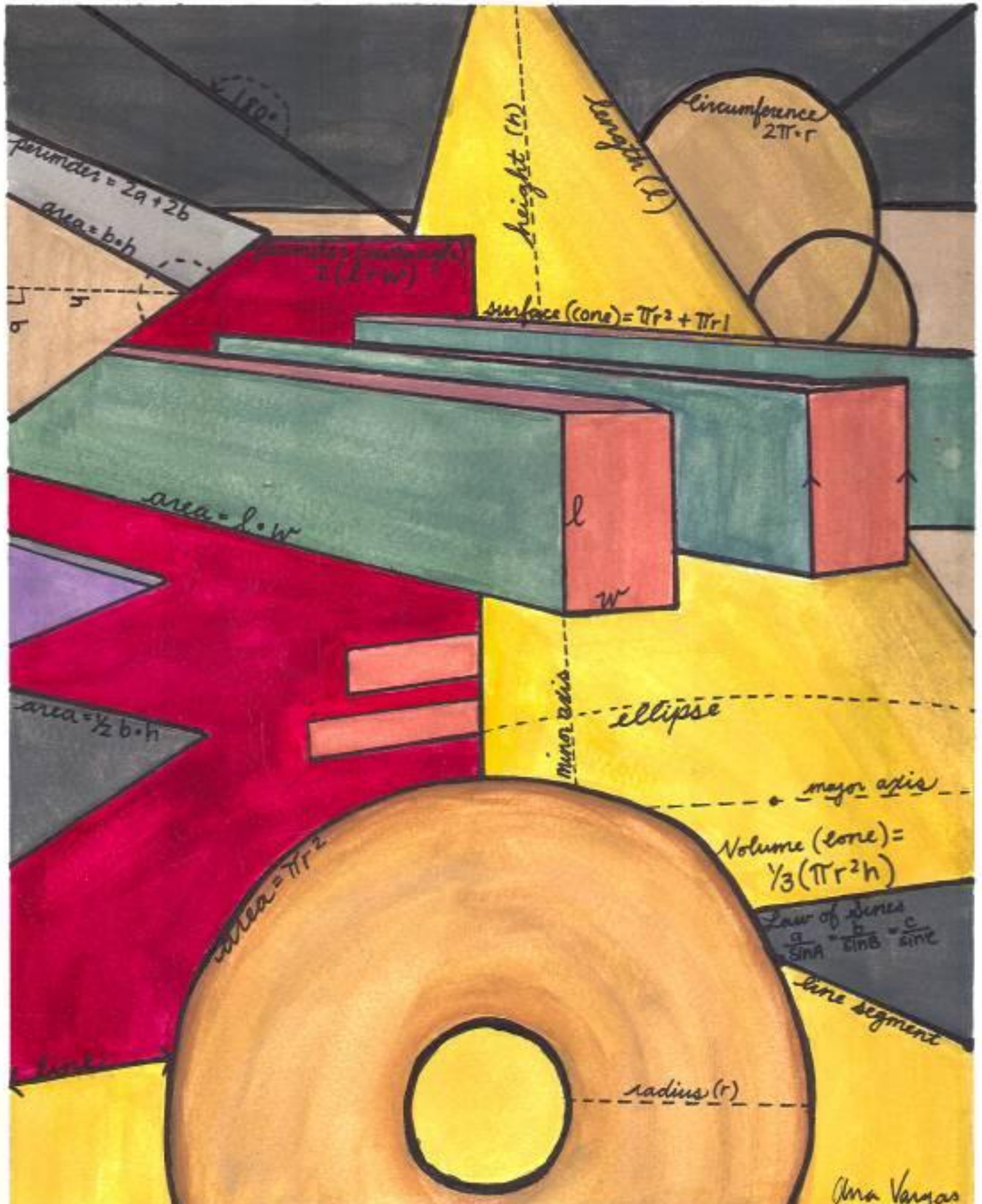
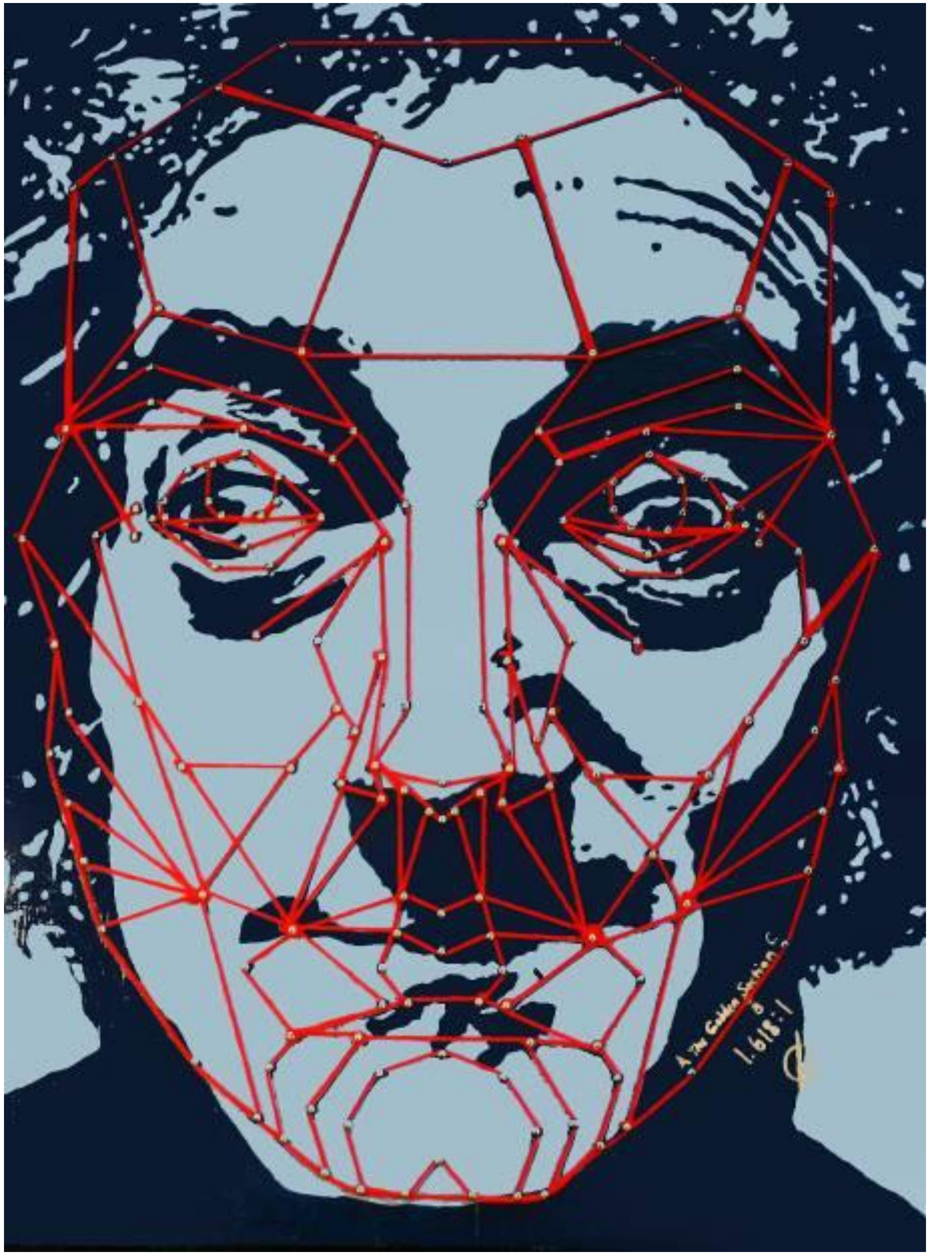
HIGH TECH HIGH®


Calculicious
Making Calculus Delicious
A Byproduct of HTH
function

Area= πr² circle
Perimeter=2l+2w Area=l·w
y=x²
line segment
Distance formula=√((y₂-y₁)²+(x₂-x₁)²)
y=mx+b
ax+by+c=0
Law of cos
Law of sin
Area=½bh c²=a²+b² SOHCAHTOA
Surface area of a cylinder=2πrh
Volume of a cylinder=πr²·h
Beth Jacobs



180°
perimeter = 2a + 2b
area = b•h
h
a
2(l + w)
height (h)
length (l)
circumference
2π•r
surface (cone) = πr² + πrl
l
w
area = l•w
area = ½ b•h
minor axis
ellipse
major axis
Volume (cone) =
⅓(πr²h)
Law of Sines
a/sinA = b/sinB = c/sinC
line segment
area = πr²
line
radius (r)
Ana Vargas


1.618:1

***"Beautiful art on the outside and delicious physics on the inside."***

**Physics Concepts Individually Packed**

# PHYS NEWTONS

# Conservation of Momentum and Energy

A train racing down the tracks hits a car. What happens to the train's kinetic energy? What happens to the train's momentum? The train's energy transforms, becoming Mechanical, Thermal and Kinetic energy, where the overall quantity of energy is conserved. The train's momentum partially transfers to the car at impact, and is conserved. See the


Momentum can be thought of as:antity of motion" that an object has: a moving car has some quantity of motion, but a parked car has none. Momentum is found by multiplying an object's mass times its speed. There is no special unit, so the units are kg × m/s. Momentum = mass (kg) × speed (m/sec).When a moving object collides with another object (moving or not) there is a transfer of momentum. The transfer is such that the total momentum before and after the collision remains equal.

The change of kinetic energy(ΔK) of an object when moving from point a to point b via a path(s) under the influence of a force F(s) is defined by the work done by this force.

Momentum and energy are both conserved quantities, meaning that they can be neither created nor destroyed. To change an objects momentum a force acts over a time. Force acting through a distance changes energy. Another difference is that momentum is a vector and energy is a scalar.

**STANDARD 2G** Students know how to solve problems involving elastic and inelastic collisions in one dimension by using the principles of conservation of momentum and energy. *Casey Stocker*

# Newton's Second Law

## F=m•a

Newton's second law states when a force is applied to an object, it will cause the object to accelerate. This is represented as force equals the product of mass and acceleration (F=m•a).

The force is directly proportional to both mass and acceleration. If you apply more force, it will cause an increase acceleration. Likewise, if you add more mass, force will need to increase as well to keep it accelerating at the same rate.

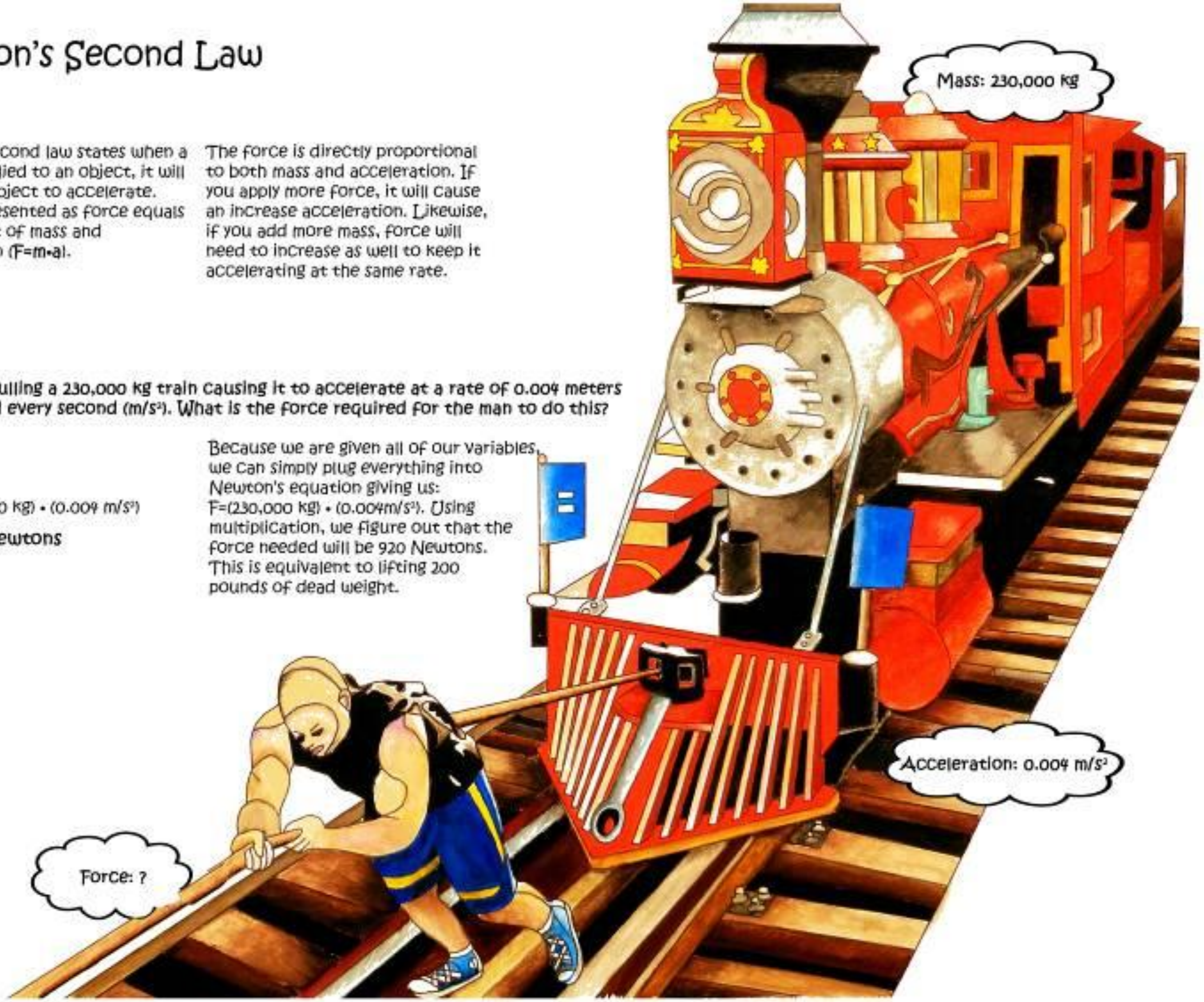
A man is pulling a 230,000 kg train causing it to accelerate at a rate of 0.004 meters per second every second ($m/s^2$). What is the force required for the man to do this?

F=m•a

F=(230,000 kg) • (0.004 $m/s^2$)

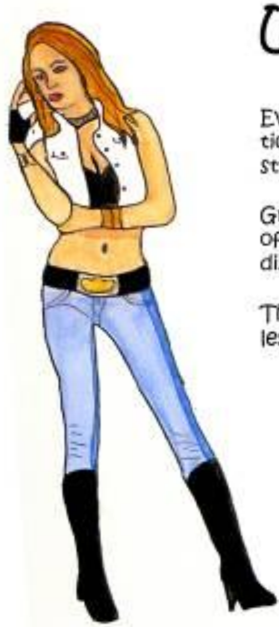
**F=920 Newtons**

Because we are given all of our variables, we can simply plug everything into Newton's equation giving us: F=(230,000 kg) • (0.004$m/s^2$). Using multiplication, we figure out that the force needed will be 920 Newtons. This is equivalent to lifting 200 pounds of dead weight.




**STANDARD1C** Students know how to apply the law F=ma to solve one-dimensional motion problems that involve constant forces (Newton's second law). *Alex Jasmund*

# Universal Gravitation



Every object in the universe attracts every other object with a gravitational force. Gravitational Force is directly dependent upon the mass of both objects. The bigger the objects, the stronger the force.

Gravitational Force also obeys the inverse square law. This means that if two objects (center of mass) are further away from each other they attract each other less. In fact, doubling the distance reduces the force by 4.

These examples relate to this law because the fat couple below with a higher mass and less distance between them is more attracted to each other than the skinny couple with


Using the equation below, we can find the force of attraction between both couples.
The fat couple is:

$$F_{grav} = G\frac{115 \cdot 110}{1^2}$$
$$= 11,500G$$

And the skinny couple is:

$$F_{grav} = G\frac{60 \cdot 50}{5^2}$$
$$= 120G$$

This law can be explained by the equation: $$F_{grav} = G\frac{m_1 \cdot m_2}{r^2}$$

G represents the universal gravitation constant which is $6.673 \times 10^{-11}\ m^3kg^{-1}s^{-2}$

M1 represents the mass of object 1 in kg, m2 represents the mass of object 2 in kg, d represents the difference separating the objects center in meters.

**STANDARD 1E** Students know the relationship between the universal law of gravitation and the effect of gravity on an object at the surface of Earth. *Cherish Burtson*

# ECONOMICS ILLUSTRATED

A HIGH TECH HIGH PROJECT
BY THE TENTH GRADE STUDENTS OF
DAN WISE AND JEFF ROBIN

# *Are Countries Free Riding Off International River Pollution?*

**Alison Conover**

***Upstream countries are receiving benefits of dumping their waste downstream because they do not need to pay for the effects of their pollution***

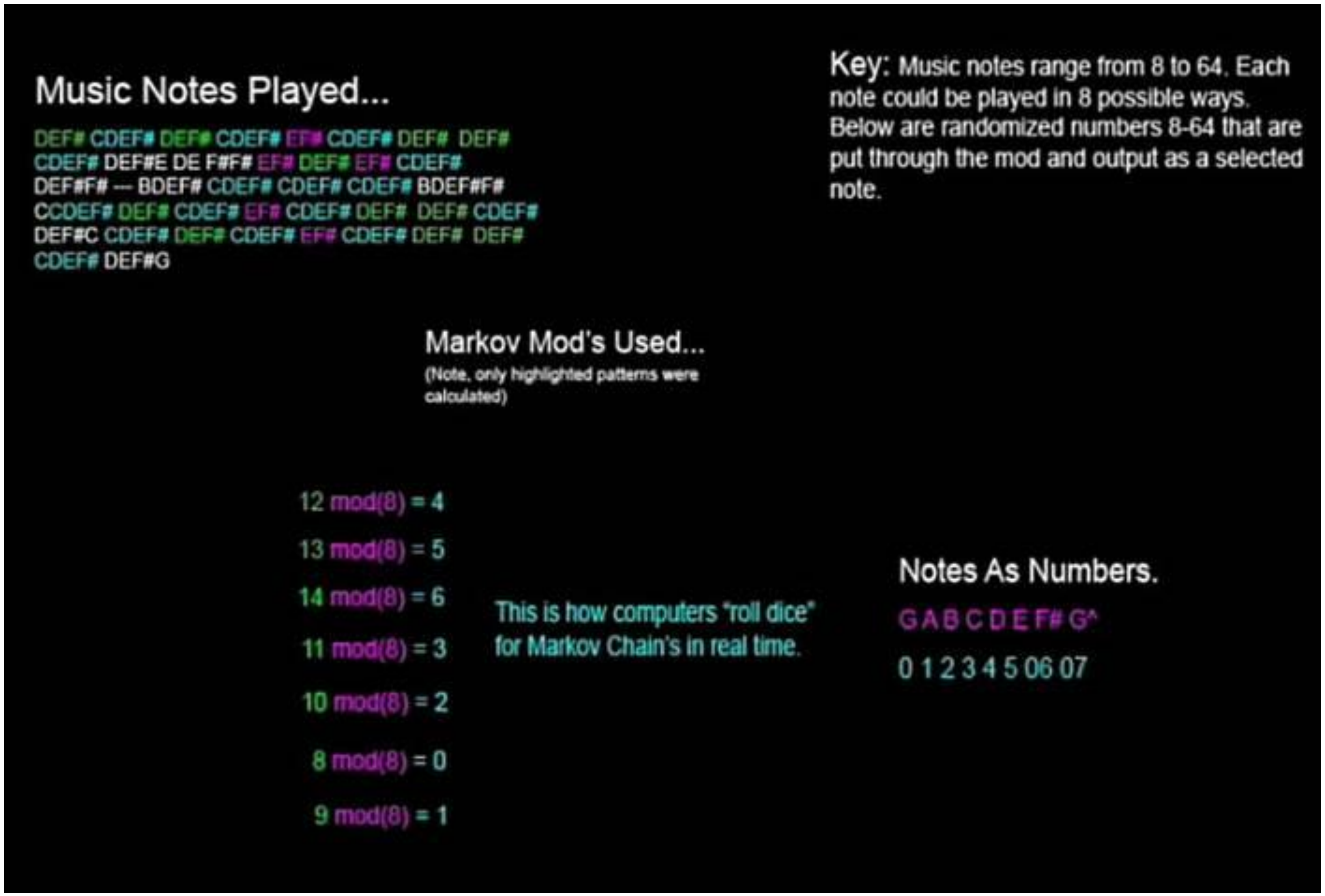
# *The Invisible Hand*

***Camille Gomez***

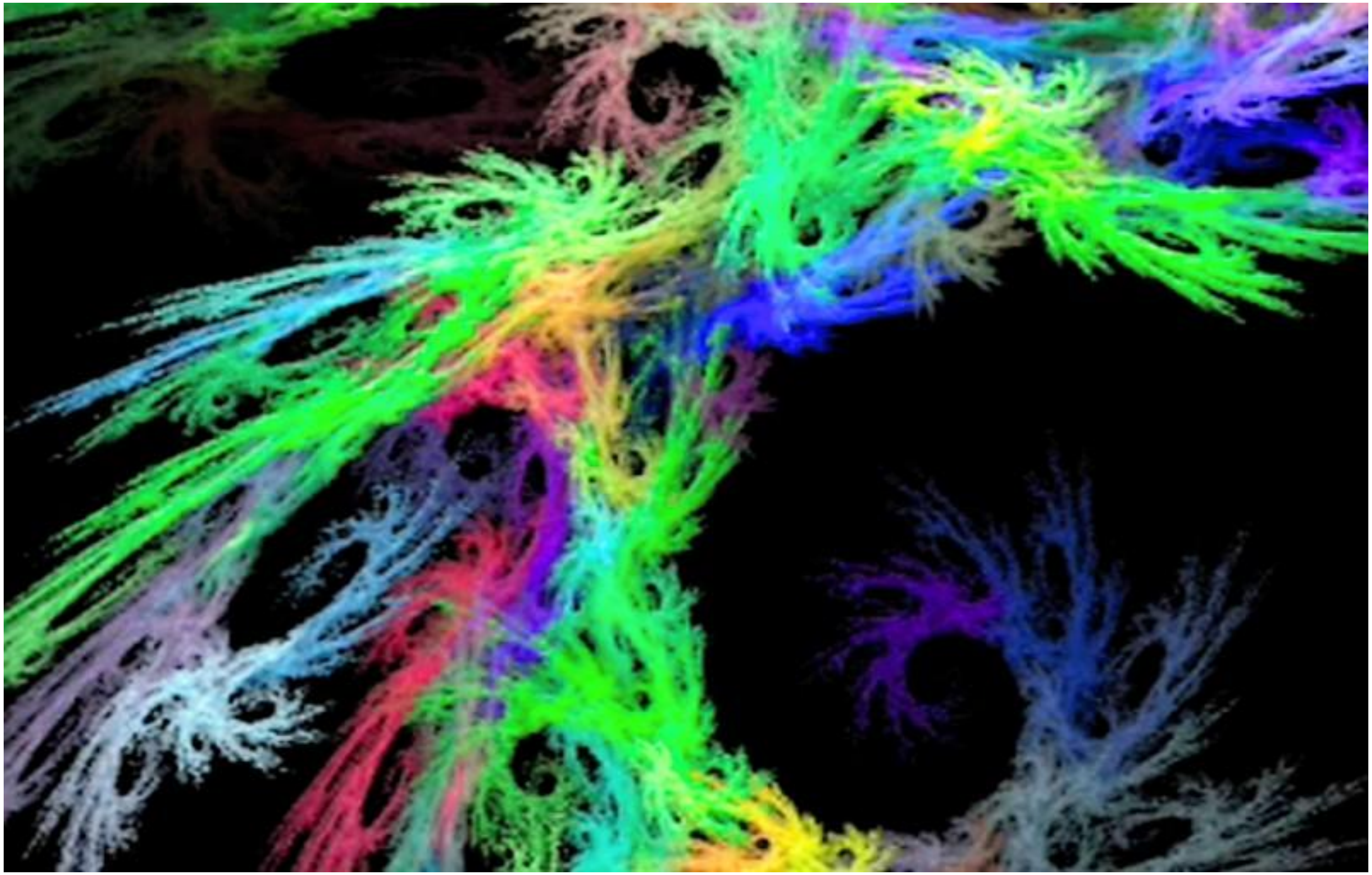
***The invisible hand is a metaphor that describes how individuals acting in their own self interest unintentionally benefit society by producing and purchasing the goods and services that are wanted and needed***

# Public Exhibition

# Algorithmic Composition

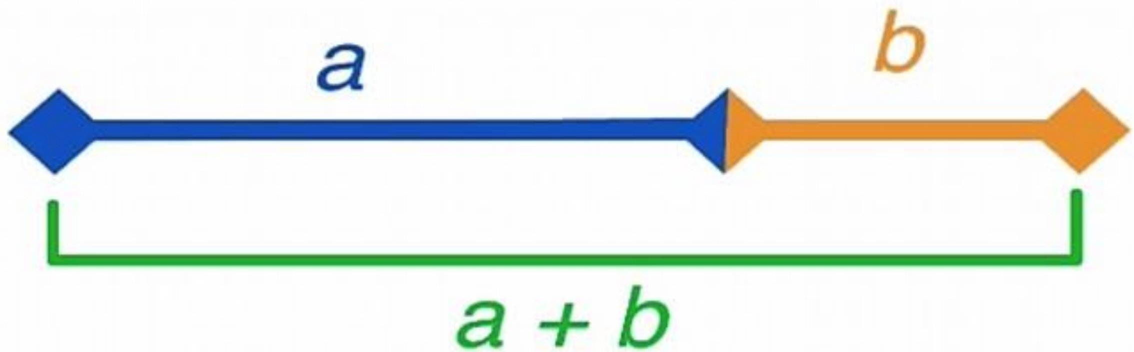


# Fractals



# Cryptography

# Beauty & Phi




$$\frac{a+b}{a} = \frac{a}{b} \equiv \varphi$$

# Madagascar

## An Environmental History

**Deforestation:** Eighty percent of Malagasy are living in poverty and rely heavily on environmental capital. The Malagasy people are looking to survive, and the conservation of resources is not one of their priorities. Illegal logging is abound as a source of income. In addition, overpopulation leads to deforestation. As the population expands, so needs the space for their cities, waste, and food; eliminating space for the forest.

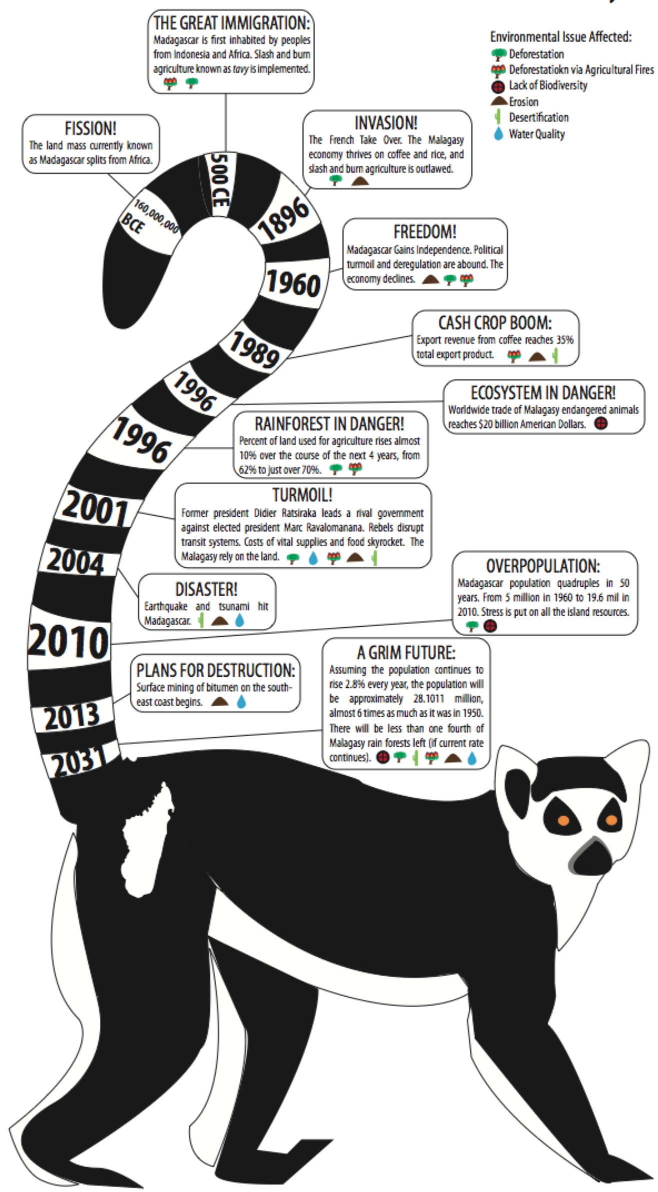
**Deforestation via Agricultural Fires:** In Madagascar, slash and burn agriculture is epidemic. In fact, only 34% of Madagascar's original 11.2 million hectares of rain forest still exist. Slash and burn type agriculture is where a section of forest is burned, and a crop is planted in the ashes. Once the crop is cultivated, the ground is left fallow for up to twenty years and a cycling system is implemented allowing vital nutrients to flow back into the soil. This method of farming is only sustainable when used for subsistence, as shorter cycles will exhaust the nutrients in the soil. On slopes, slash and burn is particularly precarious because the new vegetation, mostly grasses, is insufficient to hold the soil up, causing landslides. Madagascar's major crops are rice and coffee. Rice and coffee uses up the phosphorus, potassium, and nitrogen in the soil which cannot be returned if after cultivation because burning the leftover plant matter deprives the soil of SOM (soil organic matter).

**Lack of Biodiversity:** A loss in biodiversity continues to be a threat for Madagascar. Since 80% of species are endemic, it is extremely important that we try to conserve them. In fact, 5% of all flora and fauna in the world can only be found on this African Island. Because of the limitations imposed by the island's size, animals populations are smaller, making their ecosystems more fragile. The isolated island country's ecosystems are just that, fragile and isolated. Any small disturbance in the balance of these ecosystems will have detrimental effects.

**Erosion:** Often victims of slash and burn, agricultural lands tends to use tillage to make the land by aerating it. This changes the composition of the soil and makes it more susceptible to erosion. When it rains, particles of soil become suspended in the rain drop. As the drop travels across the Earth's floor, the friction of the soil and water cause more soil to get picked up. Since the composition of the soil is air-heavy, the topsoil can be removed from earth more easily. This not only causes a great loss in land due to erosion, but also a significant amount of nutrients from the soil to be dumped into the rivers and streams of Madagascar. This effect is only concentrated thanks to Madagascar's long dry and wet seasons because the water content of the soil is very low at the end of the dry season, only to be drenched quickly in the wet season, washing it away more quickly.

**Desertification:** Every year, more and more of Madagascar's arable land, which accounts for 5% of the island, becomes a unproductive due to the effects of desertification. Desertification is the loss of topsoil from wind and flooding due to the removal of vegetation leaving behind hard-packed, nutrient-bare soil which bakes in the sun and reduces the land to an unproductive wasteland.

**Water Pollution:** Most water pollution in Madagascar is a product of the agricultural and mining practices of the island people. Deforestation, leads to erosion, and then the soil and everything in it ends up in the rivers and streams of Madagascar. This issue is so prevalent in Madagascar that many rivers run red because of the amount of eroded material in the water. The most common materials are nitrogen (from fertilizers), as well as bitumen (asphalt) from mining. This causes eutrophication, or large algae blooms, because of the excess nutrients, such as phosphorus and nitrogen. Over time the nutrients are used up, and what is left is a large area of decaying algae which removes oxygen from the water. This causes the death of the plants and animals that rely on oxygen in the water.



# Madagascar

## An Environmental History

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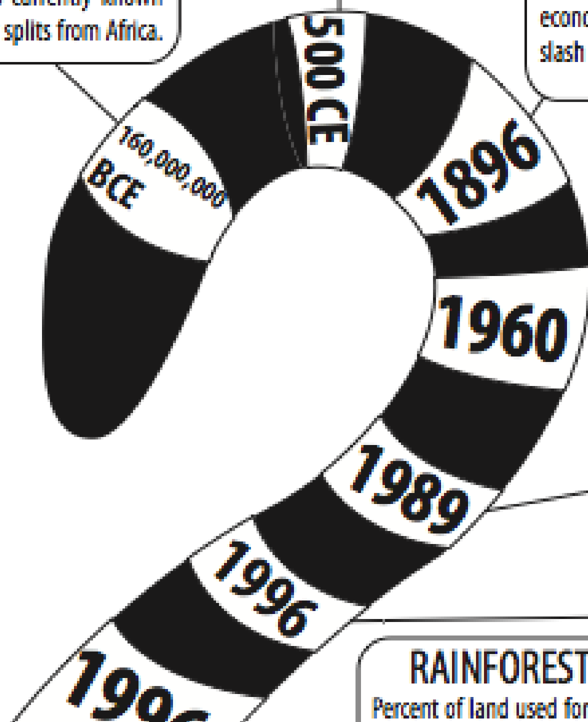
Environmental Issue Affected:

- Deforestation
- Deforestatiokn via Agricultural Fires
- Lack of Biodiversity
- Erosion
- Desertification
- Water Quality

**THE GREAT IMMIGRATION:**
Madagascar is first inhabited by peoples from Indonesia and Africa. Slash and burn agriculture known as *tavy* is implemented.

**FISSION!**
The land mass currently known as Madagascar splits from Africa.

**INVASION!**
The French Take Over. The Malagasy economy thrives on coffee and rice, and slash and burn agriculture is outlawed.




**FREEDOM!**
Madagascar Gains Independence. Political turmoil and deregulation are abound. The economy declines.

**CASH CROP BOOM:**
Export revenue from coffee reaches 35% total export product.

**ECOSYSTEM IN DANGER!**
Worldwide trade of Malagasy endangered animals reaches $20 billion American Dollars.

**RAINFOREST IN DANGER!**
Percent of land used for agriculture rises almost

# Country Profile // India

Captial: New Delhi
Population: 1.21 billion (second largest)
Square Miles: 1.27 million (seventh largest)

NGO: Afpro New Delhi
NGO: Adisil Tamil Nadu
NGO: Mt. Zion College of Nursing


Needs/Problems:
Close the open sewers | Unprotected human cleaners
No $CO_2$ vehicle limits | Heavy reliance on coal
Stagnant water | Homes don't use windows due to heat

Resources/Solutions:
India Cements Limited | Improve/create infrastrucutre
Have govt. set $CO_2$ reg. | Create waste facilites
Improve/create drains | Create netting to cover homes

Waste/pollution: is unfortunately estimated to increase by 500% in 2020 by UNEP.
Water quality: by 2020, it is estimated that India will be a "water-stressed" nation.
Malaria: Methodical spraying and testing can reduce malaria by 1/3 by 2020.

## The Issues... Present-day Issues

Solid watste pollution has been an ongoing problem in India for a long time, and burning trash is a daily practice that adds to air pollution. Water quality is another big issue that is currently ongoing (only 27% of waste water was being treated in '03) and is being addressed little by little. Malaria epidemics have claimed the lives of many of India's people, especially those living in rural areas, where stagnant water is an all too common problem.

## Pollution 18th century - Present

The Industrial Revolution brought major changes to India in mass-manufacturing, especially in the textile industry. This created an excess of solid waste, which today continues to be disposed of by burning, releasing pollutants into the air (sulfur, $CO_2$, $NO_2$, and carbon monoxide). Trash burning in India is common. For example, when a flammable material, such as petroleum-based plastic, is ignited and comes in contact with an oxidizer (such as oxygen), it releases sulfur dioxide into the air, which leads to smog and acid rain when sulfur dioxide, nitrogen dioxide, hydrogen, and a catalyst combine to create $H_2SO_4$. From 1858 to 2000, India's C.C.E. increased by over 5000 times, resulting in 22,341,971,667 tons of $CO_2$ emissions.

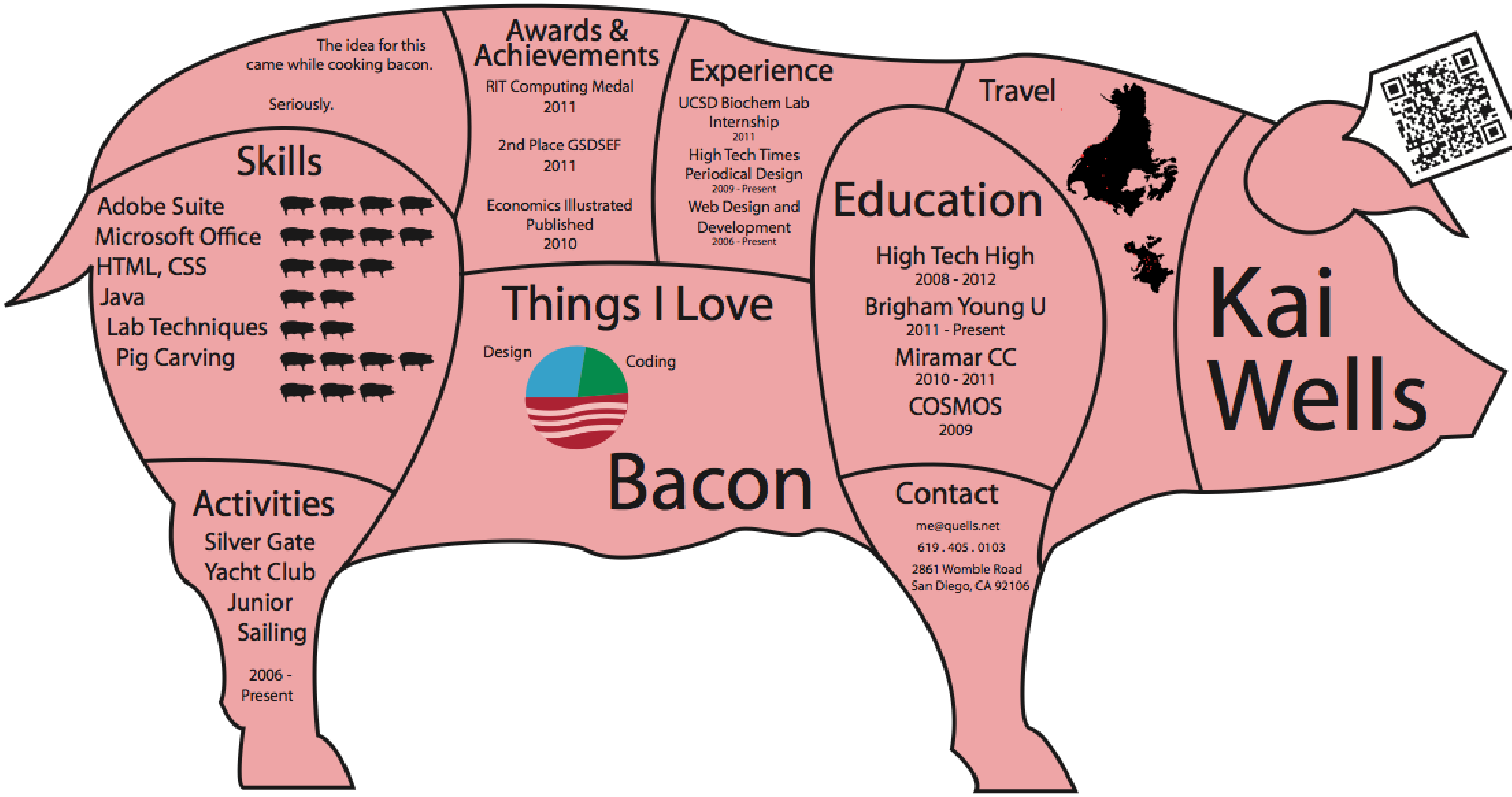
* C.C.E. - Cumulative $CO_2$ Emissions

## Water Quality 4000 BC - Present

Inadequate sewer systems are a big issue. In 2003, only 27% of India's waste water was treated! 88% of the deaths caused by diarrhea happen because of bad water, along with poor hygiene and insufficient sanitation. Human fecal matter contains strains of E. coli that cause food poisoning and even death by hemorrhaging when entering the water that people consume. One way to combat this is to ensure food is never eaten raw, but well cooked to kill bacteria. Because of a lack in good infrastructure, human cleaners take out solids from the sewer water instead of machines. Also, the excessive growth of algae can block sunlight and foul the water around it, consuming oxygen and killing other organisms such as fish.

## Malaria 1000 BC - Present

The construction of railroads and bridges in the 1800s greatly contributed to the spread of malaria by creating breeding grounds for the disease and sending infected workers to work in new areas. Around the time of WWII, particularly 1943, there were over 680,000 malaria-related deaths in India. When an infected mosquito bites a human, sporozites from the mosquito's saliva travel to the liver. Once in the liver, these organisms create thousands of merozoits, which then infect the red blood cells, spreading the infection throughout the body. In 1992, Malarone, an anti-malarial pill, became available in India. The chemical formula for Malarone is $C_{22}H_{19}ClO_3$.


The idea for this came while cooking bacon.
Seriously.
Awards & Achievements
RIT Computing Medal 2011
2nd Place GSDSEF 2011
Economics Illustrated Published 2010
Experience
UCSD Biochem Lab Internship 2011
High Tech Times Periodical Design 2009 - Present
Web Design and Development 2006 - Present
Travel
Skills
Adobe Suite
Microsoft Office
HTML, CSS
Java
Lab Techniques
Pig Carving
Education
High Tech High 2008 - 2012
Brigham Young U 2011 - Present
Miramar CC 2010 - 2011
COSMOS 2009
Things I Love
Design
Coding
Bacon
Kai Wells
Activities
Silver Gate Yacht Club Junior Sailing
2006 - Present
Contact
me@quells.net
619 . 405 . 0103
2861 Womble Road
San Diego, CA 92106

## Whats Going On?

# Friction

**There are two types of friction: Static, and Dynamic**

**Static friction is the force along the contact surface of an object, in the opposite direction of the applied force**

**Dynamic friction is the force in the opposite direction of motion as the applied force**

$F_f = \mu_d R$

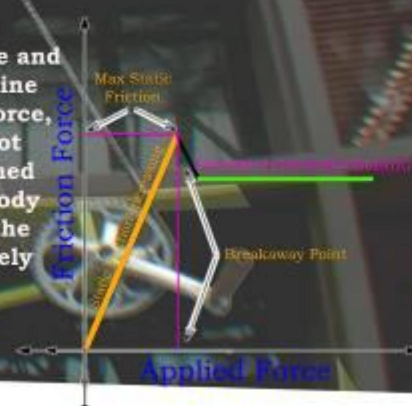
$\mu_s$ the coefficient of static (or limiting) friction

$\mu_d$ the coefficient of dynamic friction

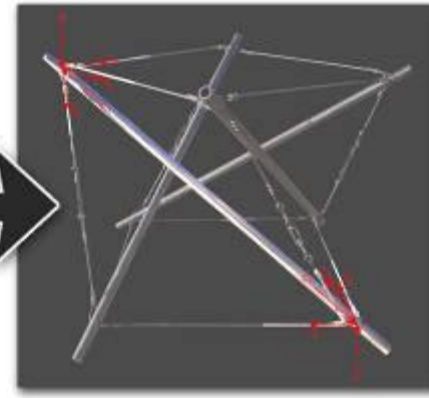
$F_f = \mu_s R$

**The magnitude of the force of friction acting between two surfaceof the normal reaction "R"**
**Thus Ff = a constant × R**
**The value of the constant"R" depends on how smooth the two surfaces are, also known as the coefficient of friction.**

**Here, the x-axis represents the applied force and the y-axis the frictional force. The orange line represents the increasing static frictional force, and throughout this range, the body does not move. When the "Breakaway point" is reached the frictional force drops rapidly, and the body begins moving. The Green line represents the dynamic frictional force, and is approximately constant.**



# T E N S E G R I T Y



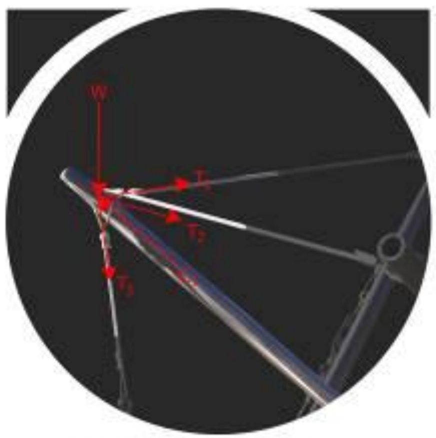
The lower portion of this chair is formed using the principles of tensegrity. "A tensegrity system is established when a set of discontinuous compressive components interacts with a set of continuous tensile components to define a stable volume in space."

The term "tensegrity" is a contraction of "tension" and "structural integrity," and was coined by Buckminster Fuller, who became famous for his work with tensegrity. Nevertheless, the x-shaped formation of tensegrity was originally discovered by Fuller's one-time student, Kenneth Snelson.

Tensegrity maximizes the use of the less voluminous tensile members (string, rope cable, etc.) while minimizing the material-heavy compression members (thick metal, wood, plastic, etc.), making the construction of tensegrity structures highly economical, and the structures themselves very resilient.

## TENSION AND COMPRESSION

In tensegrity structures, the members are either always in tension or always in compression. Tension is a force that pulls on an object. If the force of tension is greater than the resistant inward force of the object, then the object will stretch. Compression is also a force. Where tension pulls, compression pushes. If the force of compression is greater than the resistant outward force of the object, then the object will be compressed. In tensegrity, the tension members are trying to pull two points together, while the compression members try to keep the two points apart. The force exerted through tension and compression reaches a sum total of zero—static equilibrium. This is what enables the structure to maintain its form.




$\vec{W}$ = weight

$\vec{T}_1$ = tension one

$\vec{T}_2$ = tension two

$\vec{T}_3$ = tension three

$\vec{C}_1$ = compression one

$$\vec{W} + \vec{T}_1 + \vec{T}_2 + \vec{T}_3 + \vec{C}_1 = 0$$

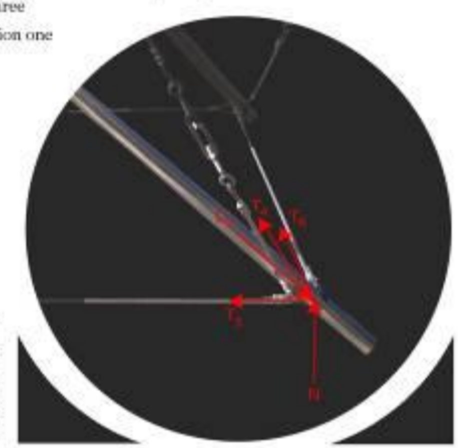
$$\vec{N} + \vec{T}_4 + \vec{T}_5 + \vec{T}_6 + \vec{C}_2 = 0$$

$$|\vec{T}_1| = |\vec{T}_2|$$

$$|\vec{T}_3| = |\vec{T}_4|$$

$$|\vec{T}_5| = |\vec{T}_6|$$

$$\vec{C}_1 = -\vec{C}_2$$




$\vec{C}_2$ = compression two

$\vec{N}$ = normal force

$\vec{T}_4$ = tension four

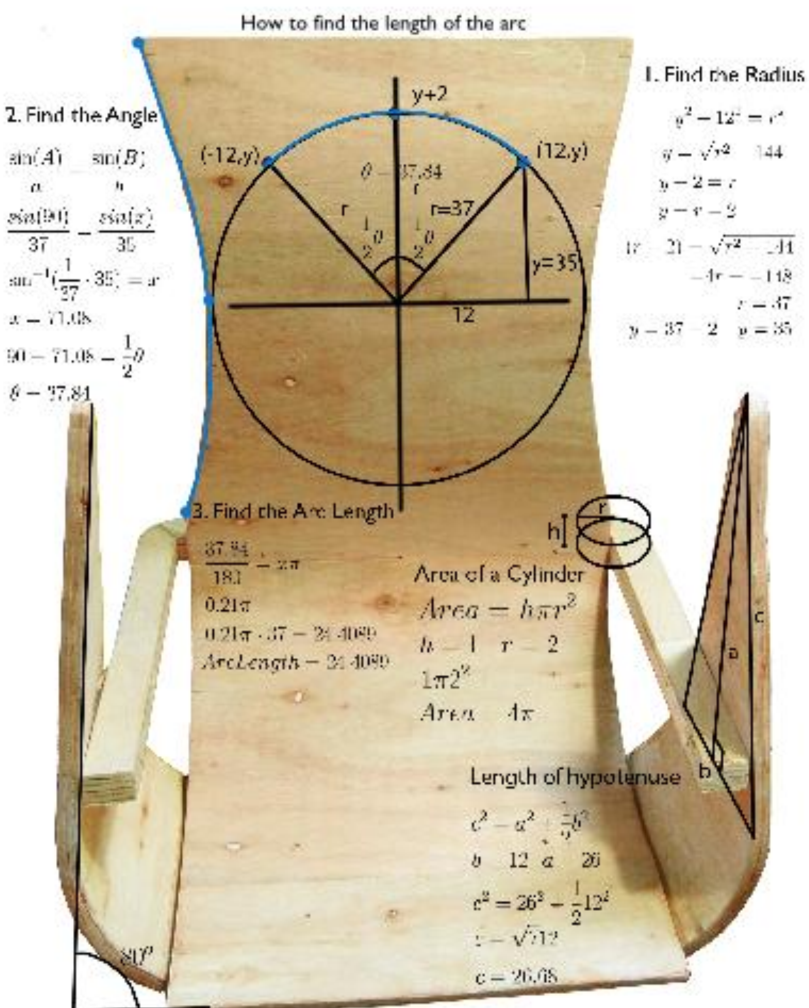
$\vec{T}_5$ = tension five

$\vec{T}_6$ = tension six

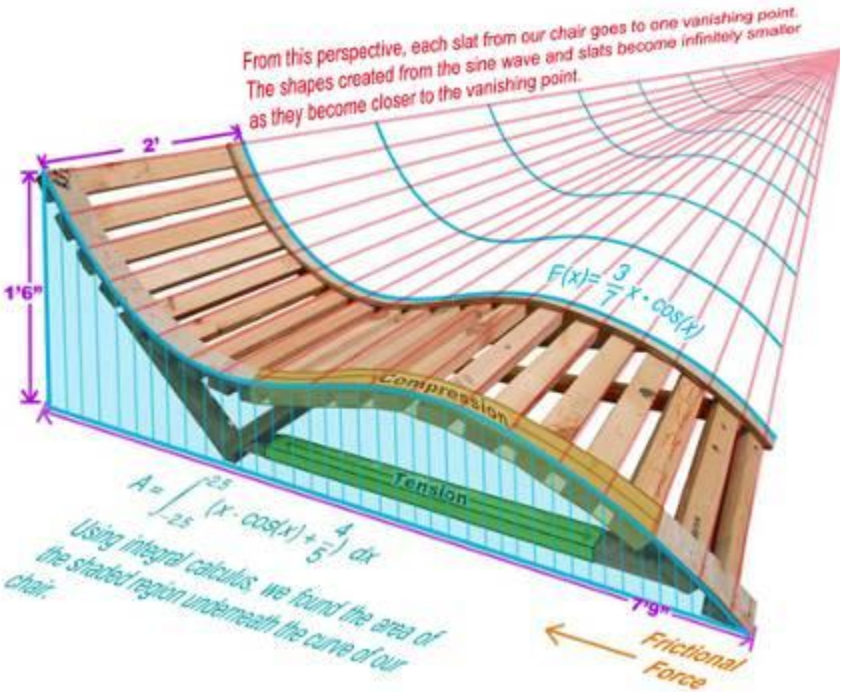
**Vectors** are quantities possessing both magnitude and direction, represented by an arrow the direction of which indicates the direction of the quantity and the length of which is proportional to the magnitude.

In a tensegrity structure, all the vectors are arranged so that they cancel each other out to create a sum total of zero—static equilibrium. The magnitude and direction of the C (compression) arrows combat the force applied by the W (weight), T (tension), and N (normal force) arrows.

# The Enterpriser




Chris Lutze
Austin Vetter




THE

# LEBOWSKI

Designed by Gabi, Sarai, and Jon