THE IMPACT OF MODERN COMPUTING ON THE ENVIRONMENT

AND HOW WE CAN SAVE THE WORLD;

A GUIDEBOOK

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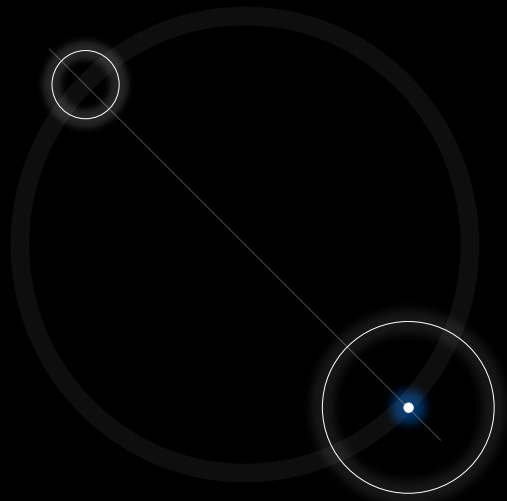

OUR STATEMENT OF PURPOSE

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Computing is necessary for our modern lives but to combat climate change, we need to work to make it more sustainable. By shedding light on things that we can do, we want to help people make positive changes. This guidebook acts as a companion manual to the content we have created and collected. We hope it inspires you and aids you in your own unique and creative endeavors towards saving the environment.

THE IMPACT OF MODERN COMPUTING

UNDERSTANDING WHAT'S HAPPENING TO THE ENVIRONMENT

THE IMPACT OF OUR DEVICES

1. Resources and Minerals
2. Manufacturing and Shipping
3. E-Waste and Electronic Recycling

1.) Impact of collecting resources and minerals

Source

Minerals collected:	However, the mining of these minerals…
• Lithium for batteries • Neodymium for magnets/vibrate feature • Gold for circuitry boards • Copper for chargers • And many more!	• Pollute the local ecosystems • Contaminate the water and food sources for locals living near the sites. • Harm the workers due to low regulation and health standards

2.) Manufacturing and shipping

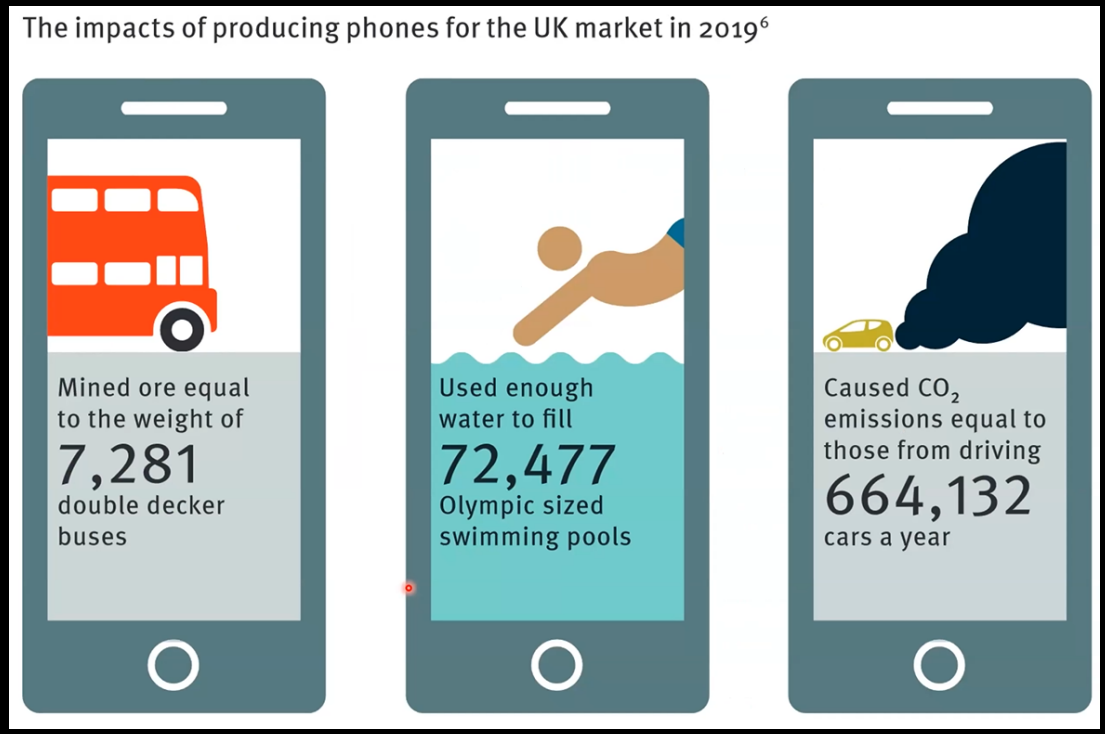
Source

The manufacturing of smart devices tend to focus on "product lifespan extension"

In other words, how much money can they make before they need to update the model.

AN EXAMPLE OF CO_2 EMISSIONS CREATED BY MANUFACTURING PHONES

Source



The Short Lifespan of Phones (Source Needed)

Name	Manufactured	Support ended	Months supported
Nexus One	January 2010	September 2011	20
Nexus S	December 2010	October 2012	22
Galaxy Nexus	November 2011	July 2013	20
iPhone	June 2007	February 2010	32
iPhone 3G	July 2008	November 2010	28
iPhone 3Gs	June 2009	February 2014	56
iPhone 4	June 2010	March 2014	45
iPad	April 2010	May 2012	25
Nokia Lumia 800	November 2011	November 2012	12
Nokia Lumia 900	April 2012	November 2012	7
HTC HD7	October 2010	November 2012	25
HTC Titan	October 2011	November 2012	13

Source

3.) E-Waste and Electronic Recycling

Spotlight on Science: E-Waste by Dr. George Porter! (Video link:)

What is 'E-Waste?'

According to CalRecycle:

"E-Waste is a popular, informal name for electronic products nearing the end of their 'useful life'".

- Example: After a year of owning a phone, it's battery and processor, along with other key components, tend to deteriorate

Why is E-Waste an issue?

Replaced

We tend to replace our outdated phones with the newest model.

According to the EPA, an estimated 75% of cellphone users don't discard or throw their phones away, but instead store them away.

Obsolete

Discarded phones leach harmful chemicals into the soil and water of the surrounding environment.

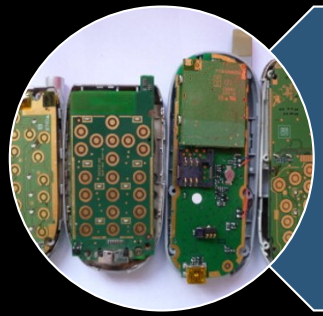
The United States generated 6.92 million tons of e-waste, about 46 pounds per person, in 2019. It recycled only 15% of the material. (Source)

Contaminated

These harmful chemicals can cause community exposure, through food, water, and the air.

Those afflicted usually aren't the buyers of the products, but rather the manufacturers and miners.

Why should you Recycle your previous cell phones?



Cell phones have valuable materials inside, such as plastics, gold, silver, and platinum.

- These metals are farmed in Rare Earth Mines.

We have an ample number of valuable materials ready to be re-used! All in your old phone drawer!

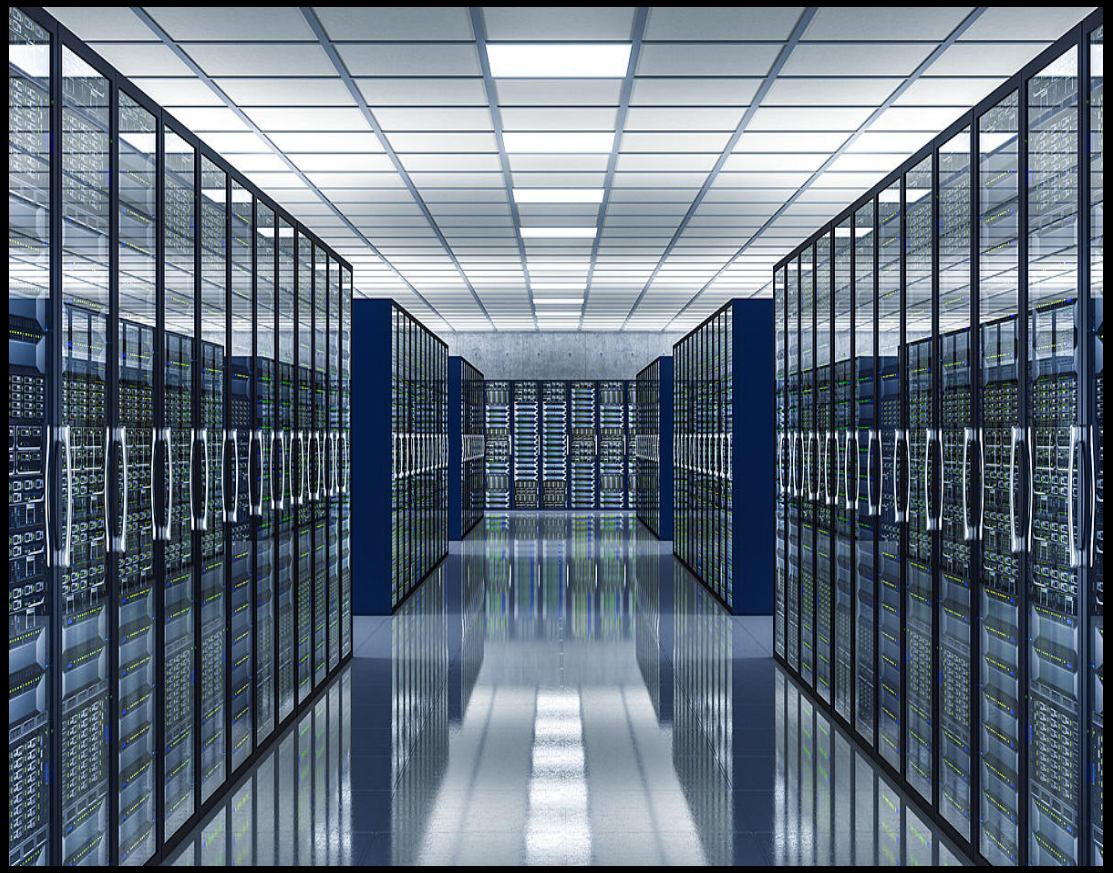
WHY DOES THIS KEEP HAPPENING?

One theory of why this continues is p**lanned obsolesce:** A system of deliberately ensuring that the current version of a product will become out of date or useless within a known period.

THE IMPACT OF DATACENTERS AND CLOUD COMPUTING

Cloud computing

Datacenters



WHAT IS CLOUD COMPUTING AND WHAT ARE DATACENTERS?

Watch Spotlight on Science: Cloud Computing! (Source link here)

The Cloud

Most apps on your phone rely on cloud **computing** (commonly referred to as the cloud) to share data and information!

Most importantly: in order to the apps to work, they send and receive data to additional software that runs on the cloud. (Two components: phone part, cloud part)

In summary: the only way our phones operate is because of cloud computing!

- Without it, we couldn't use any of our applications, like Facebook or Tiktok, etc.

But where is the cloud located?

Datacenters

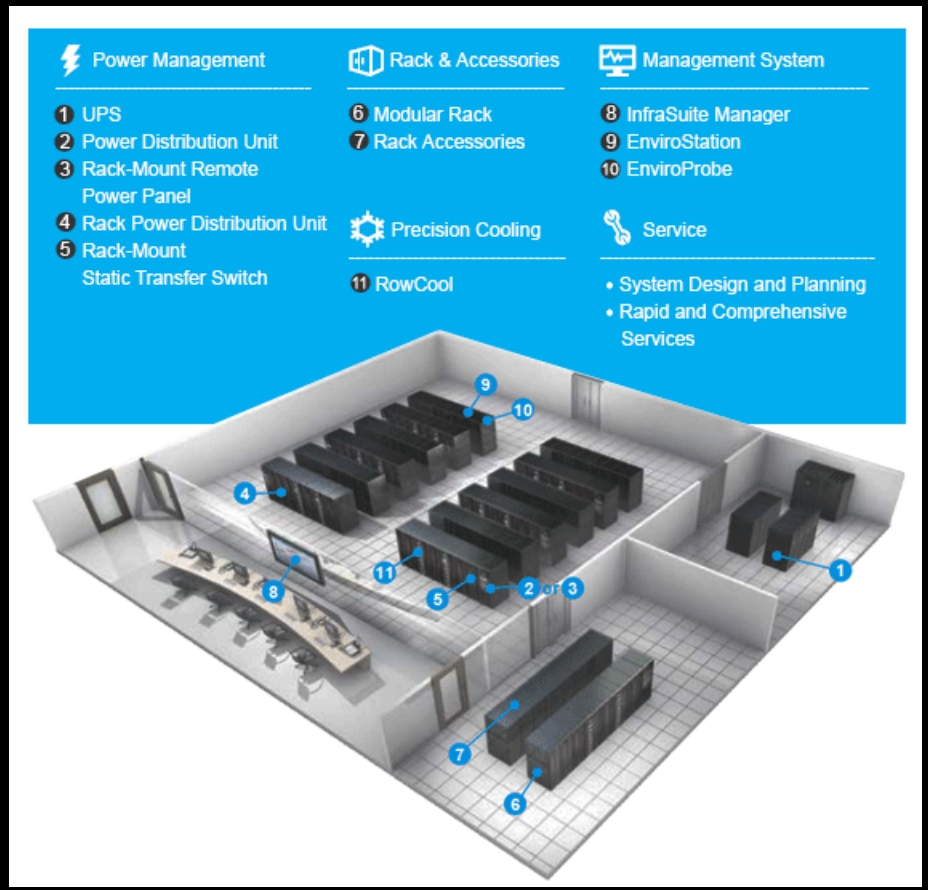
Providers like Google, Amazon, Microsoft, Facebook, and others run dozens of internet data centers:

- Large, warehouse scale buildings that host computers, storage, and networking equipment.

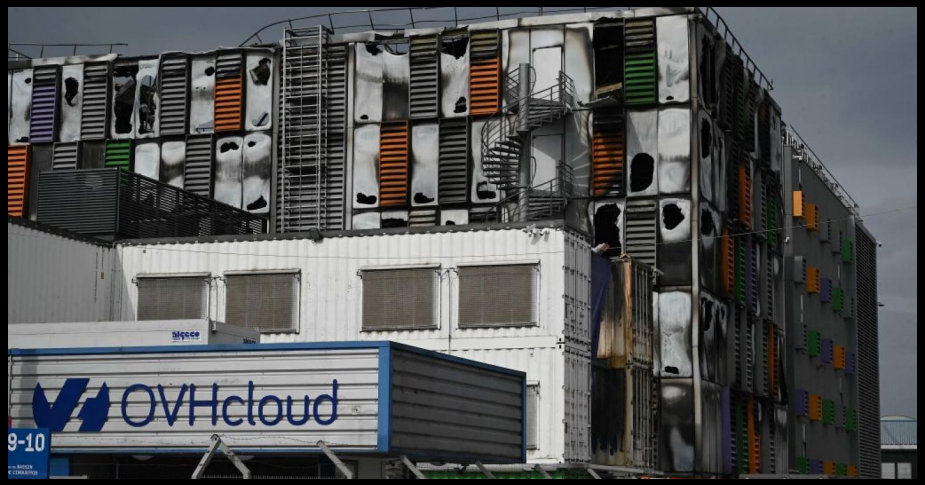
These centers can contain over 100,000 computer servers.

These computer servers stream music to our phones, store the photos to our storage, and do about everything else!

This is all spectacular! However,…



The Cost of Datacenters and Cloud Computing



Strasbourg Data Centers (after a fire)

The energy required to run these datacenters is immense.

- Example: If you think about how much power a home computer needs to operate, now multiply that by 100,000.

Worldwide, about 2% of ALL energy is used to power internet datacenters!

- That percentage is expected to double in the next few years.

What are providers doing to respond to this problem?

Some have prioritized sourcing their energy from clean sources, like solar and wind.

- This means the cloud part of your applications is based on renewable energy!

Some providers continue to source their energy from fossil fuels.

- If you're interested in knowing what your providers use, check their sustainability reports.

Summary:

- We use the cloud for virtually every aspect of our phone's life.
- The cloud operates on datacenters, amazing but costly devices.
- We need to shift the primary energy sourcing of applications from non-renewable, to renewable!

If you don't like the way your provider is running your apps, tweet them! (use #GreenApp!)

WHAT CAN YOU DO ?

STORYTELLING SECTION

USING ART TO SAVE THE ENVIRONMENT

HOW CAN THEATRE SOLVE CLIMATE CHANGE?

Learning

It cultivates learning scientific info using a creative and entertaining method!

Diversity

Allows diverse and thoughtful perspectives to come together to problem solve!

Inclusivity

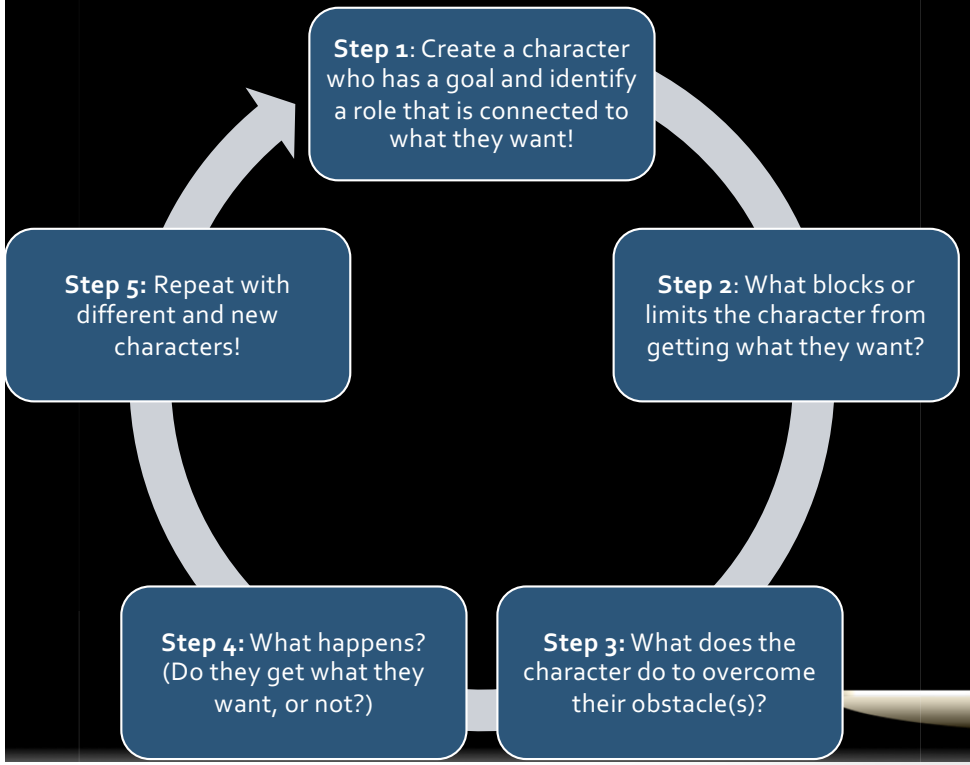
Everyone's part in a play is necessary to succeed!

Engagement

Theatre requires an audience, and thus the info is spread far and wide!

THE PLAY IDEA FLOWCHART

CREATED BY KATHERINE HARROFF



Main Character & Roles they Play	What they Want	What stands in their way	What they do to get it	What happens?
Suz **A bee.**	To have a normal life! To enjoy their youth! To fly around from flower to flower and collect pollen.	Pesticides! It's not safe to leave the hive!	Leaves the hive to attend a protest of the hive lockdown. (without a mask)	They die.
Next Character & Role				
Next Character & Role				

Play Topic Ideas

- Environmental Racism
- Globalization
- Deforestation (Lithium Triangle)
- Environmental Pollution of Manufacturing computers (embodied carbon)
- Environmental Pollution of Destroying/Throwing away computers
- Making Technology More Efficient
- Greenwashing
- Mining for Rare Earth Minerals
- Child labor/Sweatshops
- Re-vamping Classic Plays (Shakespeare, Arthur Miller, Oscar Wilde, etc.) under the stylistic lens of environmental science!
  - Example
- Corporations and their role in the environment
- Virtual Reality and the Environment

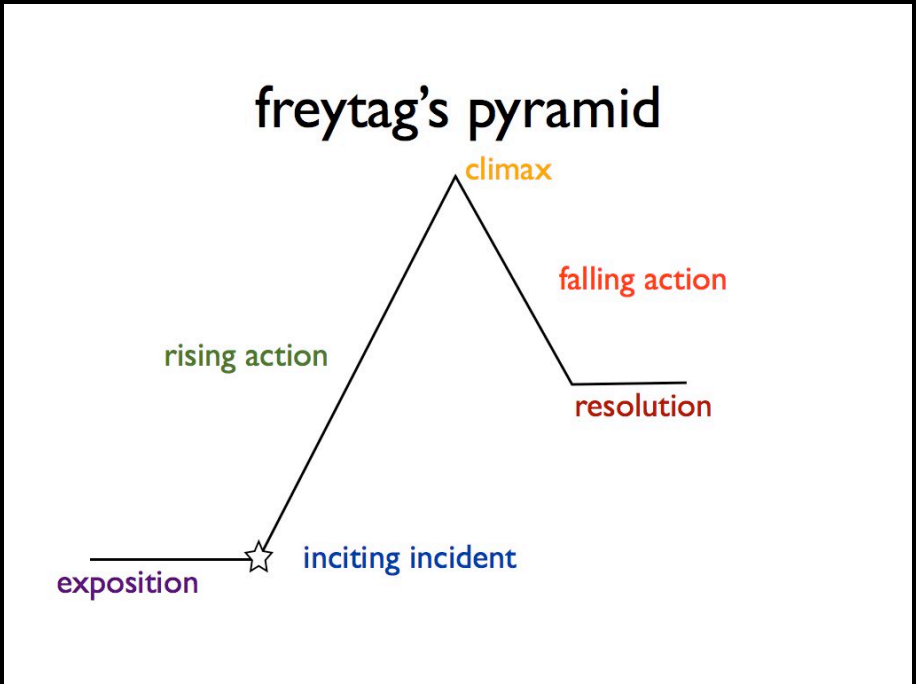
Sample Video Play

Here is an example of a short play using the play idea flowchart.

Bee Safe, by Soroya Rowley!

Link (if doesn't play)

The Freytag Pyramid



Freytag's Pyramid is a dramatic structural framework developed by Gustav Freytag.

The Pyramid contains six dramatic elements crucial to a story: Exposition, Inciting Incident, Rising Action, Climax, Falling Action, and Resolution

By following each point, you can flush out a strong skeleton to forge your story!

The Pyramid Broken Down:

Exposition

The setting, background, back story, and time of the play.

Ex: Suz and Guz, 2020, in the middle of a Pandemic

Inciting Incident

The first point of conflict: what sparks the main character(s) into action.

Ex: Suz wants to go to a protest about the lockdown.

Rising Action

The actions leading up to the climax. The plot of the story is built upon and developed here

Ex: Suz trying to get Guz to come with her.

Climax

The most dramatic part, or turning point, at which the rising action of the play is reversed to falling action.

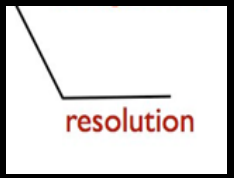
Ex: Suz leaves the house.

Falling Action

The actions following the climax, eventually leading to a resolution.

NOTE: Sometimes, there can be cliffhangers, that lead to no falling action.

Ex: Suz dies.



Resolution

The conclusion of the story's plot, whether that be satisfactory or otherwise.

Ex: Suz says: "I should of warn a mask!".

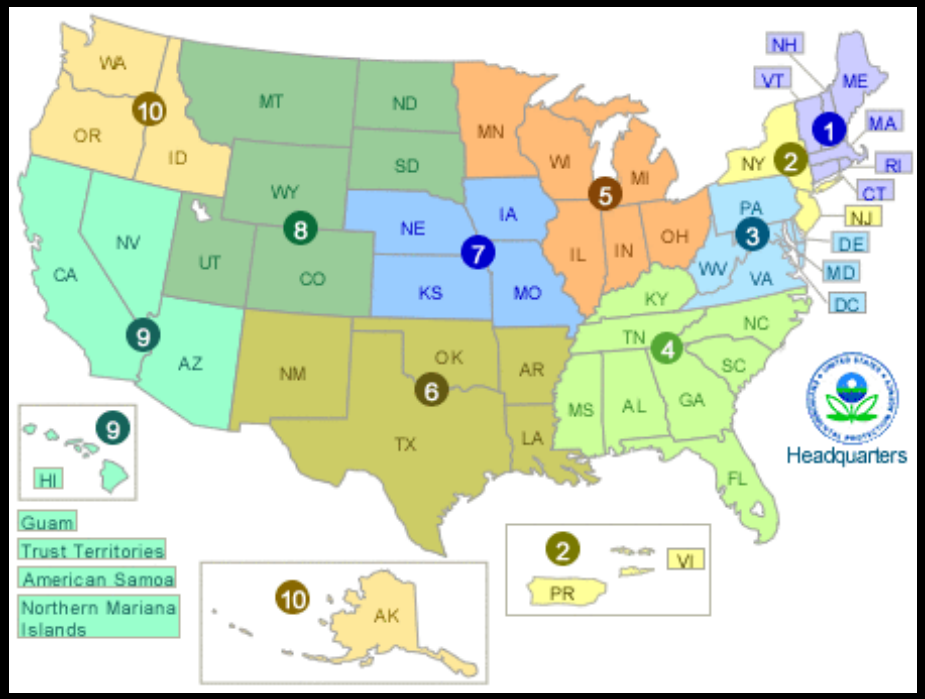
FUNDING YOUR ENDEAVORS

HOW TO CONTACT LOCAL OFFICIALS TO FUND YOUR PROJECT

Where to start!

- Acquiring funding can be a challenge but these options should help!
- **Option 1:**
  - You should start by investigating what options you have at your local institution! (school, work, community, etc.)
- **Option 2:**
  - When you've found an organization that you would like to apply to, I'd recommend checking out these videos:
    - https://www.cafonline.org/charities/resilience/survive/how-to-write-a-great-grant-application
      - The Charities Aid Foundation offers a huge number of resources on how to write a grant proposal in broken up pieces that are easy to understand.
  - If you're looking for a 30-minute crash course training of how to write a grant proposal step-by-step, check out this video!
    - https://www.youtube.com/watch?v=-VotYq3nCm8&ab_channel=GETFUNDEDwithRodney
- **Option 3:**
  - Check out YouTube, and search Google for more options!
- However, if you couldn't find a grant in your local area, you may want to check out…

Environmental Education Grant Descriptions



The Environmental Protection Agency offers plentiful resources for funding your own creative endeavors!

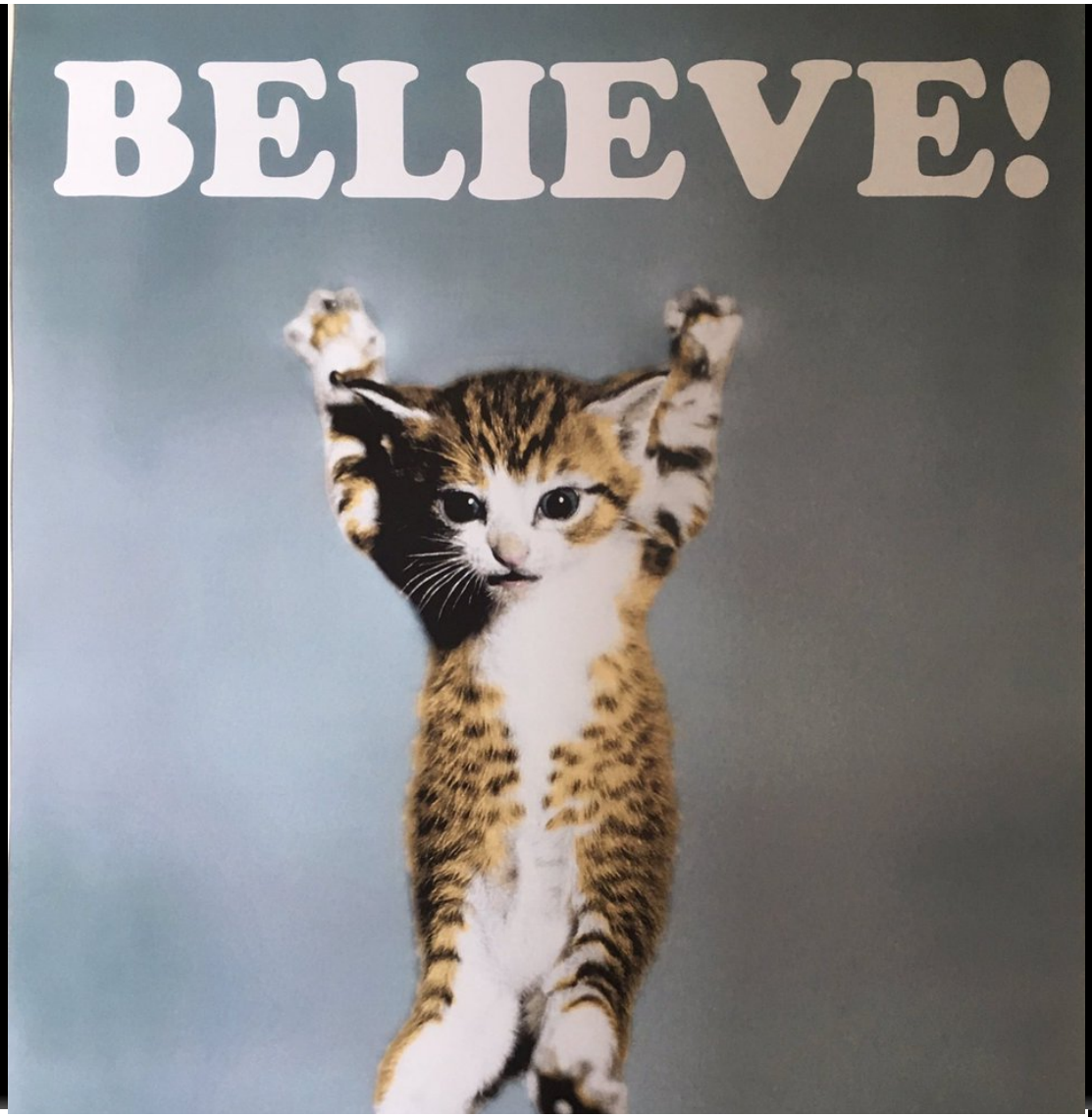
- This link will take you to a page where you can locate grants near you according to your zip code, city name, organization your interested in, or the known name of a project you're interest in!

Still Stuck?

- **Back up option 1:**
  - Although funding is a great means of acquiring equipment, props, set pieces, and other important elements to a creative production:
    - You can always work with what you have!
      - Minimalism is a great means of conveying potent messages and beautiful scenery through cunning yet cheap techniques!
  - Work with your local theatre department to see what you have access to!
- **Back up option 2:**
  - Considering publishing your work and advertising it to see if someone else can pick it up!
- **Back up option 3:**
  - Investigate the possibility of Crowdfunding, using organizations like 'Gofundme', 'Kickstarter', or 'Patreon'!

DON'T GIVE UP! KEEP CREATING, INNOVATING, THINKING!

WE HOPE THIS GUIDEBOOK HAS BEEN HELPFUL, IN ANY SHAPE OR FORM.



APPENDICES/EXTERNAL RESOURCES SECTION

PLAY TOPIC IDEAS, VIDEO LINKS, AND EVERYTHING ELSE YOU'D WANT

Video Links (We think will be helpful)

- How to write a play- five golden rules
- The importance of Storytelling
- Why the arts are essential in addressing climate change- Ben Twist Ted Talk
- Fighting Climate Change with Dance- KQED Arts
- How can we fix the massive e-waste problem?
- The Dark Side of Electronic Waste Recycling
- E-Waste: Why we need to act now
- Is the Internet bad for the environment?
- What Can I do with a Theatre Major?
- What is Cloud Computing and how does it work?

Other Useful Resources

- CalRecycle: Locating an E-Waste Recycling center near you! (link)
- Developing Green-Apps: Improving the Carbon Footprint of Mobile Applications. (link)
- Do Our mobile applications have a Real Impact on Global Warming? (link)
- Where our phones begin- the Washington Post. (link)
- How a Lithium-ion battery works- The Washington Post (link)
- Embodied Carbon (The carbon made during manufacturing of phones/devices) (link)
- How to Recycle Old Electronics (link)

Miscellaneous Rabbit Hole Links (To fuel your creativity!)

- http://css.umich.edu/factsheets/green-it-factsheet
- https://www.bi4all.pt/en/news/en-blog/the-impact-of-technologies-on-the-environment/
- https://kth.diva-portal.org/smash/get/diva2:933594/FULLTEXT01.pdf
- https://www.lancaster.ac.uk/data-science-of-the-natural-environment/blogs/green-computing-a-contribution-to-save-the-environment
- https://www.bbc.co.uk/bitesize/guides/zkhykqt/revision/6
- https://edinburghsensors.com/news-and-events/impact-of-technology-on-the-environment-and-environmental-technology/
- https://www.brookings.edu/articles/cutting-through-environmental-issues-technology-as-a-double-edged-sword/
- https://www.tecnologialibredeconflicto.org/en/environment/
- https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.295.7161&rep=rep1&type=pdf
- https://www.researchgate.net/profile/Minjung-Kwak/publication/323111576_Effect_of_mobile_apps_on_environmental_impact_of_smartphones/links/5e7db97c458515efa0adb28e/Effect-of-mobile-apps-on-environmental-impact-of-smartphones.pdf
- https://www.bbc.com/future/article/20200305-why-your-internet-habits-are-not-as-clean-as-you-think
- https://news.yale.edu/2021/01/27/surge-digital-activity-has-hidden-environmental-costs
- https://www.ovoenergy.com/blog/green/the-carbon-footprint-of-the-internet.html
- https://www.ethicalconsumer.org/technology/hidden-cost-our-digital-habits-easy-ways-reduce-our-impact
- https://www.businesstelegraph.co.uk/why-your-internet-habits-are-not-as-clean-as-you-think-bbc-news/
- https://www.youtube.com/watch?app=desktop&v=mrCcTiSL_Hg&ab_channel=TheDocumentaryChannel

Contact Us

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