

NAME \_\_\_\_\_

**Group Theory: An Introduction** (feat. the Rubik's Cube Group)

Vocabulary sheet and presentation by Jonathan Lam

Term	Notation	Definition
group	$(A, *)$	an algebraic structure comprising a set and an operation that follow the group axioms
underlying set	$A = \{1, a, b, c, \dots\}$	the set (list of elements) of a group
group law	$*$	a binary operation (an operation acting on two elements)
group axioms		closure, associativity, identity, invertibility
closure		applying the group rule on two elements of the set results in another element of the set
associativity	$a + (b + c) = (a + b) + c$ (or any other grouping)	changing the grouping of operations does not change the result
abelian group	$a + b = b + a$ for all $a, b, c \in A$	a group with a commutative group rule (changing the order of elements does not change the result)
identity element	$1$ (not literally the value 1)	an element of a group's set that results in the other operand when the group rule is performed on it; this must exist in every group
inverse element	$a^{-1} * a = 1$ for all $a \in A$	when the group rule is applied on an element and its inverse, the identity element is obtained; all elements in a group must also have an inverse in the set
cardinality (order of a set)	$ A $	the number of elements in a set
period (order of an element)	$n$ such that $a^n = 1$	the number of times the group rule must be applied on an element repeatedly until the identity element is obtained
subgroup		a group with the same operation as its overgroup whose elements are all part of its overgroup's set

More depth past the presentation's content for fun (because 10 minutes is waaaay too short):

### More about groups:

- Groups are a limited part of Set Theory, dealing only with binary operations and obeying the group axioms; sets in general can have larger n-ary operations (e.g., ternary, quaternary, etc.) and do not have to obey the group axioms
  - That being said, groups are specifically designed to highlight properties of symmetry
- A cardinal number is a number defined as the size of a set (a.k.a., order of a set), and can be either finite or transfinite (for infinite sets, see below)
  - Cardinality for finite sets with the same number of elements are equal natural numbers
  - Cardinality for infinite sets may not be the same, because they are transfinite: larger than any finite number, but smaller than absolute infinity
  - Cardinality for the subset of an infinite set can be equal to the cardinality of the original set
  - The cardinality of the Rubik's cube set is  $\frac{12! \times 2^{11} \times 8! \times 3^7}{2} \approx 4.3 \times 10^{19}$ , due to the fact that there are 12 permutations for corners ( $12!$ ), 2 orientations for corners except the last one ( $2^{11}$ ), 8 permutations for edges ( $8!$ ), 3 orientations for edges except the last one ( $3^7$ ), and an even number of cube swaps ( $2^{-1}$ )
- The order of an element of a set (a.k.a., period of an element) (not to be confused with order of a set) is the number of times the operation will be repeated on the element until the identity element is attained; if it never reaches the identity element, its order is infinite
  - For example, the order of R in the Rubik's cube  $(G, \cdot)$  is four, because you can perform the R turn four times to get back to the solved state
  - For example, the order of 1 in  $(\mathbb{Z}, +)$  is infinite, because constantly adding 1 to itself will never equal zero
  - The largest order of any element in the Rubik's cube is 1260; there are multiple elements that achieve this, but one simple one is  $RU^2D'BD'$
  - The order of the identity element is always 1 (intuitively)
- While the group rule can be represented in many ways, the most general representations include the multiplicative group and additive group representations (because addition and multiplication are both simple examples of groups)
  - Multiplicative:  $ab$  and  $a^*b$  (mimicking multiplication), in which the identity element is represented as 1 and an exponent indicates how many times it is applied to itself; its order is usually defined as the  $n$  such that  $a^n = 1$  (or infinity for an infinite order); the inverse is represented  $a^{-1}$ , and the exponent representation remains
  - Additive:  $a+b$ , in which the identity element is represented as 0 and the order is the  $n$  such that  $na = 0$ . The inverse is represented as  $-a$ .
- In symmetry groups, the arrangement of the set elements may seem reversed, but this is because of function composition notation

- For example,  $(f \cdot g)(a)$  means  $f(g(a))$ , thus  $g$  is the first operation performed, and  $f$  is second
  - Similarly, the ordinary, intuitive Rubik's cube notation would be represented backwards in correct function composition notation: RU becomes the element U·R
- In Graph Theory, a Hamiltonian path is an idea in graph theory that passes through each point exactly once, and can be used to generate an algorithm that cycles through every element of the Rubik's cube set
- The trivial group is a group with only one element in its set: the identity element
- An important part of groups is studying homomorphisms: groups with similar structures
  - Isomorphisms are bijective (one-to-one) homomorphisms
  - Automorphisms are homomorphisms over an own set

Further reading: academic reports specific to the study of Rubik's Cubes through Group Theory:

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<<http://www.math.harvard.edu/~jchen/docs/Group%20Theory%20and%20the%20Rubik's%20Cube.pdf>>.

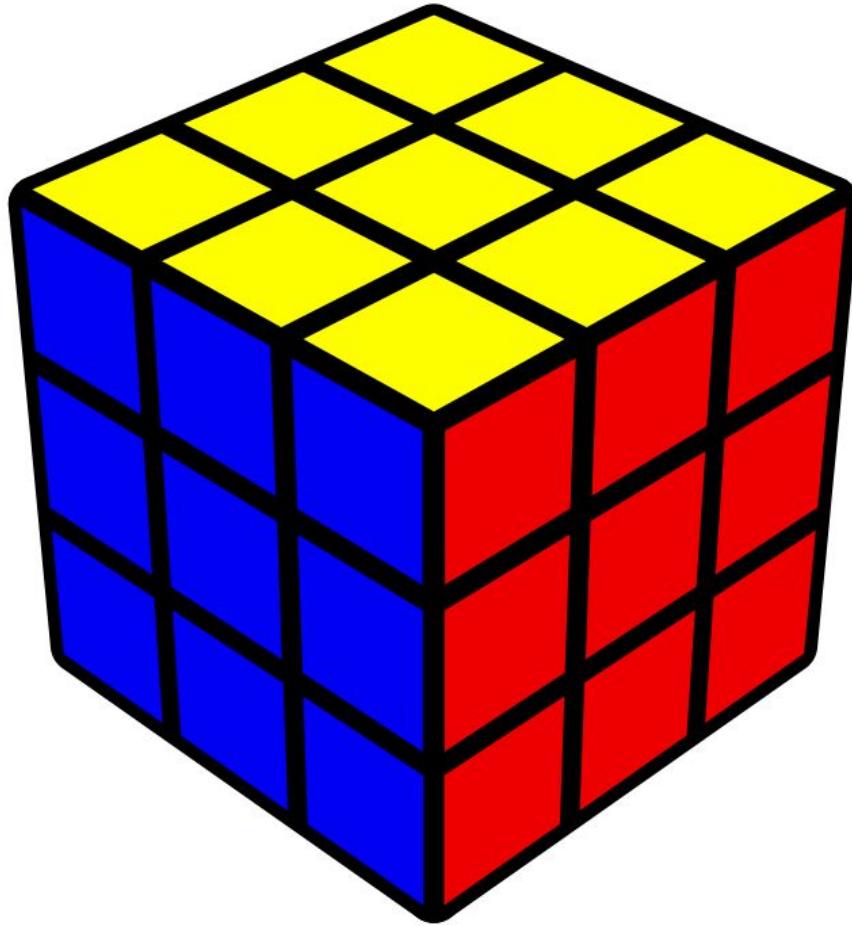
Daniels, Lindsey. *Group Theory and the Rubik's Cube*. Lakehead University, N.d. Web. 25 May 2018. <<http://math.fon.rs/files/DanielsProject58.pdf>>.

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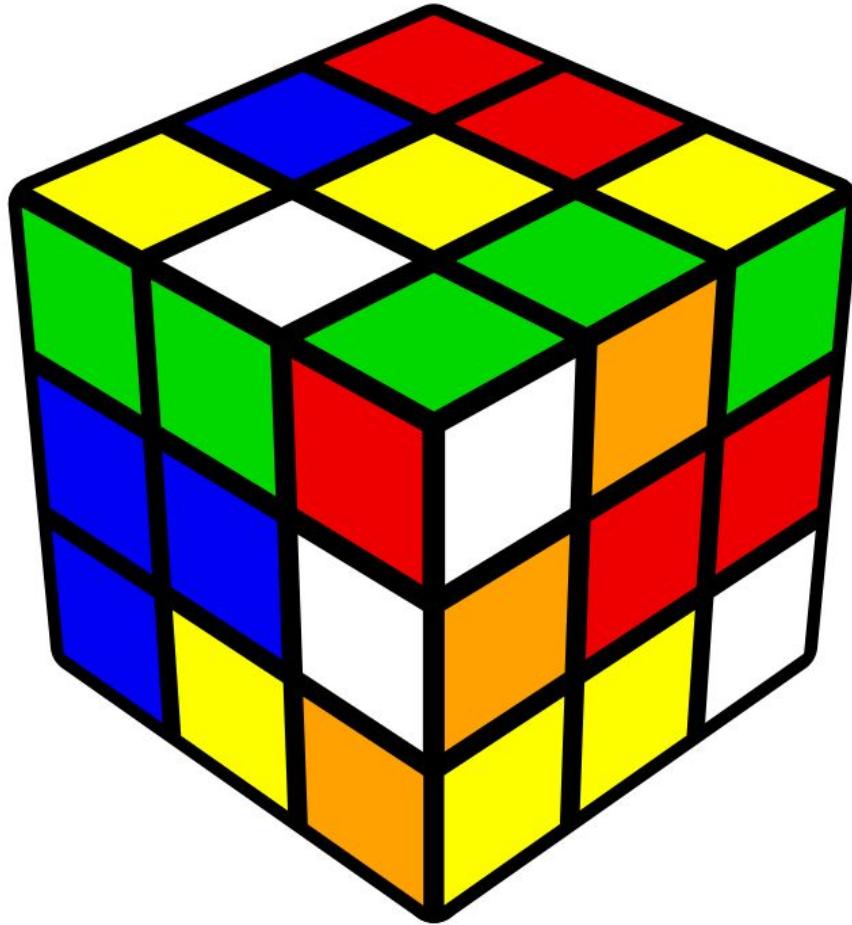
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Rubik's cubes:

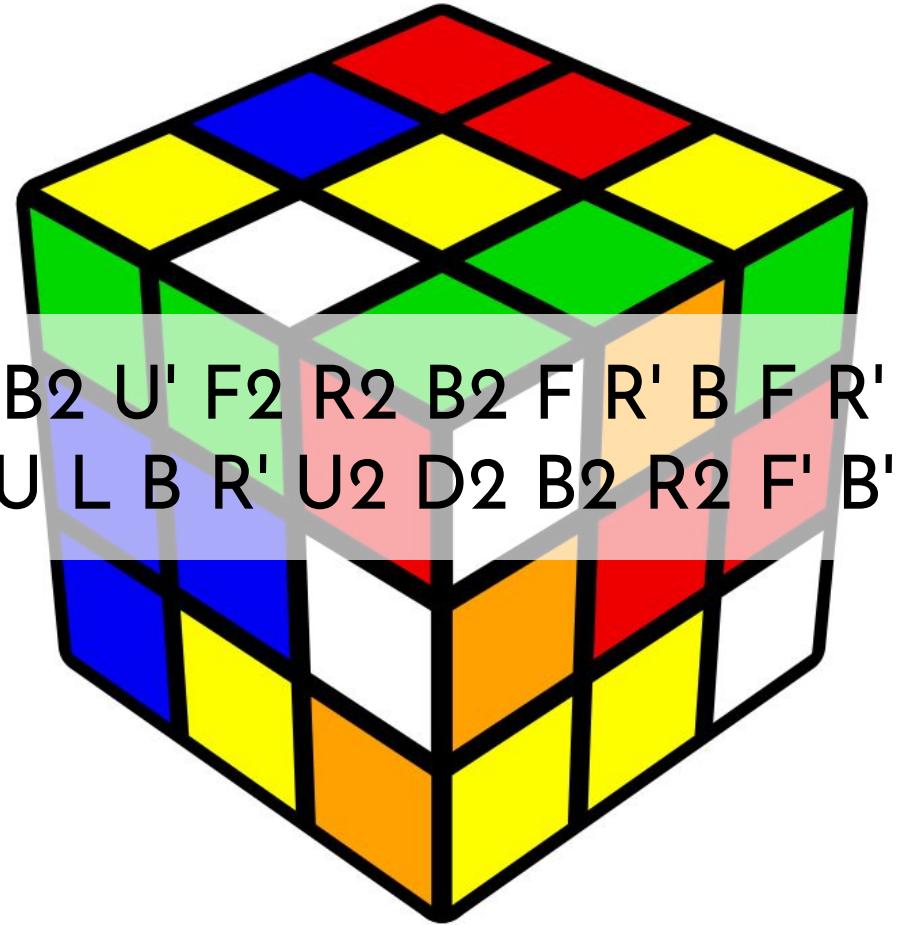
- How to solve the Rubik's cube: <https://ruwix.com/>
- Get a decent speedcube for \$2.99: <https://thecubicle.us/yuxin-little-magic-p-9649.html>



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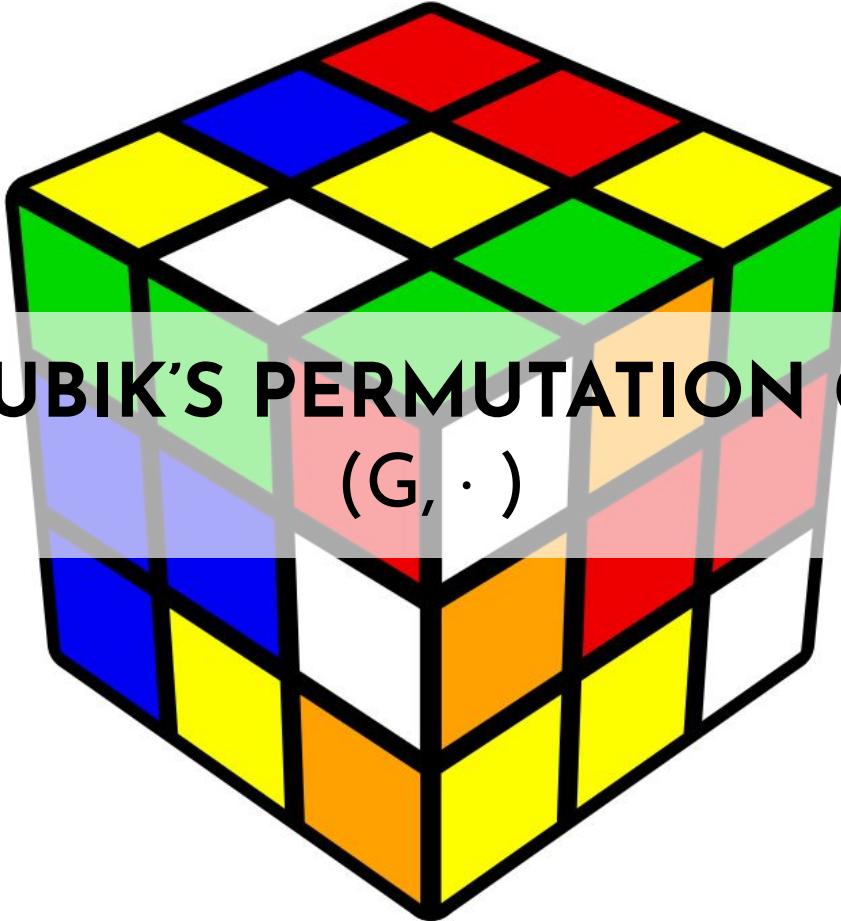
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B2 U' F2 R2 B2 F R' B F R'  
U L B R' U2 D2 B2 R2 F' B'



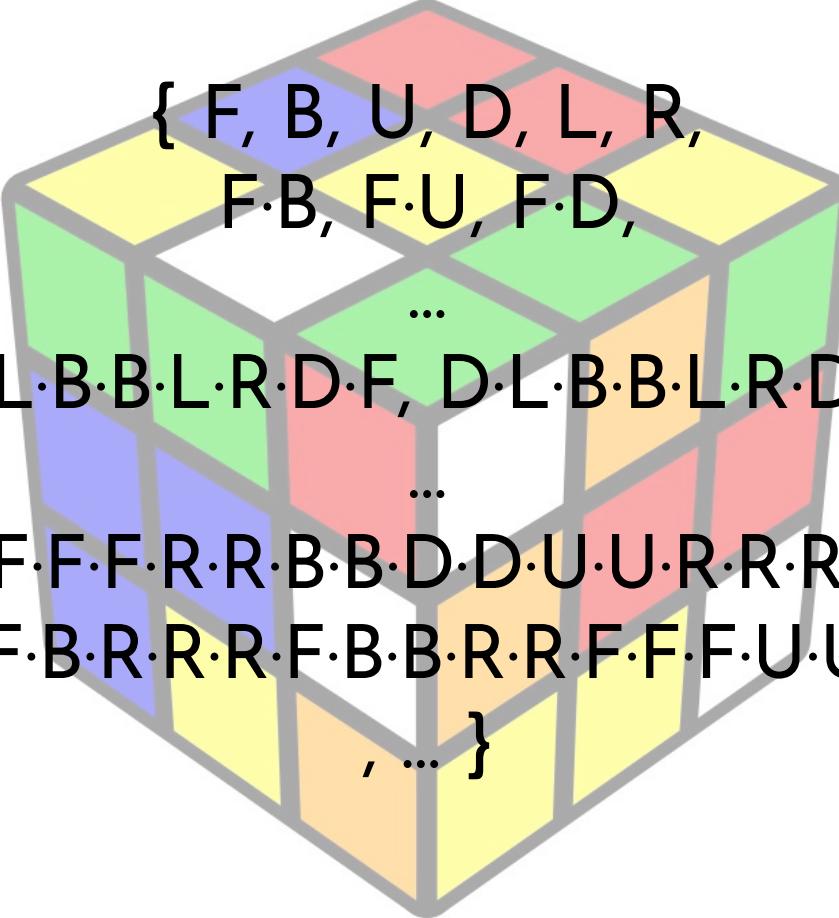
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R·R·R·F·B·R·R·R·F·B·B·R·R·F·F·F·U·U·U·B·B



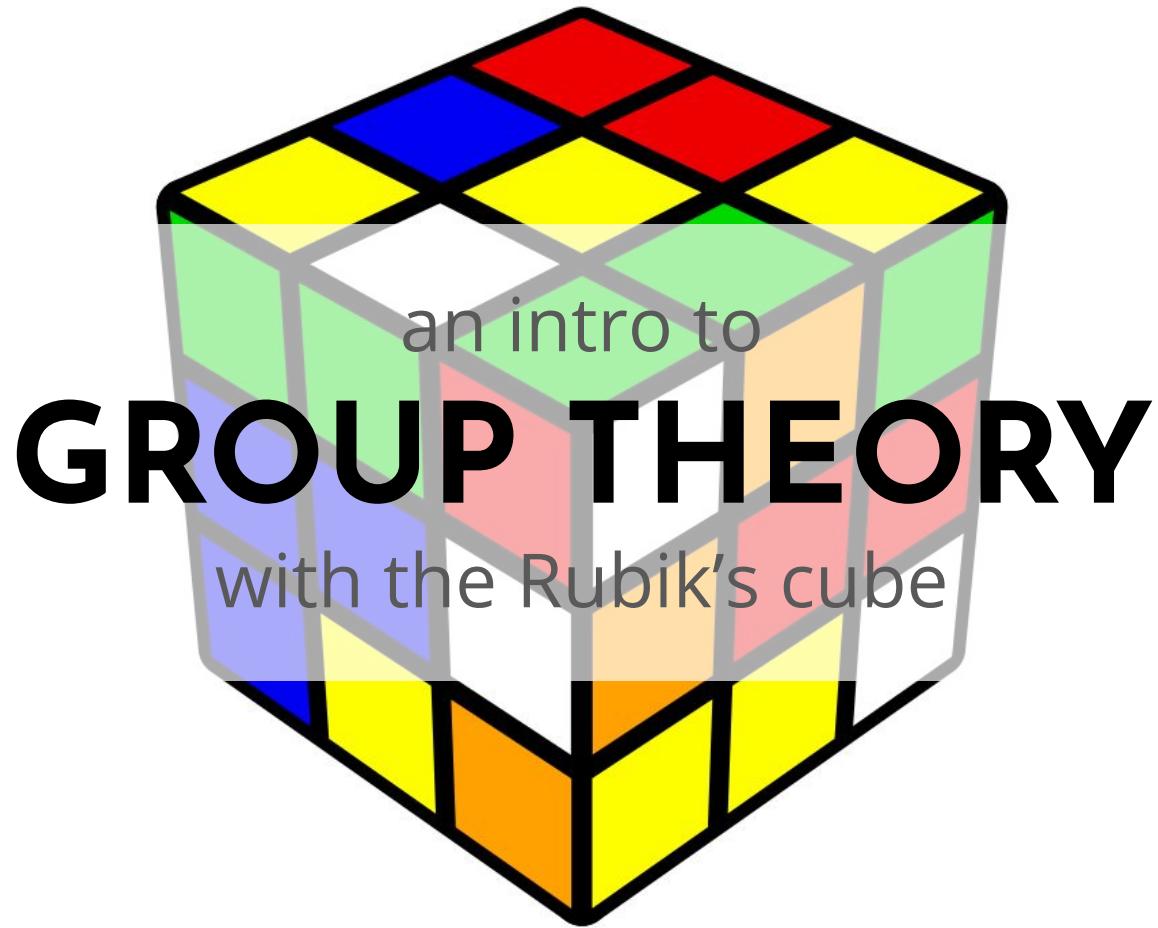
# THE RUBIK'S PERMUTATION GROUP

$(G, \cdot)$

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{ F, B, U, D, L, R,  
F·B, F·U, F·D,  
...  
D·L·B·B·L·R·D·F, D·L·B·B·L·R·D·B,  
...  
B·B·B·F·F·F·R·R·B·B·D·D·U·U·R·R·R·B·L·U·  
R·R·R·F·B·R·R·R·F·B·B·R·R·R·F·F·F·U·U·U·B·B  
, ... }



an intro to

# GROUP THEORY

with the Rubik's cube

by [jonlam](#)

# NOTICE

This falls under abstract algebra, a part of mathematics unfamiliar to us. I understand very little and am going to try to cover much information in little time. If anything is unclear, please ask right away. I'll try my best to answer.

# WHAT IS A GROUP?

A group is the combination of a set and a group law that obey the group axioms.

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SET: a list of elements

$$\mathbb{P} = \{ 2, 3, 5, 7, 11, \dots \}$$

$$\mathbb{Z} = \{ \dots -3, -2, -1, 0, 1, 2, 3, \dots \}$$

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$$\mathbb{Z} = \{ \dots -3, -2, -1, 0, 1, 2, 3, \dots \}$$

**GROUP LAW:** a binary operation (acts on two elements of a set **a** and **b**):

$$a + b$$

$$a \bmod b$$

Generic notation:  $a * b$

(looks like multiplication, because multiplication is an example of a group!)

# GROUP AXIOMS

**CLOSURE:** applying the operation to two elements of the set produces another element of the set

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**IDENTITY ELEMENT:** there is a unique "identity" element **e** in the set that results in the other operand when the operation is performed

**INVERSE ELEMENT:** for every element **a** in a group, there is an inverse element **b** in the set such that  $\mathbf{a} * \mathbf{b} = \mathbf{e}$

# EXAMPLE: ADDITION OVER INTEGERS

GROUP:  $(\mathbb{Z}, +)$

SET:  $\mathbb{Z}$ ,

GROUP RULE:  $+$

CLOSURE: adding two integers results in an integer

ASSOCIATIVITY: grouping of addition doesn't affect the result

IDENTITY ELEMENT: the identity is the unique element  $0$  ( $a + 0 = a$ )

INVERSE ELEMENT: the inverse of an element  $a$  is  $-a$  ( $a + (-a) = 0$ )

then...

# WHY STUDY AND FORMALIZE GROUPS?

"Group theory studies **symmetry**. There are symmetries everywhere.

Not only is there is symmetry in everyday life, there are symmetries in molecules, physical laws, crystals, formulae, music, and so forth. The symmetries get increasingly complicated, and an understanding of the symmetries gives insight into real properties of these objects.

I want to note that group theory studies **symmetry in the very broad sense of "reversible transformations that preserve some kind of structure"**.

While being reflected in a mirror and remaining unchanged is the usual idea of symmetry, swapping x and y in  $x^3+y^3+z^3$  is also symmetry in this broader sense, as is transposing a piece of music a half-step down."

Source: Yasha Berchenko-Kogan, Math postdoc (Quora answer to "What is the point of group theory?")

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# EXAMPLE: TURNS OVER THE RUBIK'S CUBE

GROUP:  $(G, \cdot)$

SET:  $G$ ,

GROUP RULE:  $\cdot$  (composition)

CLOSURE: performing moves one after another results in another move

ASSOCIATIVITY: grouping of symmetries doesn't affect the result

IDENTITY ELEMENT: the identity is the empty permutation  $E$  (no moves)

INVERSE ELEMENT: the inverse of an element  $a$  is the reverse permutation, denoted  $a'$

# EXAMPLE: RUBIK'S CUBE (extended)

A MORE PRECISE SET:  $G = \{ (v, r, w, s) \mid v \in C_3^7, r \in S_8, w \in C_2^{10}, s \in S_{12} \}$

where:  $v$  is the orientations of the corner cubies

$r$  is the permutations of the corner cubies

$w$  is the orientations of the edge cubies

$s$  is the permutations of the edge cubies

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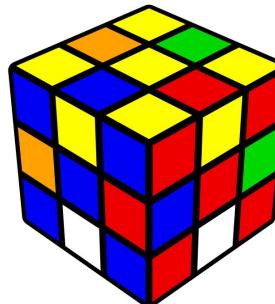
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$s$  is the permutations of the edge cubies

Example: Superflip

$$v = (1)(2)(3)(4)(5)(6)(7)$$

$$w = (1)(2)(3)(4)(5)(6)\dots(11)$$



$$r = (0, 0, 0, 0, 0, 0, 0, 0)$$

$$s = (1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1)$$

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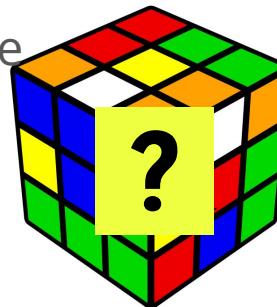
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Example: Random scramble

$$v = (1423)(587)(6)$$

$$w = (1\ 12\ 5\ 7)(6\ 3\ 2\ 4) \dots$$



$$r = (0, 1, 1, 0, 2, 1, 0, 2)$$

$$s = (1, 0, 0, 1, 1, 1, 0, 1, 0, 0, 0, 0)$$

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A MORE PRECISE SET:  $G = \{ (v, r, w, s) \mid v \in C_3^7, r \in S_8, w \in C_2^{10}, s \in S_{12} \}$

where:  $v$  is the orientations of the corner cubies

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$w$  is the orientations of the edge cubies

$s$  is the permutations of the edge cubies

- The **cardinality** (order) of a group, denoted  $|G|$ , is the length of its set
  - $|G| = 43,252,003,274,489,856,000 = (12! * 2^{11} * 8! * 3^7) / 2$
  - Cardinalities for sets can be finite or *transfinite*

# EXAMPLE: RUBIK'S CUBE (extended)

- The **order** of an element is how many times the group rule is applied to itself to attain the identity element
  - E.g.:  $U' \cdot R' \cdot U \cdot R$  has order 6, because it takes six times to get back to E
  - E.g.: E has order 1 by definition

# EXAMPLE: RUBIK'S CUBE (extended)

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  - E.g.: E has order 1 by definition
- A **subgroup**  $S_S$  of a group S is a group such that every element of  $S_S$ 's set exists in S's set
  - E.g.: The permutation subgroup  $C_p$  changes positions of cubies but maintains orientations
  - E.g.: The orientation subgroup  $C_o$  changes orientation of cubies but maintains positions
  - E.g.: The Rubik's cube group G is a subgroup of the symmetry group  $S_{48}$

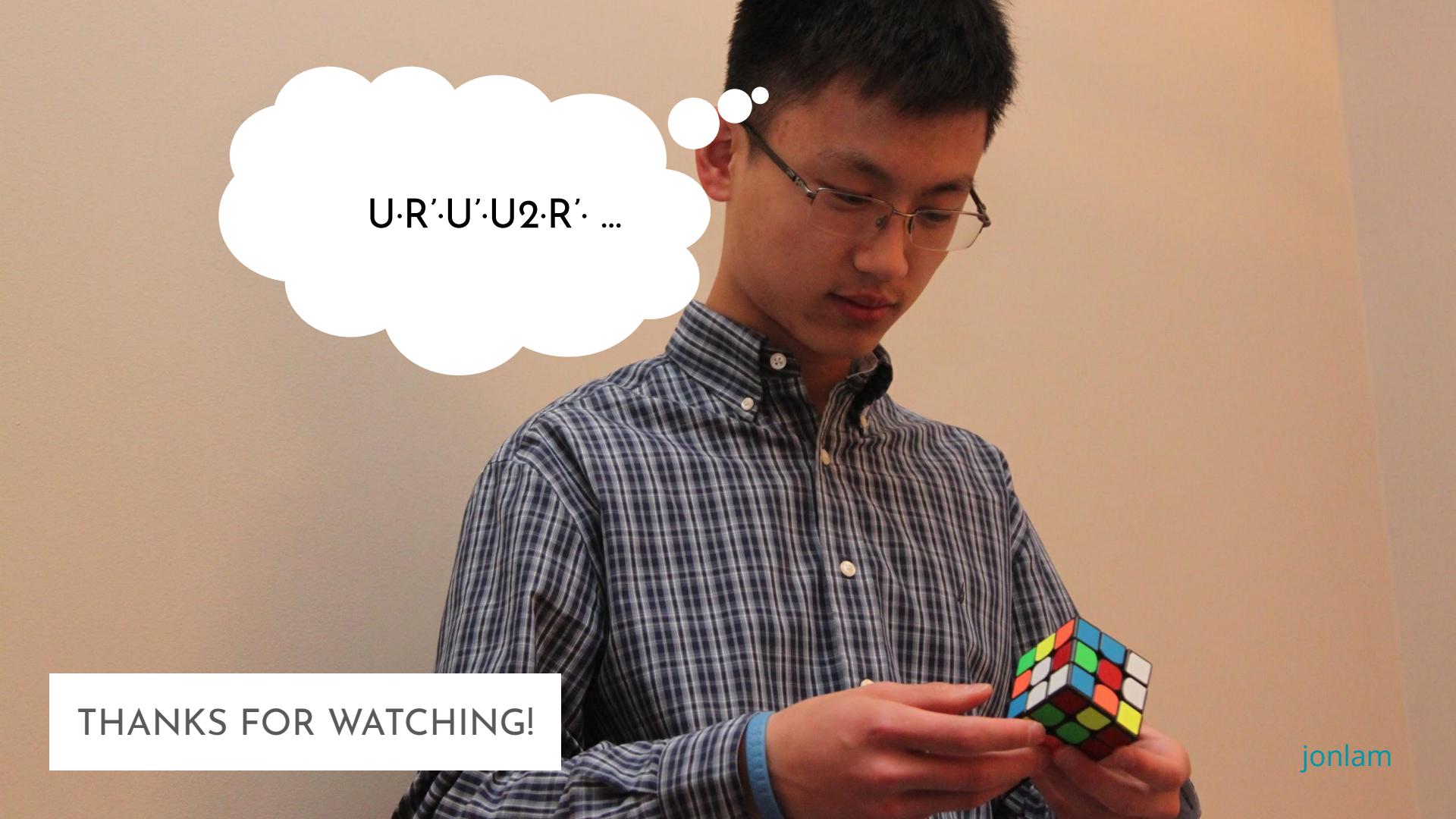
# EXAMPLES OF GROUP APPLICATIONS

*Model / Associate* mathematical objects with groups, then *study* the properties of the groups.

- Permutation groups → polynomials, combinatorics, puzzles
- Lie groups → mechanical laws of physics
- Galois groups → solvability of higher-order polynomials
- the Fundamental group → mathematical topology
- Geometric group theory → algebraic geometry, number theory
- Computational group theory → cryptography, algorithmic approaches

# RECENT / CURRENT ACTIVITY

- The classification of finite simple groups (i.e., groups that are finite and cannot be broken down into smaller groups), until 2004.
- Used to model and advance the knowledge in:
  - computer graphics
  - cryptography (multiplicative group modulo n in RSA)
  - elementary particle physics
  - the Standard Model
  - special relativity



U·R'·U'·U2·R' ...

THANKS FOR WATCHING!

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## Images:

Cube Rider API: <http://cube.crider.co.uk/visualcube.php>

## An Introduction to Group Theory through the Lens of the Rubik's Cube

Here are four observations:

1. Many mathematical operations produce a result that has the same form as its operands; i.e., the result comes from the same set as the operands.
2. Many binary mathematical operations disregard the way its elements are grouped.
3. Many mathematical operations have a unique “identity element.” When performed on the identity element and some other element, this produces the other element.
4. Many mathematical operations have an inverse element for every possible input, so that applying the operation on the element and its inverse produces the identity element.

In fact, many mathematical operations have all four of these properties, so mathematicians decided to formalize them into a mathematical structure, consisting both of a *set* of elements and an operation (called the *group rule*) that together satisfy these conditions. The structure is called a *group*, and these four properties that must be obeyed by every group are called the *group axioms*. They are, in the order above, *closure*, *associativity*, (having an) *identity element*, and *invertibility*.

Take, for example, the addition operation over the set of integers. It follows all of the group axioms. Integers are closed over addition, because adding an integer to an integer always results in another integer. The order of grouping of elements for two numbers does not matter:  $(2 + 2) + 3$  is equal to  $2 + (2 + 3)$ . The additive identity is zero; the additive inverse is the opposite of an integer.

Note that multiplication is not closed over integers, so the multiplication with integers is not a group. (Multiplication with real numbers is, however.) Note also that subtraction and division, while not considered valid operations (because they violate associativity), are simply the inverses of addition and multiplication. Therefore, when expressed in terms of addition and multiplication (and adjusting the group’s sets as necessary to include additive and multiplicative inverses), these operations can be classified as groups. Another point to note is that *associativity* does not imply *commutativity*; i.e., changing the order of the terms may not create the same result. Groups that are commutative, such as addition and multiplication, are called *abelian groups*; others, such as the Rubik’s cube group described later, are *non-abelian*.

Note that groups can be used to express much more abstract concepts than simple algebra. A higher-level example would be that of the Rubik's cube. Before going more in depth into the application of group theory to the Rubik's cube, some basic definitions need to be given:

**Definition 1:** *cubie*: a single, physical block on the Rubik's cube

**Definition 1.1:** *corner cubie*: one of eight cubies on the corner of the cube, with three stickers

**Definition 1.2:** *edge cubie*: one of twelve cubies on an edge of the cube, with two stickers

**Definition 1.3:** *center cubie*: one of six cubies on the center of a face; these do not get permuted or oriented, so they will be ignored in this discussion

**Definition 2:**  $\{ U, D, R, L, F, B \}$ : the set of possible single moves in a Rubik's cube in Singmaster notation, corresponding to clockwise turns of the up (top), down (bottom), right, left, front, and back faces

While it may not be immediately clear how the Rubik's cube might be expressed as a set (Set of cubies? Set of stickers? Set of moves?) It turns out that the Rubik's cube group (denoted  $(G, \cdot)$  from here on) is an example of a permutation group, where the set is all possible permutations of moves. Each set of moves, or each possible position of the cube, is therefore represented by one element of the set. The number of items in the set, or cardinality of the underlying set of the group, denoted  $|G|$ , is the number of possible permutations of the Rubik's cube— $|G| = 43,252,003,274,489,856,000$ . A Rubik's cube is non-abelian because changing the order of the moves does not produce the same permutation (otherwise solving it would become very easy by trial and error!).

One way, and perhaps the simplest way, to represent a group is through a permutation of moves necessary to get to a state of the cube from the solved state. This includes moves such as the group is by the permutation of moves. The set is a list of permutations generated by basic moves:  $\{ U, D, R, L, F, B \}$ , until all possible states of the cube are exhausted. This means  $\{ E, U, D, R, L, F, B, U \cdot U, U \cdot D, U \cdot R, U \cdot L, \dots \text{ etc.} \}$ , where  $E$  is the empty move (the identity element) and the group rule is composition ( $\cdot$ ). Any legal state of the Rubik's cube can be represented by a sequence of moves. The problem with this notation is that it can have repetitions of the same state: for example, the element  $U \cdot U \cdot U \cdot U$  is equivalent to  $E$ , and thus would be double-counted.

In fact, there are an infinite number of possible permutations (but only a finite number of possible states), so a more advanced notation should be used to denote the state of a cube.

The Rubik's cube is a *subgroup* of the *symmetric group*  $S_{48}$ , the permutations of the 48 non-center stickers on a Rubik's cube. Symmetric groups are permutation groups with all possible elements, but some permutation groups such as the Rubik's cube group have restrictions to prevent illegal combinations.

If all the stickers on a Rubik's cube could be freely permuted (which is clearly illegal—for example, a single corner cubie cannot have three stickers of the same color, which is possible with a total permutation), this would result in a symmetry group of  $S_{48}$ , which has a cardinality of  $48!$ , or approximately  $1.24 \times 10^{61}$ . (Luckily for speedcubers and mathematicians alike,) Many of these permutations are illegal. If we restrict the permutations so that the stickers cannot be individually permuted freely, but rather the cubies themselves (the arrangements of stickers on each cubie remains constant), then we arrive at what is known as the Illegal Rubik's Cube Group, because even then some operations are illegal due to the symmetry of the Rubik's cube group. The set I of the Illegal Rubik's Cube Group is defined as:

$$I = (C_2^{12} \times S_{12}) \times (C_3^8 \times S_8)$$
$$|I| = 2^{12} \times 12! \times 3^8 \times 8! \approx 5.19 \times 10^{20}$$

The structure of I can be explained intuitively by thinking about the structure of the Rubik's cube, but it requires some other knowledge of cube theory . The cyclic group  $C_n$  describes a set of length n (cardinality n), and the symmetric group  $S_n$  denotes a symmetric group of n elements (cardinality  $n!$ ). The first group here is  $C_2^{12}$  , which can be written  $(C_2)^{12}$ , and represents the two orientations of an edge (normal or flipped) for each of the twelve edges. This group has cardinality  $2^{12}$ . The second group is  $S_{12}$ , which represents the permutation of the twelve edges. This group has cardinality  $12!$ . The same logic can be applied to the eight corners, which have three orientations each.

Lastly, the product of two groups is another group which is the Cartesian product ( $\times$ ) of their sets, and the cardinality of a product is the product of the cardinalities of the operands:

$$|g_1 \times g_2 \times g_3 \times \dots| = |g_1| \times |g_2| \times |g_3| \times \dots$$

This allows for the calculation of the cardinality of the Illegal Rubik's Cube Group, which is the product of multiple other groups.

While this appears to make sense, there are still some further rules to govern the moves of Rubik's cubes. For example, the orientations of the first 11 edges determine the orientation of the last edge, and the same for the corners. Also, there must always be an even number of flips (the proof is not given here), so the size of  $G$  is halved from there.

$$G = (C_2^{11} \times S_{12}) \times (C_3^7 \times S_8) \div 2 = \{ (v, w, r, s) \mid v \in C_3^7, r \in S_8, w \in C_2^{10}, s \in S_{12} \}$$
$$|G| = 2^{10} \times 12! \times 3^7 \times 8! \approx 4.33 \times 10^{19}$$

This is the full, legal Rubik's cube group and its cardinality.

Looking over the equations, especially the final, precise definition of the Rubik's cube group, shows that there is a heavy connection to sets. Group theory can, in fact, be considered a subfield of *set theory*, where the sets are bound only with binary operations that follow the group axioms (whereas set theory studies sets without these limitations and with n-ary operations). But groups are specifically defined in such a way to highlight features of symmetry, where symmetry is used in the sense of “reversible transformations that preserve some kind of structure” (Berchenko-Kogan). This leads to many supporting theorems (not discussed here) that extend past regular set theory, such as Lagrange’s theorem or Burnside’s theorem, that deal with more specific applications of groups. For simplicity, only the definition of the Rubik’s cube group and its cardinality (which can be explained with basic Set Theory) are discussed in this paper, but many more applications of the Rubik’s cube group’s *subgroups* (groups whose sets are subsets of another group) and *homomorphisms* (similar group structures) exist in a deeper knowledge of group theory; for instance to discover algorithms to solve certain states.

Another observation from this work is that group theory is not often used directly to solve algebraic problems, but that a group is often fitted, or associated with a mathematical or real-world object, and the resulting group’s properties are studied. This is the case with the Rubik’s cube, as it is difficult to immediately draw conclusions from the fascinating toy. Writing it as the product of smaller, more understandable groups allows mathematicians to break down its structure and properties.

Group theory has many applications with objects with symmetry in the real world. Most clear are symmetry groups, which deal with geometric transformations (not to be confused with symmetric groups, which are a type of permutation group). This has applications from determining the properties of lattice structures to the use of Lie groups in the Standard Model

of physics. The earliest use for groups was in the late 19th century, when mathematicians were looking to solve polynomial equations with degree  $n > 4$ , realizing the symmetry of the roots and generalizing it to modern group theory. Other applications include computational group theory, which has applications with computer modeling and graphics to cryptography—the widespread RSA encryption uses the symmetry of modular multiplication groups to its advantage.

Because of the ubiquity of structures that use non-transforming operations, both in mathematics and for physical objects, it makes sense to describe an algebraic structure that can be used to generalize and mimic this symmetry. It provides an abstract basis for symmetry that can be applied to many objects, but is still powerful enough to make quantitative observations about behaviors and patterns present in the group.

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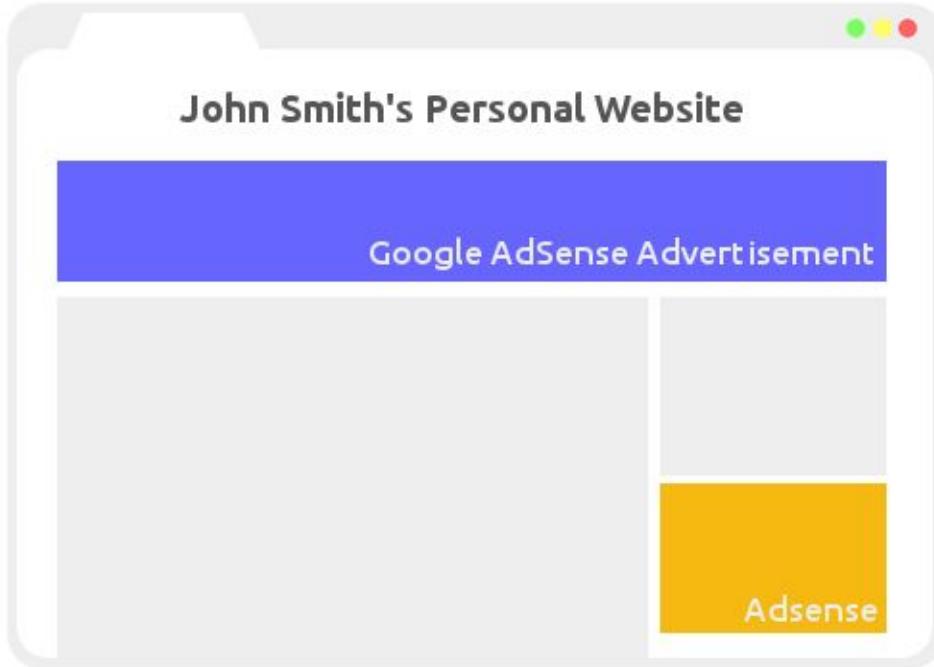
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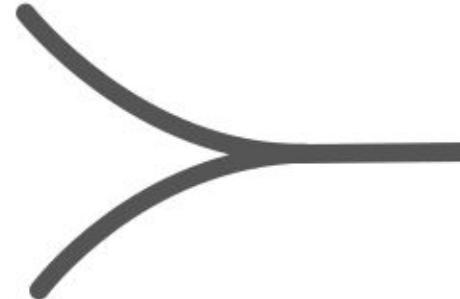
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Ad Clicks

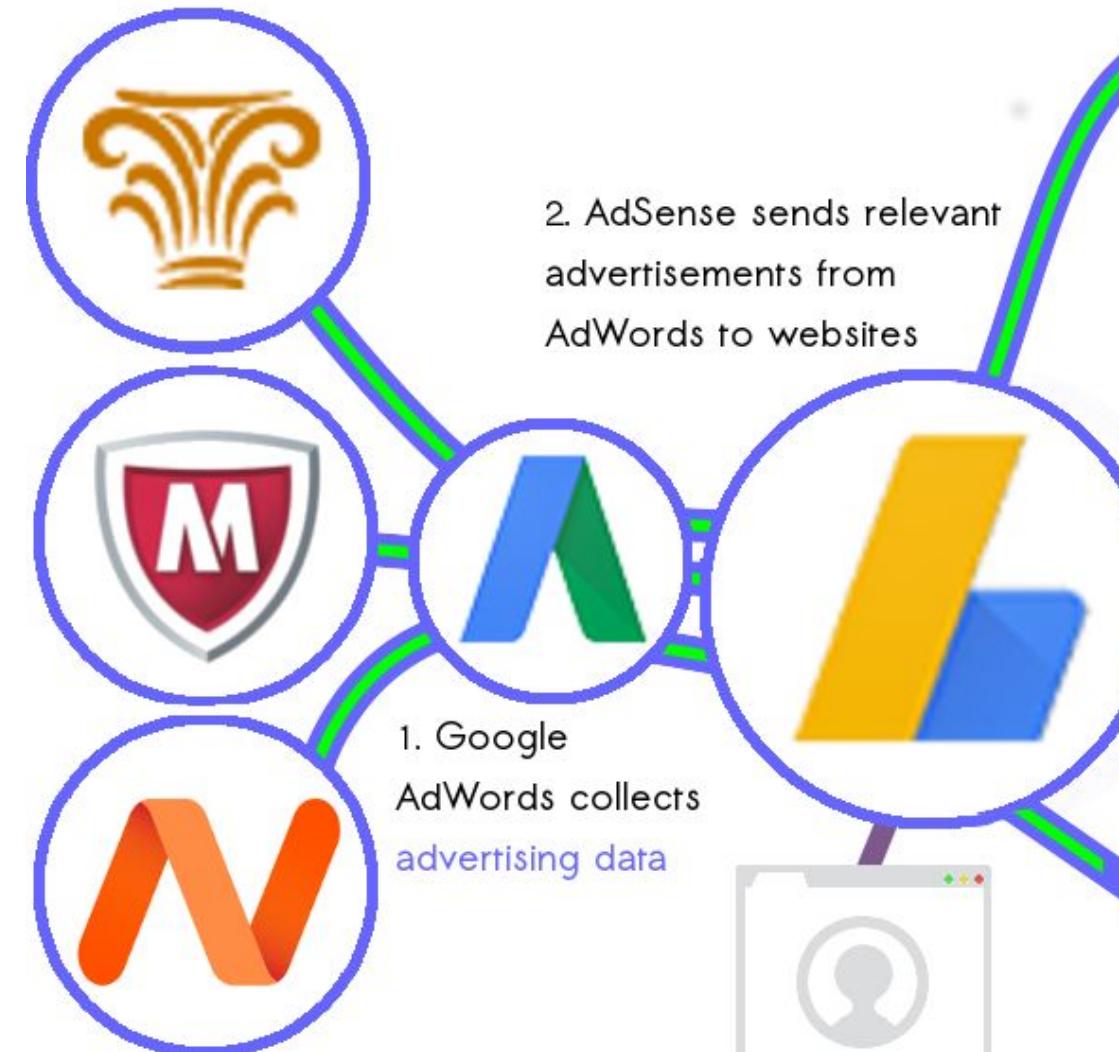


Page Impressions  
(views)



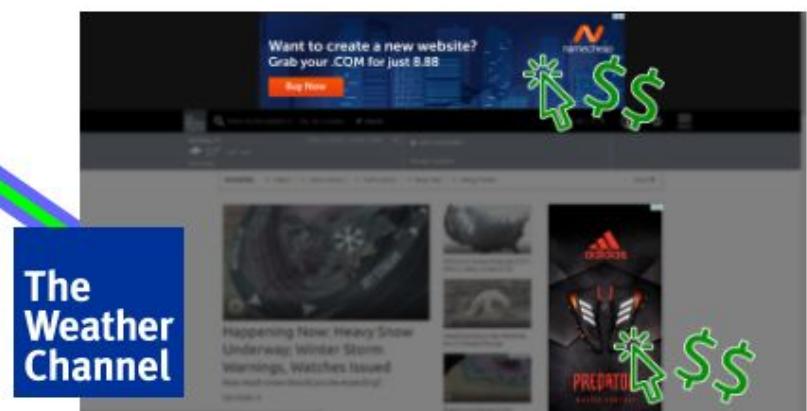
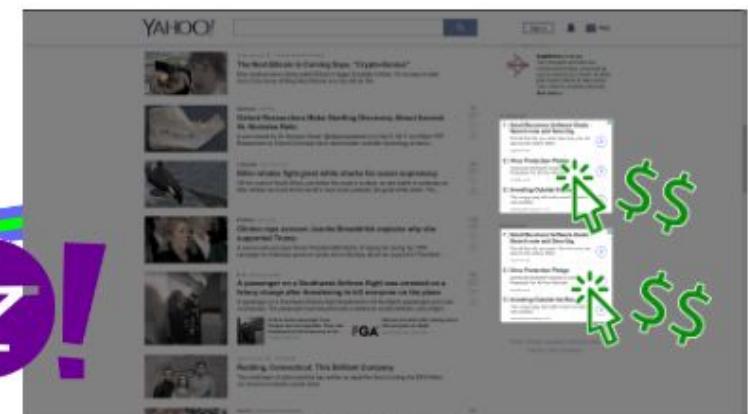
Google AdSense is a way for websites to make money from advertisement clicks and page views.

# How AdSense Works



3. AdSense collects the user's webpage visiting history and website metadata, and finds the best-matching advertisements (using the "Quality Score" algorithm).

Forbes



4. Websites receive money per-click and per-impression from the advertisements

## Explore – Impact of Computing Innovations Written Response Submission Template

Please see [Assessment Overview and Performance Task Directions for Student](#) for the task directions and recommended word counts.

### Computational Artifact

2a)

My computing innovation Google AdSense, a solution for websites to create revenue by hosting advertisements. Approximately 12.5 million websites (by December 2017) use AdSense (“Websites using Google Adsense”), it comprises over half of all digital advertising revenue (Ingram), and advertising constitutes over 80% of Google’s 2017 income (“Alphabet Investor Relations”). The first page of my computational artifact shows its general purpose: to allow people to monetize their AdSense-enabled website. The second page describes how it functions by showing how it collects data from the user, webpage, and AdWords, and pays out on a per-click and per-pageview basis.

2b)

My computing artifact is a three-page PDF with the graphics created with GIMP (GNU Image Manipulation Program). I split it up into an introduction page that gives a general sense of AdSense’s intended purpose, a page with a description of how it works, and a page with statistical data to emphasize its impact. The logos were all downloaded from the web and their sources were cited. I added text and other graphics (e.g., arrows, clipart icons) using GIMP. The graphics were all created in PNG format, but copied into a PDF document to be submitted.

## Computing Innovation

2c)

One beneficial economic effect of AdSense is the monetization of websites for any website owner, creating a new financial option for creators of digital content (e.g., writers, artists). Before AdSense, only major websites were paid by advertisers to host advertising. AdSense revolutionized digital advertising by allowing any webpage with AdSense installed to host advertisements and generate revenue (Cook). While Google collects 32% of the payment from the advertiser ("15 AdSense Facts & Stats You Wouldn't Have Ever Found"), the remaining 68% allowed many people to make a non-trivial income simply by having a webpage with AdSense. This is especially beneficial to people who spend their career publishing content online, such as bloggers or digital artists, that would usually not generate any revenue, for which AdSense can act as a partial or full income.

A harmful effect of Google AdSense is the rise of what are known as MFA (Made For AdSense) webpages, low-quality websites filled with advertisements and usually containing a cluster of commonly-searched information copied from other websites so that they show up on search results webpages (Karch). Many are designed with SEO (Search Engine Optimization) to appear more often on search result pages and with arbitrage— where advertisements lead to other MFA pages with higher-paying keywords— to improve their profit (Karch). Thus AdSense affects society by promoting low-quality, profit-oriented websites that negatively impact the quality of the Internet, in turn making researchers and students using search engines less productive.

2d)

If AdSense is installed on a website, it collects the advertising data stored by Google AdWords, which includes the price that the advertiser pays per advertisement click, relevant keywords, and the image, text, and/or video data that comprise the advertisement. AdSense also collects data about the user's visited websites via tracking cookies, as well as metadata from the webpage. It runs a "Quality Score" algorithm based on the price-per-click and relevance of an advertisement to the webpage's content and the user's interests from their cookie history ("How does AdSense work?"). Its output is the choice of advertisement to be served on a webpage, which aims to be relevant to the user's interest or need.

A potential data privacy concern is that Google AdSense uses tracking cookies. Cookies are small text files in which websites temporarily store information about viewers of those websites, and usually can only be accessed by the website that created them. They are often used in digital shopping carts or for persistent login sessions and are not inherently dangerous. However, tracking cookies differ from regular cookies because they can be accessed by multiple websites ("Tracking Cookie Description"). In particular, AdSense stores a list of AdSense websites that the user has visited, allowing them to collect data about the user's interests. The concern is that while this allows relevant advertisements to be served, Google also has control over this data and can sell it to other companies that use targeted advertisements (e.g., Facebook or Amazon).

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2e)

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[www.forbes.com/sites/clareoconnor/2017/09/19/forbes-magazine-logo-typography-centennial/](http://www.forbes.com/sites/clareoconnor/2017/09/19/forbes-magazine-logo-typography-centennial/).  
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### 3. Program Code

All code in the racing-game project written by the two AP CSP students, compiled for use in the AP CSP Create PT, are included. The directory structure of necessary project files (\* indicates a file/directory of code that we did not write, and therefore did not include as one of the files below), in order of the included files, is shown below:

```
- node_modules/ *
- package.json
- Procfile
- server.js
- public/
  - index.html
  - game.html
  - js/
    - three.js/ *
    - index.js
    - game.js
    - hostGraphics.js
    - clientGraphics.js
  - css/
    - main.css
    - index.css
    - host.css
    - client.css
  - assets/
    - map/
      - map1.png
      - map2.png
    - blacktop_texture.jpg
    - dawnmountain-xneg.png
    - dawnmountain-xpos.png
    - dawnmountain-yneg.png
    - dawnmountain-ypos.png
    - dawnmountain-zneg.png
    - dawnmountain-zpos.png
    - grass_texture.jpg
    - loading_bg.png
```

---

package.json (information necessary for Node.js); author: Jonathan Lam

```
{
  "name": "racing-game",
  "description": "Multiplayer racing game for AP CSP Create task. Hosted online at
https://racing-game-csp.herokuapp.com with Heroku hosting.",
  "version": "0.0.1",
  "keywords": "multiplayer, racing, game, CSP, computer science principles",
  "dependencies": {
    "express": "4.16.0",
    "express-session": "^1.15.6",
    "express-socket.io-session": "^1.3.2",
    "socket.io": "^2.0.4"
  },
  "repository": {
```

```

    "type": "git",
    "url": "https://www.github.com/jlam5555/racing-game.git"
},
"license": "MIT"
}

```

---

Procfile (information necessary for Heroku hosting); author: Jonathan Lam  
web: node server.js

---

```

server.js (server script; handles routing and socket.io); author: Rahul Kiefer and Jonathan Lam
/** 
 * Basic app routing using express
 * @author Jonathan Lam
 */

// express and http packages for basic routing
var express = require('express');
var app = express();
var http = require('http').Server(app);

// set port to environment-defined port or 5000 (default)
http.listen(
  process.env.PORT || 5000,
  () => console.log(`Listening on port ${process.env.PORT || 5000}.`));

/** 
 * Get socket.io dependency
 * @author Jonathan Lam
 */

// socket.io for real-time WebSocket communication
var io = require('socket.io')(http);
var session = require('express-session')({
  secret: 'test-secret',
  resave: true,
  saveUninitialized: true
});
app.use(session);
var sharedsession = require('express-socket.io-session');
io.use(sharedsession(session, { autoSave: true }));

// callback to listen for io events
io.on('connection', socket => {

  // handle when a person connects
  console.log(`A user with socket id ${socket.id} has connected.`);

  // sync up to express
  socket.handshake.session.socketId = socket.id;
  socket.handshake.session.save();
})

```

## 2c (embedded algorithm 1)

```
// handle when a person creates a new game
socket.on('createNewGame', callback => {

    // make sure user is not already in a game
    if(socket.handshake.session.gameId !== undefined) return;

    // generate random id of five letters
    var gameIdCharacters = 'abcdefghijklmnopqrstuvwxyz';
    var gameId;
    do {
        gameId = '';
        while(gameId.length < 5) {
            gameId += gameIdCharacters.substr(Math.floor(Math.random() * gameIdCharacters.length), 1);
        }
    } while(Object.keys(rooms).indexOf(gameId) !== -1);

    rooms[gameId] = { host: null, clients: [] };

    callback(gameId);

});

// check if user is host
socket.on('isHost', callback => {
    var hostInterval = setInterval(() => {
        socket.handshake.session.reload(() => {
            if(socket.handshake.session.host !== undefined) {
                clearInterval(hostInterval);
                callback(socket.handshake.session.host === true,
                    socket.handshake.session.socketId);
            }
        });
    }, 50);
});

// set a user's name
socket.on('setName', name => {
    // get room, set name
    var room = rooms[socket.handshake.session.gameId];
    room.clients.find(client => client.socketId === socket.id).name = name;

    // tell sockets to update names
    io.to(socket.handshake.session.gameId).emit('updateUsers',
        room.clients.map(client => client.name));
});
```

```

});

// handle device orientation input
socket.on('deviceOrientation', (forwardSpeed, turnSpeed) => {

    // if not in game return
    if(!socket.handshake.session.gameId) return;

    // get correct client
    var client = rooms[socket.handshake.session.gameId].clients.find(client =>
client.socketId === socket.id);

    // if host return
    if(!client) return;

    // update client acceleration, heading
    // acceleration is Limited from -90 to +90
    // heading is converted into radians
    client.acceleration = -Math.max(-90, Math.min(90, forwardSpeed));
    client.turn = Math.PI/180 * turnSpeed;

    // prevent invalid accelerations and turn speeds
    if(client.acceleration < -90 || client.acceleration > 90) client.acceleration =
0;
    if(client.turn < -90 || client.turn > 90) client.turn = 0;
});

// handle when a person disconnects
socket.on('disconnect', () => {
    console.log(`A user with socket id ${socket.id} has disconnected.`);

    // delete room if host
    if(socket.handshake.session.gameId !== undefined && socket.handshake.session.host
== true) {
        // delete room
        delete rooms[socket.handshake.session.gameId];

        // tell users to go away
        io.to(socket.handshake.session.gameId).emit('terminateGame');
    }

    // delete person if client and if room exists
    else if(socket.handshake.session.gameId !== undefined &&
socket.handshake.session.host === false) {

        // only do if room exists (room may not exist because it is deleted when host
leaves)
        var room = rooms[socket.handshake.session.gameId];
        if(room !== undefined) {

            // delete client from room
            room.clients = room.clients.filter(client => client.socketId !== socket.id);

            // update room host
        }
    }
}

```

```

        io.sockets.sockets[room.host.socketId].emit('updatedMap', room.clients);

        // update other users
        io.to(socket.handshake.session.gameId).emit('updateUsers',
room.clients.map(client => client.name));
    }
}

// also remove from session
socket.handshake.session.gameId = undefined;
socket.handshake.session.host = undefined;
socket.handshake.session.save();
});

});

/** 
 * Do game updates (position, speed, acceleration (friction), and heading
 * (turn)) every 10ms. This happens here to ensure every person moves at the
 * same speed. The friction is calculated as a piecewise function (Linear
 * deceleration at high speeds, and a deceleration proportional to the
 * speed at low speeds) to make the driving feel more realistic. The constants
 * and multipliers were determined by trial and error to make the driving
 * feel realistic.
* <p>
* Equations:
* - Update speed:           newSpeed      = oldSpeed + acceleration *
accelerationMultiplier - friction
* - Friction:               friction      = { if |newSpeed| >
frictionConstant * 1.5 then newSpeed > 0 ? -frictionConstant : frictionConstant
*                                         if |newSpeed| <
frictionConstant * 1.5 then newSpeed * 0.5
* - Update x position:     newPlayerX    = oldPlayerX +
Math.cos(heading) * speed * speedMultiplier
* - Update y position:     newPlayerY    = oldPlayerY +
Math.sin(heading) * speed * speedMultiplier
* - Update heading (direction): newPlayerHeading = oldPlayerHeading + turnSpeed
* speed * turnMultiplier
* @author Jonathan Lam
*/
var accelerationMultiplier = 0.01; // fraction of the input acceleration that goes
into the acceleration
var speedMultiplier = 0.005; // fraction of the input speed that goes into
the speed
var turnMultiplier = 0.0002; // fraction of the input turn that goes into
the turn
var highSpeedFrictionConstant = 0.25; // linear deceleration of car at high speeds
var lowSpeedFrictionMultiplier = 0.1; // fraction of the speed that the friction will
go against
setInterval(() => {
    // update every game room
    for(var room of Object.keys(rooms)) {
        for(var client of rooms[room].clients) {

```

```

// update player speed
client.speed += client.acceleration * accelerationMultiplier;
// bound player speed between -180 and +180
if(client.speed < -90) client.speed = -90;
if(client.speed > 90) client.speed = 90;

// calculate simulated friction and add to speed
var friction = (Math.abs(client.speed) > highSpeedFrictionConstant * 1.5)
    ? (client.speed > 0 ? 1 : -1) * highSpeedFrictionConstant
    : client.speed * lowSpeedFrictionMultiplier;
client.speed -= friction;

// update player position (depends on heading)
client.x += Math.cos(client.heading) * client.speed * speedMultiplier;
client.y += Math.sin(client.heading) * client.speed * speedMultiplier;

// update player heading (turn speed is proportional to the speed and angle of
turn)
client.heading += client.turn * client.speed * turnMultiplier;
}

// send data to host
var socket;
if(rooms[room].host && (socket = io.sockets.sockets[rooms[room].host.socketId]) !== undefined) {
    socket.emit('updatedMap', rooms[room].clients);
}
// send data to clients
for(var client of rooms[room].clients) {
    if((socket = io.sockets.sockets[client.socketId]) !== undefined) {
        socket.emit('updatedMap', rooms[room].clients);
    }
}
},
}, 10);

/**
 * Rooms to allow people to play multiplayer
 * @todo add verification that server is created, number of people is Less than 3
 * @author Jonathan Lam
 */

var rooms = {};
/*
room format: {
    host: [hostId],
    clients: [arrayOfClientIds]
}
client format: {
    name: [name],
    id: [sessionId],
    x: [xPosition],

```

```
y: [yPosistion],  
z: 0 (for now),  
heading: [heading]  
}  
*/
```

## 2c (embedded algorithm 2)

```
app.get('/game/: gameId', (req, res, next) => {
  // send to game file
  res.sendFile(`__dirname/public/game.html`);

  // get gameId parameter
  var gameId = req.params.gameId.toLowerCase();
  var socket;

  // sync up to socket to join room (keep refreshing until socketId is updated)
  var syncInterval = setInterval(() => req.session.reload(() => {
    if(req.session.socketId != undefined && (socket =
      io.sockets.sockets[req.session.socketId]) != undefined) {
      clearInterval(syncInterval);
    }
  }));

  // error 1: room does not exist
  if(Object.keys(rooms).indexOf(gameId) == -1) {
    socket.emit('err', `Game room "${gameId}" does not exist.`);
    return;
  }

  // error 2: room has more than four people in it
  if(rooms[gameId].clients.length > 3) {
    socket.emit('err', `Game room "${gameId}" is already full.`);
    return;
  }

  // error 3: user is already in the game
  if(rooms[gameId].clients.find(client => client.sessionId === req.session.id) !==
    undefined || (rooms[gameId].host && rooms[gameId].host.sessionId === req.session.id)) {
    socket.emit('err', `You are already in this game on another tab.`);
    return;
  }

  // add gameId to session, session id to game room
  req.session.gameId = gameId;

  // if first person, then host; if not, then client
  if(rooms[gameId].host === null) {
    rooms[gameId].host = {
      sessionId: req.session.id,
      socketId: socket.id
    };
    req.session.host = true;
  } else {
    // create default client
    rooms[gameId].clients.push({
      sessionId: req.session.id,
      socketId: socket.id,
      name: null,
      x: 0,
      y: 0,
      z: 0,
      acceleration: 0,
      speed: 0,
      heading: 0,
      turn: 0
    });
    req.session.host = false;
  }
  req.session.save();

  // join game room
  socket.join(gameId);
  socket.emit('gameId', gameId);
  io.to(gameId).emit('updateUsers', rooms[gameId].clients.map(client =>
  client.name));
  console.log(`A user with socket id ${socket.id} has joined the room ${gameId}.`);
}, 50);
});
```

```

/**
 * Static serving in express for resources (*.css, *.js)
 * @author Jonathan Lam
 */
app.use(express.static('public'));



---


public/index.html (HTML for landing page); author: Rahul Kiefer and Jonathan Lam
<!--
Basic HTML Layout
@author Jonathan Lam
-->
<!doctype html>
<html>
<head>
<title>Racing Game</title>

<!--
meta tags for site crawling
@author Jonathan Lam
-->
<meta charset='utf-8'>
<meta name='description' content='Multiplayer racing game for AP CSP Create
task'>
<meta name='author' content='Jonathan Lam <jonathan.lam@er9.org>, Rahul Kiefer
<rahul.kiefer@er9.org>'>
<meta name='keywords' content='multiplayer, racing, game, CSP, computer science
principles, jonathan lam, rahul kiefer'>

<!--
Set the viewport for responsive web design on mobile
This doesn't work too well, so commented it out
@author Jonathan Lam
-->
<!-- <meta name='viewport' content='width=device-width, initial-scale=1.0'> -->

<!--
include stylesheets
@author Jonathan Lam
-->
<link rel='stylesheet' href='css/main.css'>
<link rel='stylesheet' href='css/index.css'>

<!--
include FontAwesome icon set (to make website look pretty)
See https://fontawesome.com/ for more information
@author Jonathan Lam
-->
<script defer src='https://use.fontawesome.com/releases/v5.0.8/js/all.js'
integrity='sha384-SlE991lGASHoBfWbelyBPLsUlwY1GwNDJo3jSJ004KZ33K2bwfV9YBauFfnzvynJ'
crossorigin='anonymous'></script>

<!--

```

```
    include socket.io library for use of WebSockets/Long-polling to communicate in
real time with server
    See https://socket.io/ for more information
    @author Jonathan Lam
    -->
<script src='/socket.io/socket.io.js'></script>

<!--
    include main script
    @author Jonathan Lam
-->
<script src='/js/index.js' defer></script>

</head>
<body>

<!--
    Create a room for hosts
    @author Jonathan Lam
-->
<div class='deviceTypeContainer' id='desktopContainer'>

    <!--
        Link to GitHub for information and code
        @author Jonathan Lam
    -->
    <a id='infoLink' title='Click to see more information and the source on
GitHub.' href='https://github.com/jlam5555/racing-game' target='_blank'>
        <i class='fas fa-info-circle'></i>
    </a>

    <div class='deviceTypeIcon'>
        <i class='fas fa-desktop'></i>
    </div>
    <button id='createGame'>CREATE GAME</button>
</div>

<!--
    Join a room for mobile
    @author Jonathan Lam
-->
<div class='deviceTypeContainer' id='mobileContainer'>
    <div class='deviceTypeIcon'>
        <i class='fas fa-mobile'></i>
    </div>
    <div id='joinGameContainer'>
        <input type='text' id='joinGameId' placeholder='GAME ID'>
        <button id='joinGame'>JOIN GAME</button>
    </div>
</div>

</body>
</html>
```

---

```
public/game.html (HTML for gameplay page); author: Rahul Kiefer and Jonathan Lam
<!--
  Basic HTML Layout
  @author Jonathan Lam
  -->
<!doctype html>
<html>
  <head>
    <title>Racing Game</title>

    <!--
      meta tags for site crawling
      @author Jonathan Lam
      -->
    <meta charset='utf-8'>
    <meta name='description' content='Multiplayer racing game for AP CSP Create
task'>
    <meta name='author' content='Jonathan Lam <jonathan.lam@er9.org>, Rahul Kiefer
<rahul.kiefer@er9.org>'>
    <meta name='keywords' content='multiplayer, racing, game, CSP, computer science
principles, jonathan lam, rahul kiefer'>

    <!--
      Set the viewport for responsive web design on mobile
      This didn't work too well, so commented it out for now
      @author Jonathan Lam
      -->
    <!-- <meta name='viewport' content='width=device-width, initial-scale=1.0'> -->

    <!--
      include stylesheets
      @author Jonathan Lam
      -->
    <link rel='stylesheet' href='/css/main.css'>
    <link rel='stylesheet' href='/css/host.css'>
    <link rel='stylesheet' href='/css/client.css'>

    <!--
      include socket.io Library
      @author Jonathan Lam
      -->
    <script src='/socket.io/socket.io.js'></script>

    <!--
      include three.min.js Library
      See https://threejs.org/ for more information
      @author Rahul kiefer
      -->
    <script src='/js/three.js/three.js'></script>

    <!--
      include THREE.js Line Library files (not included in main THREE.js Library) to
make race track
```

```

Source:
https://github.com/mrdoob/three.js/tree/cb4c23fea8b667b6126635be64825d0cc1fa5f4b/examples/js/lines
@author Rahul Kiefer
-->
<script src='/js/three.js/line/LineSegmentsGeometry.js'></script>
<script src='/js/three.js/line/LineGeometry.js'></script>
<script src='/js/three.js/line/WireframeGeometry2.js'></script>
<script src='/js/three.js/line/LineMaterial.js'></script>
<script src='/js/three.js/line/LineSegments2.js'></script>
<script src='/js/three.js/line/Line2.js'></script>
<script src='/js/three.js/line/Wireframe.js'></script>

<!--
  include FontAwesome icon set (to make website look pretty)
  @author Jonathan Lam
-->
<script defer src='https://use.fontawesome.com/releases/v5.0.8/js/all.js'
integrity='sha384-S1E991lGASHoBfWbelyBPLsUlwY1GwNDJo3jSJ004KZ33K2bwfV9YBauFfnzvynJ'
crossorigin='anonymous'></script>

<!--
  Includes the graphics script.
<p>
  hostGraphics.js is for the computer (host). This includes views for all
players, and sets up the basic scene.
<p>
  clientGraphics.js is for the mobile device (client). This includes a
simplified, single viewport that is shown on mobile devices.
@author Rahul Kiefer
-->
<script src='/js/hostGraphics.js' defer></script>
<script src='/js/clientGraphics.js' defer></script>

<!--
  include main script
  @author Jonathan Lam
-->
<script src='/js/game.js' defer></script>

</head>
<body>

<!--
  Controls div on left
  @author Jonathan Lam
-->
<div id='controls'>

  <!-- Show names (these are absolutely positioned over the canvas) -->
  <div id='names'></div>

  <!-- Link to return to homepage -->
  <a id='homeLink' href='/' class='vCenter'>
```

```

<span class='fas fa-chevron-circle-left'></span>
</a>

<!-- Shows errors if they exist on entry -->
<div id='error' class='vCenter'></div>

<!-- Show game ID -->
<div id='gameIdContainer' class='vCenter'>
  <span id="gameIdInnerContainer">
    ID: <span id='gameId'></span>
  </span>
</div>

</div>

<!--
  Main canvas on right
  @author Jonathan Lam
-->
<div id='game'></div>

</body>
</html>

```

```

public/js/index.js (script for landing page); author: Jonathan Lam
/**
 * This file is for the homepage.
 */

/**
 * Connect to socket.io
 * @author Jonathan Lam
 */
var socket = io();

```

2c

```
/**  
 * Create a game when button is clicked  
 * @author Jonathan Lam  
 */  
var createGameButton = document.querySelector('#createGame');  
createGameButton.addEventListener('click', () => {  
    // redirect to page on click  
    socket.emit('createNewGame', new gameId => {  
        window.location.href = `${window.location.href}game/${new gameId}`;  
    });  
});  
  
/**  
 * Join a room when button is clicked  
 * @author Jonathan Lam  
 */  
var joinGameId = document.querySelector('#joinGameId');  
var joinGameButton = document.querySelector('#joinGame');  
joinGameButton.addEventListener('click', () => {  
    if(joinGameId.value.trim() !== '') {  
        window.location.href = `${window.location.href}game/${joinGameId.value}`;  
    }  
})  
  
/**  
 * Make recommendation  
 * @author Jonathan Lam  
 */  
// if large window size or deviceorientationevent not supported, recommend host  
if(window.innerWidth >= 1920 || !window.DeviceOrientationEvent) {  
    document.querySelector('#desktopContainer').classList.add('recommended');  
}  
// else recommend client  
// this double-checks if deviceorientationevent works (and if it doesn't, recommends desktop)  
else {  
    if(window.DeviceOrientationEvent) {  
        window.addEventListener('deviceorientation', event => {  
            if(event.alpha === null) {  
                document.querySelector('#desktopContainer').classList.add('recommended');  
            } else {  
                document.querySelector('#mobileContainer').classList.add('recommended');  
            }  
        });  
    }  
}
```

```

} else {
  document.querySelector('#mobileContainer').classList.add('recommended');
}
}



---



public/js/game.js (script for gameplay, excluding graphics); author: Rahul Kiefer and Jonathan Lam

/*
 * This file is for the game (excluding graphics).
 */

/*
 * Connect to socket.io
 * @author Jonathan Lam
 */
var socket = io();

// get game id to show on element #gameId
socket.on('gameId', gameId => {
  var gameIdText = "";
  var gameIdChars = gameId.split("");
  for(var char of gameIdChars) {
    gameIdText += `<span class='gameIdChar'>${char.toUpperCase()}</span>`;
  }
  document.querySelector('#gameId').innerHTML = gameIdText;
});

/*
 * Get errors on joining room
 * @author Jonathan Lam
 */
socket.on('err', msg => {
  document.querySelector('#gameIdContainer').style.display = 'none';
  document.querySelector('#names').style.display = 'none';
  document.querySelector('#error').textContent = `Error: ${msg}`;
});

/*
 * Get name if client
 * @author Jonathan Lam
 */
var isHost;
var socketId;
socket.emit('isHost', (isHostResponse, socketIdResponse) => {

  if(!isHostResponse) {

    // ask for name, send to server
    var defaultNames = ["Richard", "Rasmus", "Tony", "Aubrey", "Don
Juan", "Graham", "Dennis", "George", "Ted", "Rufus", "Rami", "Willem", "Peter", "Zack", "Oscar"
,"Rick", "Brandon", "Charlie", "Louie", "Phil", "Nigel", "Earl", "Jones", "Carl", "Jake", "Rich
ter", "Russell",
          "Corey", "Alex", "Ash", "Mark", "Irvin", "Dallas\n "]
  }
})

```

```
    var name = prompt('What is your name?', defaultNames[Math.floor(Math.random() * defaultNames.length)]);
    socket.emit('setName', name);

    // set socketId
    socketId = socketIdResponse;
}

// set host flag (true if host, false if client)
isHost = isHostResponse;
});
```

2d

```
/**  
 * Update name listing  
 * @author Jonathan Lam  
 */  
var namesElement = document.querySelector('#names');  
socket.on('updateUsers', names => {  
    /**  
     * Position name on top left of correct screen  
     * @author Jonathan Lam  
     */  
    var positions;  
    switch(names.length) {  
        // one person joined: full screen  
        case 1:  
            positions = [ [ 0, 0 ] ];  
            break;  
        // two people in the game: side by side  
        case 2:  
            positions = [ [ 0, 0 ], [ width/2, 0 ] ];  
            break;  
        // three people in the game: top two side by side, bottom in center  
        case 3:  
            positions = [ [ 0, 0 ], [ width/2, 0 ], [ width/4, height/2 ] ];  
            break;  
        // four people in the game: top two side by side, bottom two side by side  
        case 4:  
            positions = [ [ 0, 0 ], [ width/2, 0 ], [ 0, height/2 ], [ width/2, height/2 ] ];  
            break;  
        // nobody joined; no positions  
        case 0:  
        default:  
            break;  
    }  
    var namesElement = document.querySelector('#names');  
    namesElement.innerHTML = '';  
    for(var i = 0; i < names.length; i++) {  
        var nameDiv = document.createElement('div');  
        nameDiv.classList.add('name');  
        nameDiv.style.left = positions[i][0] + 40 + 'px'; // added padding 40px  
        nameDiv.style.top = positions[i][1] + 40 +  
        document.querySelector('#controls').clientHeight + 'px'; // added padding 40px  
        nameDiv.appendChild(document.createTextNode(names[i] || 'An unnamed driver'));  
        namesElement.appendChild(nameDiv);  
    }  
    // update cars and cameras  
    updateCars();  
    // if client  
    if(isHost !== undefined && !isHost) {  
        // overwrite main render function with client one  
        overwriteRender(socketId);  
        // add .mobile class to controls to transform it  
        document.querySelector('#controls').classList.add('mobile');  
    }  
});
```

```

/**
 * Terminate game (if host Leaves)
 * @author Jonathan Lam
 */
socket.on('terminateGame', () => {
  window.location.href = '/';
});

/**
 * If client, get orientation event and send to server
 * Calculates forward speed from gamma (and beta), turn from beta
 * @author Jonathan Lam
 */
window.addEventListener('deviceorientation', event => {

  // only do this for client
  if(isHost) return;

  // adjusting the 'no pedal' position from flat to 45 degrees
  var beta = event.beta;
  var gamma = event.gamma + 45;

  var forwardSpeed = 0, turnSpeed = 0;
  // device facing upwards
  if(Math.abs(beta) < 90) {
    forwardSpeed = gamma;
    turnSpeed = beta;
  }
  // device facing downwards -- put at extreme (-90 or 90)
  else {
    forwardSpeed = gamma < 0 ? 90 : -90;
    turnSpeed = (beta < 0 ? -180 : 180) - beta;
  }

  // send in deviceorientation
  // comment this for testing on desktop
  socket.emit('deviceOrientation', forwardSpeed, turnSpeed);

});
// uncomment this for testing on desktop
// setTimeout( () => socket.emit('deviceOrientation', 10, 50), 1000 );

/**
 * Get all client positions
 * Host will show all
 * Client will show view from just their car
 * @author Jonathan Lam
 */
socket.on('updatedMap', mapData => {
  map = mapData;
});

```

---

public/hostGraphics.js (main graphics file, graphics for computer screen (host)); author: Rahul Kiefer and Jonathan Lam

```

/**
 * host graphics file
 * <p>
 * Critical functions: init(), animate(), render()
 * @author Rahul Kiefer
 */

/**
 * Use #game as base element
 * width and height are global variables used for the width and height of the
 * canvas, and are set in the resize handler
 * @author Jonathan Lam
 */
var element = document.querySelector('#game'), width, height;

/**
 * Event handler to update width and height on window resize (canvas resizes
 * automatically). Also called in init() to initialize width and height.
 * @author Jonathan Lam
 */
function resizeHandler() {

    // update width and height
    width = element.getBoundingClientRect().width;
    height = element.getBoundingClientRect().height;

    // update main camera aspect ratio and renderer size
    camera = new THREE.PerspectiveCamera(75, width / height, 0.1, 1000);
    renderer.setSize(width, height);

}

window.addEventListener('resize', resizeHandler);

/**
 * Create scene and camera
 * @author Rahul Kiefer
 */
var scene = new THREE.Scene();
var camera = new THREE.PerspectiveCamera(75, width / height, 0.1, 1000);

/**
 * Create renderer
 * @author Rahul Kiefer
 */
var renderer = new THREE.WebGLRenderer();
renderer.setSize(width, height);
element.appendChild(renderer.domElement);

/**
 * Car class (a function as per JS standards). Create using 'new Car()'
 * <p>
 * Publicly available fields: .mesh (to change position and rotation)

```

```

    * @param id The id of the car (the socketId of the client) to correctly match the
client camera to the car
    * @todo Make member fields private
    * @return undefined
    * @author Rahul Kiefer
    */
function Car(id) {

    /**
     * Set id of car (to attach camera to correct car on mobile)
     * @author Jonathan Lam
     */
    this.id = id;

    /**
     * Draw shape of car, and then extrude
     * @author Rahul Kiefer
     */
    var hoodHeight = 1.25;           // height of a car's hood
    var carHeight = hoodHeight + .75; // distance between ground and roof

    // drawing the car shape
    this.shape = new THREE.Shape();
    this.shape.moveTo(0, 0);
    this.shape.lineTo(0, hoodHeight); // from front bottom to front of hood
    this.shape.lineTo(2, hoodHeight); // from front of hood to windshield
    this.shape.lineTo(2.5, carHeight); // from bottom of windshield to top of
windshield
    this.shape.lineTo(4.5, carHeight); // from top of windshield to top of back
window
    this.shape.lineTo(5, hoodHeight); // from top of back window to bottom of back
window
    this.shape.lineTo(6, hoodHeight); // from bottom of back window to top of trunk
    this.shape.lineTo(6, 0);        // from top of trunk to bottom of trunk
    this.shape.lineTo(0, 0);

    // use basic extrudegeometry
    this.extrudeSettings = {
        steps: 1,                // extrudegeometry uses one intermediate shape
        amount: 3,               // width of car
        bevelEnabled: false,     // bevel set to false to make the texture (UV) mapping
easier
        // bevelThickness: .5,
        // bevelSize: .5,
        // bevelSegments: 2,
        material: 0,            // first material (texture) in material array is for
sides
        extrudeMaterial: 1       // second material (texture) in material array is for the
front, hood, windshield, top, rear windshield, rear hood, rear (and bottom)
    }
    this.geometry = new THREE.ExtrudeGeometry(this.shape, this.extrudeSettings);

    /**
     * Create materials (Lambert textures) with UV mapping for custom extrude geometry

```

```

    * @author Jonathan Lam
    */

// Load materials
this.materials = [];
for(var i = 0; i < 2; i++) {
    // texture 1 (sides) is located at /assets/map/map1.png
    // texture 2 (other faces) is located at /assets/map/map2.png
    var texture = new THREE.TextureLoader().load(`/assets/map/map${i+1}.png`);
    if(i == 1) {
        // scaling for the extrude material
        // scale goes from x: 0-2, y: (-2)-1 (this is for the UV mapping to work)
        texture.repeat.set(1/2, 1/3);
        texture.offset.set(0, 2/3);
    } else {
        // scaling for the side material
        // scale goes from x: 0-6, y: 0-2
        texture.repeat.set(1/6, 1/2);
    }
    this.materials.push(new THREE.MeshLambertMaterial({ map: texture }));
}

/**
 * UV mapping for the car texture
* <p>
* Brief description of UV mapping: UV mapping is a system to get a 2D image
* wrapped around a 3D shape. Luckily, this is relatively easy for objects
* with flat faces (such as this car), which means that we simply have to
* translate coordinates from the 2D "map" to the 3D geometry.
* <p>
*
* (0, 1)           (2, 1)      // The map is a square image with
* +-----+          +-----+      // the labelled (U, V) coordinates.
* |           |          |      // These specific (U, V) coordinates
* |           |          |      // were made to wrap around the car.
* |           |          |
* |           |          |
* |           |          |
* |           |          |
* +-----+
* (0, -2)         (2, -2)

* <p>
* Different 3D triangular "faces" of the car geometry, numbered 12-25, were
* programmatically mapped to the corresponding (U, V) coordinates on the
* map.
* <p>
* Made with a LOT of painstaking trial-and-error. =/ I thought this
* deserves its own special comment.
* @author Jonathan Lam
*/
// no change to sides (faceVertexUvs indeces 0-11)
// no change to bottom (faceVertexUvs indeces 26-27)

```

```

// side lengths correspond to the lengths of the sides of the car's Shape
var sideLengths = [ 0, 1.25, 2, Math.sqrt(0.5*0.5 + 0.75*0.75), 2,
Math.sqrt(0.5*0.5 + 0.75*0.75), 1, 1.25 ];
// cumulative lengths correspond to the length of the sides from the start of the
car's Shape
var cumulativeLengths = sideLengths.map((e, index) => sideLengths.slice(0,
index+1).reduce((accumulator, value) => accumulator + value));
// positions correspond to the scaled version of the cumulative lengths for the UV
map
var positions = cumulativeLengths.map(length => length /
cumulativeLengths[cumulativeLengths.length-1] * 2);

// start from front, go to back (index 25 is front, index 14 is back)
for(var i = 25; i >= 12; i--) {

    // generate correct set of UV map points in points array
    var points;

    // even face numbers
    if(i % 2 == 0) {
        points = [
            { x: positions[(25-i-1) / 2 + 1], y: 1 },
            { x: positions[(25-i-1) / 2], y: 1 },
            { x: positions[(25-i-1) / 2 + 1], y: -2 },
        ];
    }
    // odd face numbers
    else {
        points = [
            { x: positions[(25-i) / 2], y: 1 },
            { x: positions[(25-i) / 2], y: -2 },
            { x: positions[(25-i) / 2 + 1], y: -2 },
        ];
    }

    // add uv map to geometry
    this.geometry.faceVertexUvs[0][i] = points;
}

/**
 * Create mesh and add to scene
 * @author Rahul Kiefer
 */
this.mesh = new THREE.Mesh(this.geometry, this.materials);
scene.add(this.mesh);

/**
 * Attach a camera to a car when car joins
 * Called in updateCars()
 * @author Jonathan Lam
 */
this.addCamera = camera => {
    this.camera = camera;
}

```

```

        this.mesh.add(camera);
    };

    /**
     * Remove a car and its associated camera when car leaves
     * Called in updateCars()
     * @author Jonathan Lam
     */
    this.remove = () => {
        this.mesh.remove(this.camera);
        scene.remove(this.mesh);
    };
}

// initial car at 0,0 for testing and as a reference point
// remove in production code
// var car = new Car();

/**
 * Creating multiple views
 * @todo Make this programatically instead of hardcoding it in, explain position
and rotation metrics
 * @author Jonathan Lam
*/
var views = [
    // car 1: left top [currently: viewing car from front *FIX*]
{
    left: 0,
    top: 0,
    width: 0.5,
    height: 0.5,
    position: [3, -15, 1.5], rotation: [Math.PI/2, 0, 0], // BOTTOM (for debug)
    position: [-10, 1, 1.5], rotation: [0, -Math.PI/2, 0], // FRONT (for debug)
    position: [3, 15, 1.5], rotation: [-Math.PI/2, 0, 0], // TOP (for debug)
    position: [3, 1, 15], rotation: [0, 0, 0], // SIDE (for debug)
    position: [20, 1, 1.5], rotation: [0, Math.PI/2, 0], // BACK (for debug)
    position: [20, 3, 1.5], rotation: [0, Math.PI/2, 0], // NORMAL (for prod)
    fov: 30,
    enabled: true
},
    // car 2: right top (Looking down on car from above)
{
    left: 0.5,
    top: 0,
    width: 0.5,
    height: 0.5,
    position: [20, 3, 1.5],
    rotation: [0, Math.PI/2, 0],
    fov: 30
},
    // car 3: left bottom
{
    left: 0,
    top: 0.5,

```

```

        width: 0.5,
        height: 0.5,
        position: [20, 3, 1.5],
        rotation: [0, Math.PI/2, 0],
        fov: 30
    },
    // car 4: right bottom
    {
        left: 0.5,
        top: 0.5,
        width: 0.5,
        height: 0.5,
        position: [20, 3, 1.5],
        rotation: [0, Math.PI/2, 0],
        fov: 30
    }
];

```

```

/**
 * updateCars() function
 * This is called every time a user enters Leaves (upon the 'updateUsers' message
from socket.io (see /public/js/game.js))
 * @return undefined
 * @author Jonathan Lam
 */

```

```

// map and car arrays to map (client positions) and cars (Car objects)
var map = [];
var cars = [];

// updateCars function
function updateCars() {

    // remove all cars ("reset" array)
    for(var i = 0; i < cars.length; i++) {
        cars[i].remove();
    }
    cars = [];

    // make new cars ("refresh" the array)
    for(var i = 0; i < map.length; i++) {
        var car = new Car(map[i].socketId);
        // x and y are coordinates on flat plane in server
        // x and z are coordinates on flat plane in three.js
        car.mesh.position.x = map[i].x;
        car.mesh.position.z = map[i].y;
        car.mesh.position.y = map[i].z;
        car.addCamera(views[i].camera);
        cars.push(car);
    }

    // disable all views after view 1 that are enabled
    // i.e., the first view is default, even if no cars; the others are triggered by
multiple people entering the game
}

```



```

        views[1].left = 0.5;
        break;
    case 3:
        // if three or four cars, set to one-quarter screen size
        views[0].width = views[1].width = views[2].width = 0.5;
        views[0].height = views[1].height = views[3].height = 0.5;
        views[1].left = 0.5;
        views[2].top = 0.5;
        views[2].left = 0.25;
        break;
    case 4:
        views[0].width = views[1].width = views[2].width = views[3].width = 0.5;
        views[0].height = views[1].height = views[3].height = views[3].height = 0.5;
        views[1].left = 0.5;
        views[2].top = 0.5;
        views[2].left = 0.0;
        views[3].top = 0.5;
        views[3].left = 0.5;
        break;
    }
}

/**
 * init() function to set up views, objects
 * @return undefined
 * @author Rahul Kiefer
 */
function init() {

    // initialize width and height
    resizeHandler();

    // create a camera for every view, using views array values
    for(var view of views) {
        var camera = new THREE.PerspectiveCamera(view.fov, width/height, 0.1, 7500);
        camera.position.fromArray(view.position);
        camera.rotation.fromArray(view.rotation);
        view.camera = camera;
    }

    /**
     * Create skybox (side Length of 5000)
     * Example used for template: stemkoski.github.io/Three.js/Skybox.html
     * @todo Change images to match theme
     * @author Jonathan Lam
     */
    var imagePrefix = '/assets/dawnmountain-';
    var directions = [ 'xpos', 'xneg', 'ypos', 'yneg', 'zpos', 'zneg' ];
    var imageSuffix = '.png';
    var skyGeometry = new THREE.CubeGeometry(5000, 5000, 5000);

    var materialArray = [];
    for (var i = 0; i < 6; i++) {
        materialArray.push(new THREE.MeshBasicMaterial({

```

```

    map: new THREE.TextureLoader().load(imagePrefix + directions[i] + imageSuffix),
    side: THREE.BackSide
  }));
}
var skyMaterial = materialArray;
var skyBox = new THREE.Mesh(skyGeometry, skyMaterial);
scene.add(skyBox);

/**
 * Create spot Light (sun, directly above)
 * @author Rahul Kiefer
 */
var spotLight = new THREE.PointLight( 0xffffffff );
spotLight.position.set(0, 1000, 0);

spotLight.shadow.camera.near = 500;
spotLight.shadow.camera.far = 10000;

scene.add(spotLight);

/**
 * Create ambient Light (is this necessary?)
 * @todo Remove?
 * @author Rahul Kiefer
 */
var ambLight = new THREE.AmbientLight(0xf5f5f5); //soft white light
scene.add(ambLight);

/**
 * Create the floor
 * @author Rahul Kiefer
 */
var floorTexture = new THREE.TextureLoader().load('/assets/grass_texture.jpg');
floorTexture.wrapS = floorTexture.wrapT = THREE.RepeatWrapping;
floorTexture.repeat.set(50, 50);
var floorMaterial = new THREE.MeshBasicMaterial( { map: floorTexture, side:
THREE.DoubleSide } ); //Floor looks better as a MeshBasicMaterial
var floorGeometry = new THREE.PlaneGeometry(5000, 5000, 10, 10); //Floor is
5000x5000 to match skybox
var floor = new THREE.Mesh(floorGeometry, floorMaterial);
floor.rotation.x = Math.PI / 2;
scene.add(floor);

var track = new THREE.Shape();

track.moveTo(150,-2500);
track.lineTo(150,2500);
track.lineTo(100,2500);
track.lineTo(100,-2500);
track.lineTo(150,-2500);

var trackExtrudeSettings = {
  amount: 5,
  bevelEnabled: false,

```

```

    bevelSegments: 2,
    steps: 1,
    bevelSize: 1,
    bevelThickness: 1
};

var trackTexture = new THREE.TextureLoader().load('/assets/blacktop_texture.jpg');
trackTexture.wrapS = trackTexture.wrapT = THREE.RepeatWrapping;
trackTexture.repeat.set( 1, 1 );
var trackMaterial = new THREE.MeshBasicMaterial( {map: trackTexture, side: THREE.DoubleSide} );
var trackGeometry = new THREE.ExtrudeGeometry(track, trackExtrudeSettings);
var raceTrackMesh = new THREE.Mesh( trackGeometry, trackMaterial );

raceTrackMesh.rotation.x = Math.PI / 2;
raceTrackMesh.position.y = 0.01; //barely above the ground
scene.add(raceTrackMesh);

}

/**
 * Function animate() to run the animation
 * This is run on every frame, by window.requestAnimationFrame()
 * @return undefined
 * @author Rahul Kiefer
 */
function animate() {
    // update coordinates of cars
    for(var i = 0; i < map.length; i++) {
        if(cars[i]) {
            // see note above for switched z and y
            cars[i].mesh.position.x = map[i].x;
            cars[i].mesh.position.z = -map[i].y;
            cars[i].mesh.position.y = map[i].z;
            cars[i].mesh.rotation.y = map[i].heading;
        }
    }

    // render views
    render();

    // wait until canvas ready to render
    requestAnimationFrame(animate);
}

/**
 * render() function to render the scene by setting up each viewport (camera) as
 * appropriate
 * @author Jonathan Lam
 */
function render() {
    for(var view of views) {
        // if disabled, skip
        if(!view.enabled) continue;

```

```

var camera = view.camera;

// set viewport
var viewLeft = Math.floor(width * view.left);
var viewTop = Math.floor(height * view.top);
var viewWidth = Math.floor(width * view.width);
var viewHeight = Math.floor(height * view.height);

renderer.setViewport(viewLeft, viewTop, viewWidth, viewHeight);
renderer.setScissor(viewLeft, viewTop, viewWidth, viewHeight);
renderer.setScissorTest(true);
renderer.setClearColor(view.background);

// update camera
camera.aspect = viewWidth/viewHeight;
camera.updateProjectionMatrix();

// render view
renderer.render(scene, camera);
}

}

// initialize the scene (both for clients and host)
init();

// begin the simulation/animation/game
animate();

```

public/graphics/clientGraphics.js (secondary graphics file for mobile screen (client)); author: Jonathan Lam

```

/**
 * client graphics file
 * <p>
 * Critical functions: render() (overwrite the one in hostGraphics)
 * Initialization is already set up in the main graphics file
 * @author Jonathan Lam
 */

/**
 * Function overwriteRender to overwrite the main render function for a client
 * device.
 * <p>
 * This is called when the user's car is created (after the first updateCars()
 * in the 'updateUsers' websocket event). It replaces the four-car view with a
 * simple view from the windshield of the client's car.
 * @param id socketId of the client; used to match the car
 * @return none
 * @author Jonathan Lam
 */
function overwriteRender(id) {

// create camera

```

```

var camera = new THREE.PerspectiveCamera(30, width/height, 0.1, 20000);
camera.position.set(0, 3, 1.5);
camera.rotation.set(0, Math.PI/2, 0);

// attach camera to car (match socket ids)
cars.find(car => car.id === id).addCamera(camera);

// simple, single camera full-screen viewport
render = function() {
    renderer.setViewport(0, 0, width, height);
    renderer.render(scene, camera);
};

}

```

---

```

public/css/main.css (global CSS rules); author: Jonathan Lam
/***
 * Generic page style
 * Applies to both index.html and game.html
 */

/***
 * Import source code pro monospace font for use
 * @author Jonathan Lam
 */
@import url('https://fonts.googleapis.com/css?family=Source+Code+Pro');

/***
 * Set basic styles for all elements and html, body
 * @author Jonathan Lam
 */
* {
    box-sizing: border-box;
}
html, body {
    margin: 0;
    height: 100%;
    font-size: 16px;
    font-family: source code pro, monospace;
}
a, button, select, input {
    outline: none;
    border: none;
    font-size: inherit;
    font-family: inherit;
    color: inherit;
}
button, input {
    border: none;
    padding: 1em;
}
input {
    background-color: #eee;
}

```

```
}
```

---

```
public/css/index.css (CSS rules for landing page); author: Jonathan Lam
/**
 * Styles for homepage
 * Applies to index.html
 */

/**
 * Put computer and smartphone divs side by side
 * @author Jonathan Lam
 */
body {
    display: flex;
    flex-direction: row;
    background-image: url('/assets/loading_bg.png');
    background-position: center;
    background-size: cover;
    color: white;
}
#infoLink {
    display: block;
    position: absolute;
    top: 1em;
    left: 1em;
    padding: 0.5em;
    cursor: pointer;
}
.deviceTypeContainer {
    flex-grow: 1;
    flex-basis: 50%;
    display: flex;
    flex-direction: column;
    justify-content: center;
    padding: 3em;
    font-size: 1.25em;
    background-color: rgba(50, 50, 50, 0.8);
}
.deviceTypeIcon {
    font-size: 10em;
    text-align: center;
}
.deviceTypeHeader {
    text-align: center;
}
.deviceTypeContainer.recommended {
    background-color: rgba(0, 0, 0, 0.3);
}
.deviceTypeContainer.recommended::before {
    content: 'RECOMMENDED';
    font-size: 2em;
    margin-bottom: -1em;
    text-align: center;
```

```

    display: block;
    position: relative;
    top: -1em;
}
#joinGameContainer {
    display: flex;
    flex-direction: row;
}
#joinGameId {
    flex-grow: 5;
}
#joinGame {
    flex-grow: 1;
}
button, input {
    background-color: #222;
    border-radius: 0.25em;
    cursor: pointer;
}

```

---

public/css/host.css (CSS rules for host in gameplay): author: Rahul Kiefer and Jonathan Lam

```

/**
 * Styling for the host
 * Applies to game.html
 */

/**
 * Make body a flex element for easy alignment of controls and canvas
 * @author Jonathan Lam
 */
body {
    display: flex;
    flex-direction: column;
}

/**
 * General class for centered vertical align (used for controls)
 * @author Jonathan Lam
 */
.vCenter {
    display: flex;
    flex-direction: column;
    justify-content: center;
}

/**
 * styling the controls
 * @author Jonathan Lam
 */
#controls {
    flex: 0 1 0;
    display: flex;
    flex-direction: row;
}
```

```
flex-basis: 4em;
background-color: black;
color: white;
}
#homeLink {
  flex-basis: 2em;
  font-size: 2em;
  padding: 0.5em;
  transition: background-color 0.2s;
}
#homeLink:hover {
  background-color: darkgrey;
}
#gamIdContainer {
  flex: 1 0 0;
}
#gamIdInnerContainer {
  width: 100%;
  text-align: center;
  font-size: 1.5em;
}
.gamIdChar {
  display: inline-block;
  margin: 0 0.125em;
  padding: 0.25em;
  width: 1.5em;
  text-align: center;
  background-color: darkgrey;
  color: white;
  border-radius: 0.125em;
}
/**
 * styling the canvas and names
 * @author Rahul Kiefer
 */
canvas {
  width: 100% !important;
  height: 100% !important;
  display: block;
}
#game {
  flex: 1 0 0;
  overflow: hidden;
}
#names {
  width: 0;
}
.name {
  position: absolute;
  display: inline-block;
  color: black;
  padding: 0.5em;
  font-size: 1.5em;
```

```
background-color: rgba(255, 255, 255, 0.5);
border-radius: 0.125em;
}



---


public/css/client.css (CSS rules for client in gameplay); author: Jonathan Lam
/**
 * Styling for the game client (driver)
 * Applies to game.html
 */

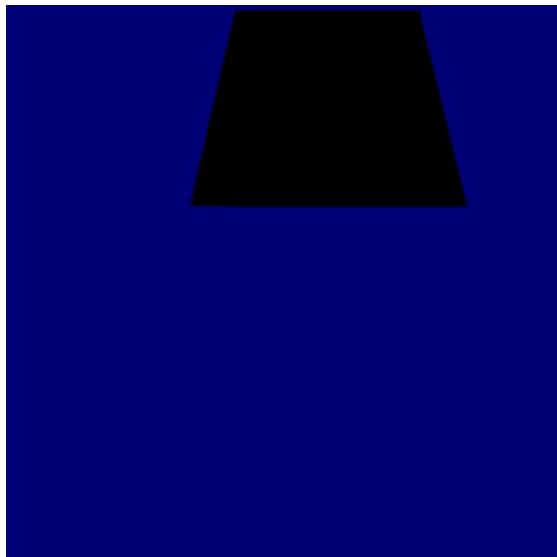
/**
 * Hide #names, #gameIdContainer (only necessary for host)
 * @author Jonathan Lam
 */
#controls.mobile > #names,
#controls.mobile > #gameIdContainer {
    display: none;
}

/**
 * Make back button smaller
 * @author Jonathan Lam
 */
#controls.mobile {
    flex: 0 0 0;
}
#controls.mobile > #homeLink {
    width: 2em;
    height: 2em;
    position: absolute;
    top: 1em;
    left: 1em;
    font-size: 3em;
    border-radius: 100%;
    background-color: rgba(0, 0, 0, 0.25);
}
#controls.mobile > #homeLink:active {
    background-color: transparent;
}
```

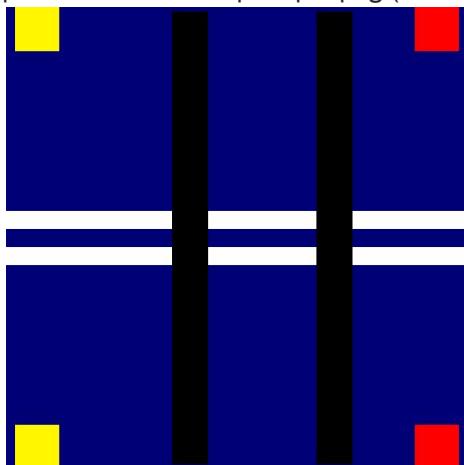
---

Assets:

public/assets/map/map1.png (UV map of car sides); author: Jonathan Lam



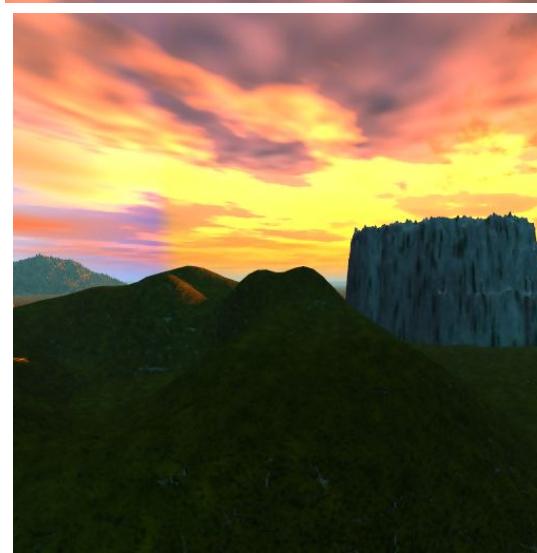
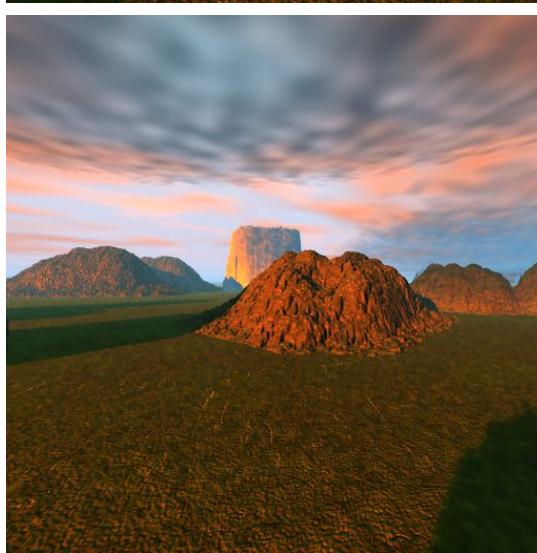
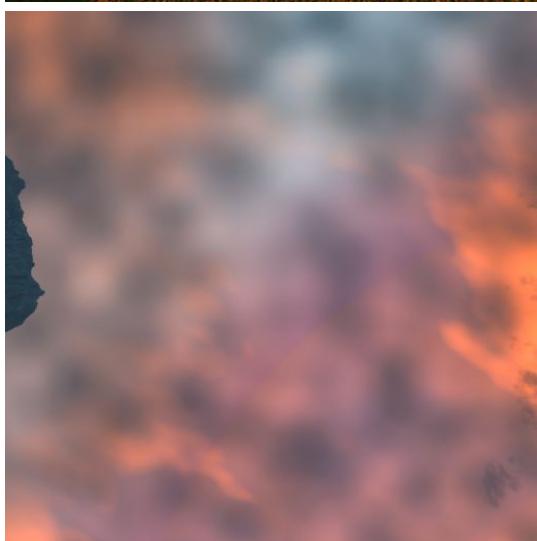
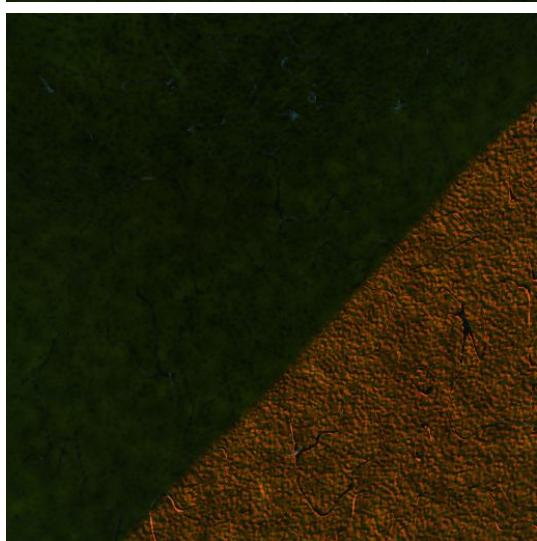
public/assets/map/map2.png (UV map of car top); author: Jonathan Lam



public/assets/blacktop\_texture.jpg; downloaded from Internet



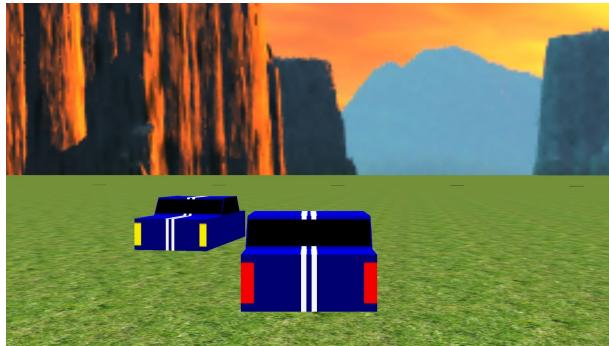
public/map/dawnmountain-\*.png (multiple files); downloaded from Internet



public/assets/grass\_texture.jpg; downloaded from Internet



public/assets/loading\_bg.jpg; author: Jonathan Lam



## Create – Applications From Ideas

### Written Response Submission Template

Please see [Assessment Overview and Performance Task Directions for Student](#) for the task directions and recommended word counts.

#### Program Purpose and Development

2a)

The program was a website designed to be a multiplayer game in which up to four people could join the same game “room,” in which the users could see each other’s cars. The programming languages involved were JavaScript, HTML, and CSS. We used Node.JS for the server-side code, using the socket.io library to establish websockets for real-time interaction with the client-side code and the express dependency for routing, as well as the Three.js library client-side library to aid with 3D rendering. The intended purpose of the program was to create a fun, multiplayer game involving physical controls (i.e., tilting a smartphone as opposed to pressing keys) that could be played with any modern smartphone. The video demonstrates the basic server functionality (creating, entering, and leaving the game room), and show example gameplay of two players using iPhone controllers and an iMac as the display computer.

2b)

The iterative process for debugging errors involved logging relevant variables, commenting code added since the latest working deployment, and paying close attention to error messages.

One problem I solved independently was that the creation of socket.io (websockets) connections would not always be created before the express (routing) connections, making necessary websocket verification during routing difficult. After identifying the problem by logging variables and realizing that the websocket was sometimes undefined, I tried putting an arbitrary 500ms delay before the verification, but the websocket connection wasn't always created in time on slow Internet connections and long delays ensued on fast connections. I improved this by repeatedly checking for the websocket connection on a 50ms interval, putting some extra strain on the server but ensuring both connections and lessening unnecessary delay.

Another hurdle I overcame independently was figuring how to UV-map the car (wrapping a 2D design over the 3D car shape), a concept I wasn't familiar with. This involved searching documentation and slightly tweaking parameters on demonstrative code to see their effect. I logged the default UV parameters and changing one UV plane at a time, refactoring the UV mapping code into a loop afterwards to remove redundancy.

2c)

One algorithm is the creation of a game room, which happens between the `#createGame` button click and the loading of the game screen on the computer, and is necessary to ensure a unique game id is created and the user is eligible to join.

Clicking the `#createGame` button (in `public/index.html`) begins the algorithm, triggering the event handler below in `public/js/index.js`.

```
/** 
 * Create a game when button is clicked
 */
var createGameButton = document.querySelector('#createGame');
createGameButton.addEventListener('click', () => {
    // redirect to page on click
    socket.emit('createNewGame', newGameId => {
        window.location.href = `${window.location.href}game/${newGameId}`;
    });
});
```

This event handler sends out the “`createNewGame`” signal to the server, which is handled by `server.js` event handler (first embedded algorithm) below:

```
// handle when a person creates a new game
socket.on('createNewGame', callback => {
    // make sure user is not already in a game
    if(socket.handshake.session.gameId !== undefined) return;
    // generate random id of five letters
    var gameIdCharacters = 'abcdefghijklmnopqrstuvwxyz';
    var gameId;
    do {
        gameId = '';
        while(gameId.length < 5) {
            gameId += gameIdCharacters.substr(Math.floor(Math.random() *
gameIdCharacters.length), 1);
        }
    } while(Object.keys(rooms).indexOf(gameId) !== -1);
    rooms[gameId] = { host: null, clients: [] };
    callback(gameId);
});
```

This event handler uses two nested loops to randomly create a unique five-character alphabetic game code randomly, which is sent back to the event handler in `public/js/index.js` using a callback function. After receiving the game code, the event handler redirects to the url “/game/(game id),” which is then handled by the routing function in `server.js` shown below (second embedded algorithm):

```
app.get('/game/:gameId', (req, res, next) => {
    // send to game file
    res.sendFile(`_${dirname}/public/game.html`);
    // get gameid parameter
    var gameId = req.params.gameId.toLowerCase();
```

```
var socket;
// sync up to socket to join room (keep refreshing until socketId is
updated)
var syncInterval = setInterval(() => req.session.reload(() => {
  if(req.session.socketId !== undefined && (socket =
io.sockets.sockets[req.session.socketId]) !== undefined) {
    clearInterval(syncInterval);
    // error 1: room does not exist
    if(Object.keys(rooms).indexOf(gameId) === -1) {
      socket.emit('err', `Game room "${gameId}" does not exist.`);
      return;
    }
    // error 2: room has more than four people in it
    if(rooms[gameId].clients.length > 3) {
      socket.emit('err', `Game room "${gameId}" is already full.`);
      return;
    }
    // error 3: user is already in the game
    if(rooms[gameId].clients.find(client => client.sessionId ===
req.session.id) !== undefined || (rooms[gameId].host &&
rooms[gameId].host.sessionId === req.session.id)) {
      socket.emit('err', 'You are already in this game on another tab.');
      return;
    }
    // add gameId to session, session id to game room
    req.session.gameId = gameId;
    // if first person, then host; if not, then client
    if(rooms[gameId].host === null) {
      rooms[gameId].host = {
        sessionId: req.session.id,
        socketId: socket.id
      };
      req.session.host = true;
    } else {
      // create default client
      rooms[gameId].clients.push({
        sessionId: req.session.id,
        socketId: socket.id,
        name: null,
        x: 0,
        y: 0,
        z: 0,
        acceleration: 0,
        speed: 0,
        heading: 0,
        turn: 0
      });
      req.session.host = false;
    }
    req.session.save();
    // join game room
    socket.join(gameId);
    socket.emit('gameId', gameId);
```

```
    io.to(gameId).emit('updateUsers', rooms[gameId].clients.map(client =>
  client.name));
  console.log(`A user with socket id ${socket.id} has joined the room
${gameId}.`);
},
}), 50);
});
```

This algorithm uses logic (if-statements) to verify that the user can join the game room and determine whether the user is a host or client, accordingly assigning the correct attributes to the server's game room variable, and finally routes the user to the `public/game.html` file.

2d)

```

socket.on('updateUsers', names => {
    /**
     * Position name on top left of correct screen
     */
    var positions;
    switch(names.length) {
        // one person joined: full screen
        case 1:
            positions = [ [ 0, 0 ] ];
            break;
        // two people in the game: side by side
        case 2:
            positions = [ [ 0, 0 ], [ width/2, 0 ] ];
            break;
        // three people in the game: top two side by side, bottom in center
        case 3:
            positions = [ [ 0, 0 ], [ width/2, 0 ], [ width/4, height/2 ] ];
            break;
        // four people in the game: top two side by side, bottom two side by side
        case 4:
            positions = [ [ 0, 0 ], [ width/2, 0 ], [ 0, height/2 ], [ width/2,
height/2 ] ];
            break;
        // nobody joined; no positions
        case 0:
        default:
            break;
    }
    var namesElement = document.querySelector('#names');
    namesElement.innerHTML = '';
    for(var i = 0; i < names.length; i++) {
        var nameDiv = document.createElement('div');
        nameDiv.classList.add('name');
        nameDiv.style.left = positions[i][0] + 40 + 'px'; // added padding 40px
        nameDiv.style.top = positions[i][1] + 40 +
document.querySelector('#controls').clientHeight + 'px'; // added padding
40px plus height of controls
        nameDiv.appendChild(document.createTextNode(names[i] || 'An unnamed
driver'));
        namesElement.appendChild(nameDiv);
    }
    // update cars and cameras
    updateCars();
    // if client
    if(isHost !== undefined && !isHost) {
        // overwrite main render function with client one
        overwriteRender(socketId);
        // add .mobile class to controls to transform it
        document.querySelector('#controls').classList.add('mobile');
    }
});

```

This abstraction I made independently is the event listener for the “`updateUsers`” event in `public/js/game.js`. This function updates the client-side users array and the display every time there is a change to the array of users on the server-side (change in number of users or user names). It manages the positions of the names on the screen, calls the `updateCars()` function (from `/public/js/hostGraphics.js`) to update the array of 3D Car objects, and modifies the render function by calling `overwriteRender()` for smartphone controllers—a total of over 180 lines of code. The “`updateUsers`” event is sent out in three different instances by `server.js` (when a user joins and sets their name, when a user leaves, and when a game is created). This manages complexity by grouping together many lines of code which only operate in tandem into a single instruction invoked with the “`updateUsers`” from the server. This abstraction reduces code redundancy, makes any future need to update the client-side users array(e.g., if the color of a user’s car could be changed) very simple, and makes debugging the transfer of user data easy because the code is all in one place.

## AP CSP Processing Final Project Report

1. The program I created was a game. You're Joe the ninja, and you're hungry! Steal all the food as quickly as possible from the table before being caught. You get caught once the light turns on. There will only be a 0.33 second "warning" before the light turns on, so you have to hide real quickly!

You can move left/right with the left/right arrows. You can steal food by pressing the up arrow. And you can hide using the down arrow.

Some of the features of this program include the random creation of food, the movement of the food corresponding to the ninja's movement, movement of the ninja with the down key, animation of the fruit as they are eaten, and various aspects of a game (keeping score, time, lives).

2. An example of each of the following elements:
  - Use of basic primitive shapes: Ellipses are used for the foods and ninja's head; lines are used for the ninja's body; a rectangle is used for the table; and triangles are used in the apples.
  - Diverse and intentional use of color: The default stroke is all black, but the ninja's stroke is made partially transparent when hiding; the oranges are orange; the apples are red with a green leaf; the table is brown; the background is dark when the ninja is free to move, and light when he is caught (and in the middle as a warning)
  - Some element of randomization: the fruits are randomly placed along the table; the intervals of time before the light turns on again are randomized
  - Looping structure: looping over the foods to draw them all
  - Selection (if) statement: only printing a food if it hasn't been eaten
  - Animation!: The table and foods are animated when the person moves; the foods are animated when eaten
  - Any element of user interaction: the four arrow keys are used to play the game
  - Use at least one variable: example variables include personXPos, numLives
3. I learned a lot of the convenience/shorthand functions and constants provided by Processing, such as PI, cos(), sin(), millis(), etc. I used a lot of help from the Processing documentation.
4. I would add more interesting foods, as well as different point values for the different foods and different difficulties for picking them up. If I had more time past that, I would create multiple levels with harder difficulties (shorter warning times).
5. I'd give myself a 5. I didn't copy any code, and I spent all of the class time given for this project working on the project. I also spent a lot of time writing multiple drafts of the project before I settled on a final version: my first idea was to create a beach scene using mathematics (e.g., the fibonacci sequence for shells) to create cool graphics, but it didn't look as good as I wanted to, and I ended up writing two drafts for this game because the first one was messy and I wanted to reorganize my code using OOP.

## Moment of Inertia Lab

---

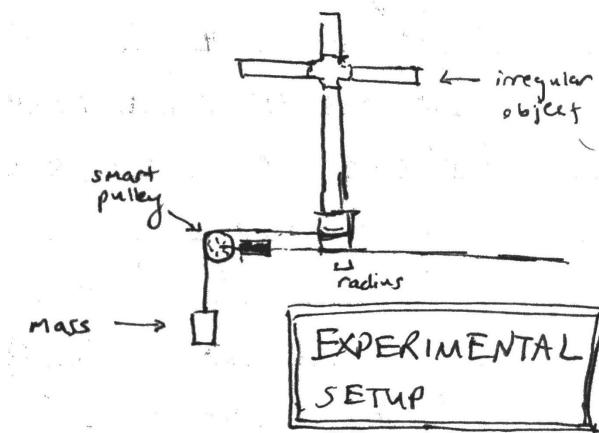
### Introduction

Lab Partners: Madeline Massey, Emily Shaw, David Landry

Purpose: The purpose of this lab is to experimentally determine the moment of inertia ( $I$ ) of an irregular object.

Procedure: We chose to determine the moment of inertia of a PVC pipe construction (an irregular shape) by using the calculating torque by finding the tension force caused by the measured downwards acceleration. To do this, we first determined the radius of the object by measuring the circumference of the base of the irregular object, which the rope was tautly wrapped around, and then dividing by  $2\pi$ . Then we measured the downwards acceleration of a known mass, (which is equal to the tangential acceleration of the PVC construction). We measured the tangential acceleration using a LabQuest smart pulley by finding the slope of the regression of the velocity. Using just these measurements, we were able to determine the moment of inertia using the formulas (listed below) for net force of the falling object, angular acceleration of the object, and the torque equations.

### Experimental Setup:




---

### Data and Observations

#### Radius

Variables:  $C$  = circumference (m),  $r$  = radius (m)

$$C = 0.129m \Rightarrow r = \frac{C}{2\pi} = 0.02053m$$

#### Acceleration of Different Masses

Mass (kg)	Acceleration ( $\frac{m}{s^2}$ )				
	Trial 1	Trial 2	Trial 3	Trial 4	Average

0.050	0.01504	0.01491	0.01358	0.01202	0.01291	0.01369
0.100*	0.02679	0.02797	0.02663	0.02730	0.02809	0.02734
0.150	0.04286	0.04037	0.04411	0.04122	0.04379	0.04247

\* an acceleration of 0.16302 was recorded for the 100g mass but discarded as an outlier

## Calculations / Graphs

### Calculation of the Moment of Inertia (I)

Variables:  $\alpha$  = angular acceleration ( $\frac{\text{rad}}{\text{s}^2}$ ),  $F_T$  = tension force (N),  $\tau$  = torque ( $\text{m} \cdot \text{N}$ ),  $a$  = tangential acceleration (acceleration of falling mass) ( $\frac{\text{m}}{\text{s}^2}$ ),  $I$  = moment of inertia ( $\text{kg} \cdot \text{m}^2$ ),  $g$  = gravitational acceleration ( $\frac{\text{m}}{\text{s}^2}$ ),  $r$  = radius (m)

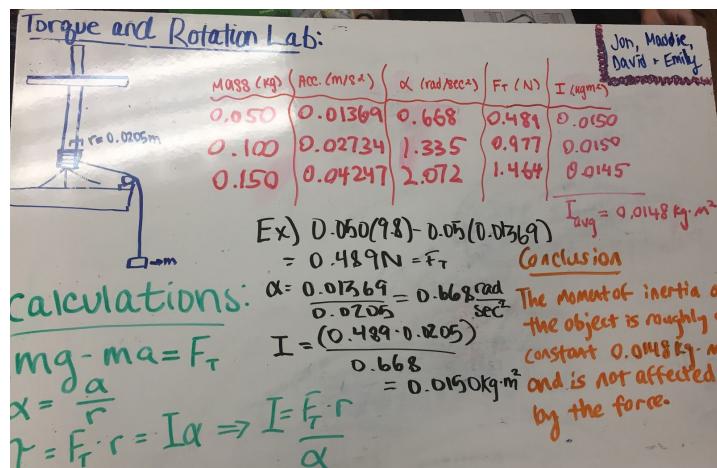
$$\alpha = \frac{a}{r}, F_T = mg - ma, \tau = I\alpha = F_T \cdot r \Rightarrow I = \frac{F_T \cdot r}{\alpha} = \frac{(mg - ma)r}{\frac{a}{r}} = \frac{(g - a)mr^2}{a} = (\frac{g}{a} - 1)mr^2$$

$$\text{Example calculation (for 50g): } I = \left(\frac{9.8 \text{ m/s}^2}{0.01369 \text{ m/s}^2} - 1\right) \cdot 0.050 \text{ kg} \cdot (0.0253 \text{ m})^2 = 0.0150 \text{ kg} \cdot \text{m}^2$$

### Moments of Inertia for Different Masses

Mass ( $m$ , in kg)	Average Tangential Velocity ( $a$ , in $\frac{\text{m}}{\text{s}}$ )	Radius ( $r$ , in m)	Moment of Inertia ( $I$ , in $\text{kg} \cdot \text{m}^2$ )
0.050	0.01369	0.02053	0.0150
0.100	0.02734	0.02053	0.0150
0.150	0.04247	0.02053	0.0145
<b>Mean I:</b> 0.0148			

### Whiteboard



---

## Results and Conclusion

### Potential Errors

At first, we had our LabQuest in the wrong setting for the velocity measurements. We had it set to the default setting (picket fence), instead of the ten-spoke wheel. We only noticed this after collecting all of our data. To avoid re-collecting all of the data, we conjectured that there would be a proportional relationship between our measured velocities and the true velocity, in which the proportionality constant is the ratio of the distance between the fence posts and the distance between the wheel spokes. We tested this by doing one trial on each mass and found that there was indeed a proportional relationship of about  $0.22 (\pm 0.01)$ . All of our data was multiplied by this constant to get our final values, which are displayed in the above tables. Because this seems to make sense (there should be a proportional relationship between the speeds), our data were very precise, and our calculated moment of inertia is in the same range as the other groups', we are pretty confident that it should still work.

Another potential error is that we ignored one measured acceleration value from the 100g mass ( $0.16302 \frac{m}{s^2}$ ) because it seemed to be a far outlier that was likely caused by human error caused by accidentally pulling down the string and increasing the acceleration.

Because our values were so close to one another (our three calculated moments of inertia ranged by only  $0.0005 kg \cdot m^2$ ) and fell within the class range of  $0.01 kg \cdot m^2$  to  $0.02 kg \cdot m^2$ , we are fairly confident with our results. A possible factor that may have affected our results is inertia, which may have caused a lower acceleration and slightly lower moment of inertia in our 150g mass trial, but it was most likely insignificant because our calculated values were so consistent between the different masses and accelerations.

### Conclusion

We conclude that the moment of inertia of this irregular object (the PVC pipe construction) is roughly  $0.0148 kg \cdot m^2$ , and that this value is not affected by the amount of torque applied to it (in our case, it was not affected by the amount of falling mass pulling on it).

## Pendulum Lab Report

---

### Introduction

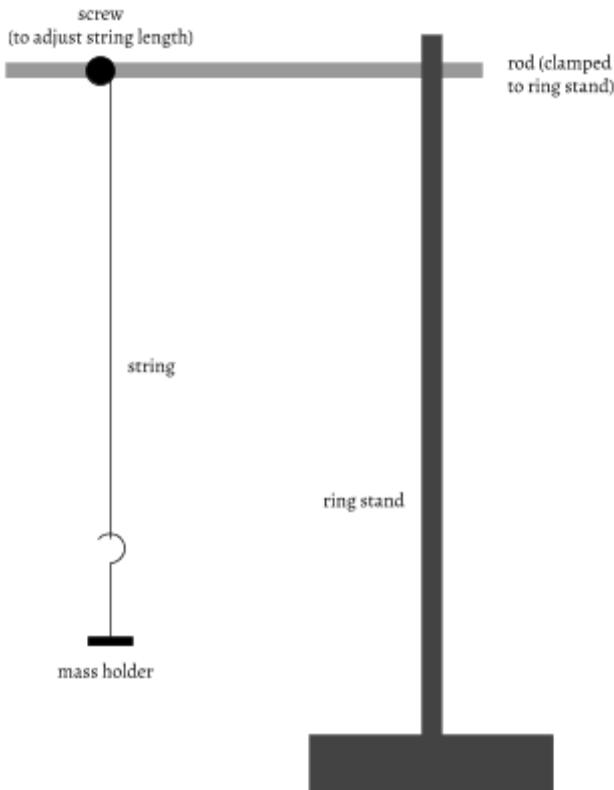
Lab Partners: Foster Rowberry, Nikitha Edupuganti

Purpose: The purpose of this lab is to determine the effect of the radius (distance from mass to axis), mass, and amplitude (initial angle) have on the period of a pendulum.

Procedure: We had a rod that was clamped perpendicular to a ring stand. The rod was clamped to the top of the ring stand to give maximum clearance for the pendulum. We attached the string by putting it under a screw, so that it was an adjustable length, and we attached a 50.g mass holder to the bottom of the string. The pendulum swung parallel to the ring to avoid collisions. (See illustration below).

We tested each variable by keeping the other two constant, and then running three trials at each specific variable level. The mass only considered the mass of the mass hanger and weights, not the string. The radius (distance from the axis to the mass) was measured from the screw to the approximate center of mass of the masses. The amplitude was measured using a protractor at the top of the string. We measured the time of ten periods using an iPhone timer, and then divided by ten to get an approximate period length.

### Experimental Setup



---

## Data and Observations

### Notes on Data:

- Pendulum radius measured from estimated center of mass to the rotation axis.
- The mass of the string is negligible and not considered in mass measurements.
- Amplitude is measured in degrees from the vertical.
- The data rows labelled with an asterisk (\*) are the same trial with the initial conditions for all three variables (mass = 0.050kg, amplitude = 10° and radius = 0.0620m).

Data for Changing Mass vs. Pendulum Period (radius = 0.6200m, amplitude = 10°)

Mass (kg)	Ten Period Time (s)			Average Ten Period Time (s)	Average Period (s)
	Trial 1	Trial 2	Trial 3		
0.050*	16.16	14.71	15.05	15.31	1.531
0.100	15.98	16.08	15.95	16.00	1.600
0.150	16.18	16.41	16.20	16.26	1.626
0.200	16.18	16.31	16.28	16.26	1.626

Data for Changing Amplitude vs. Pendulum Period (radius = 0.6200m, mass = 0.050kg)

Amplitude (°)	Ten Period Time (s)			Average Ten Period Time (s)	Average Period (s)
	Trial 1	Trial 2	Trial 3		
5	16.08	15.74	16.17	16.00	1.600
10*	16.16	14.71	15.05	15.31	1.531
20	16.08	16.35	16.01	16.15	1.615
30	16.57	16.31	16.61	16.50	1.650
40	16.33	16.47	16.27	16.36	1.636

Data for Changing Radius vs. Pendulum Period (mass = 0.050kg, amplitude = 10°)

Radius (m)	Ten Period Time (s)			Average Ten Period Time (s)	Average Period (s)
	Trial 1	Trial 2	Trial 3		
0.0620	16.16	14.71	15.05	15.31	1.531

0.2250	9.60	9.68	9.15	9.48	0.948
0.3800	12.08	12.24	12.44	12.25	1.225
0.6200*	16.16	14.71	15.05	15.31	1.531
0.8900	17.97	17.23	17.57	17.59	1.759
0.9100	18.65	19.11	19.28	19.01	1.901

---

## Calculations / Graphs

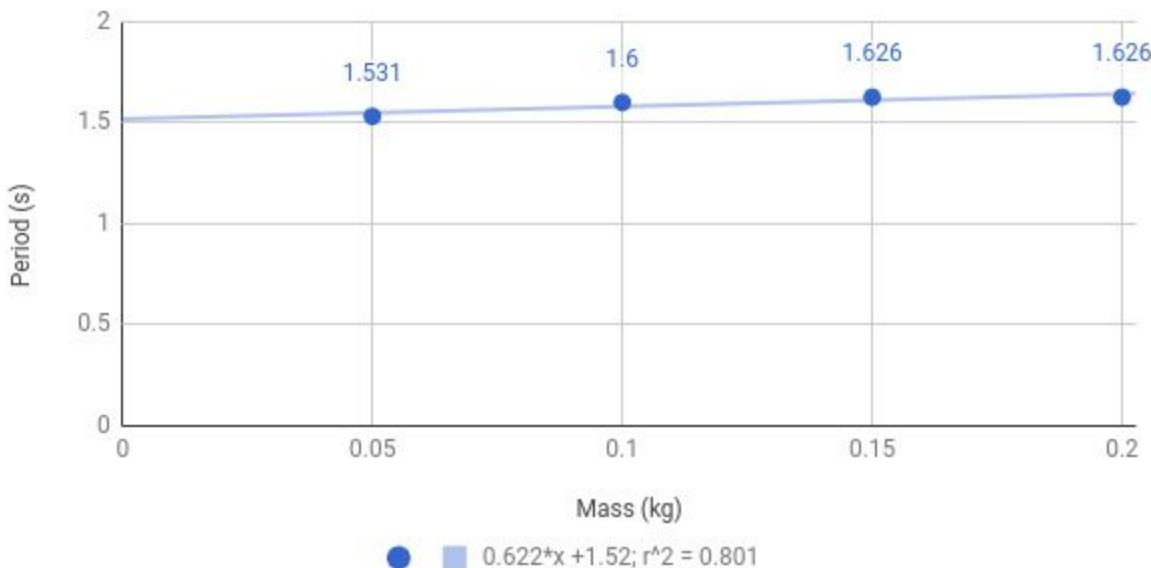
### Calculations

Average period = Average ten period time / 10

### Graphs

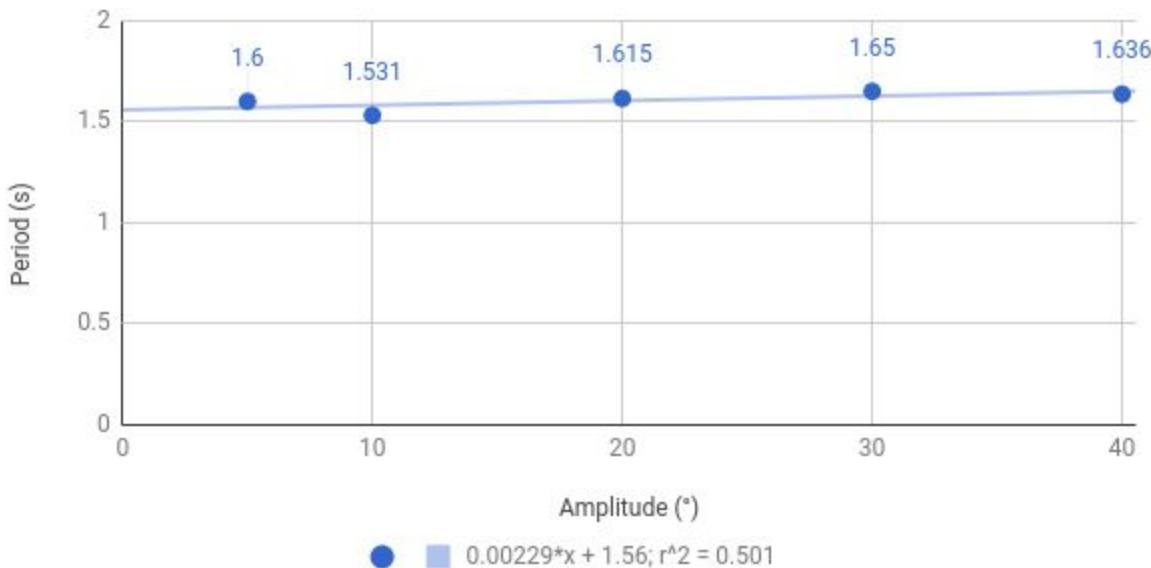
#### Average Period vs. Mass

Amplitude = 10°, Radius = 0.6200m



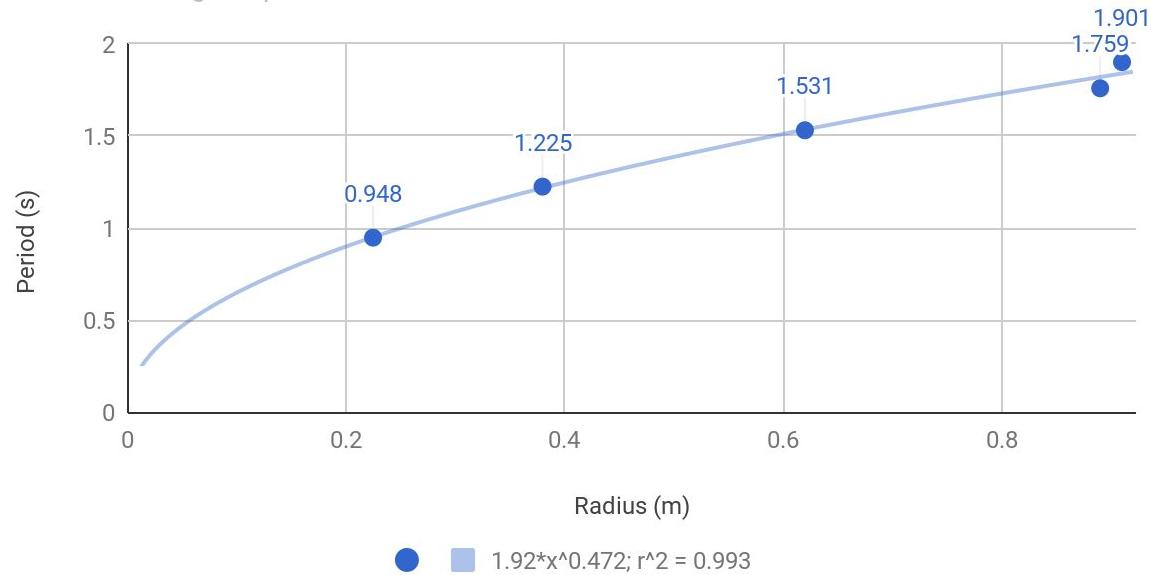
## Average Period vs. Amplitude

Mass = 0.050kg, Radius = 0.6200m



## Average Period vs. Radius

Mass = 0.050kg, Amplitude =  $10^{\circ}$



---

Results and Conclusion

Data Analysis

We observed a very slight positive linear correlation (almost constant linear graphs) in the period-mass and period-amplitude graphs. Their respective slopes are  $0.622\text{s/kg}$  and  $0.00229\text{s/degree}$ , respectively, meaning that there is almost no change in period if the mass (kg) or amplitude (degrees) change. This makes sense, because increasing either the mass or amplitude (which increases the height) increases the gravitational potential energy of the mass (as gravitational potential energy =  $mgh$ ). If we set  $h=0$  at the equilibrium point, this means that all of the gravitational potential energy is converted to the kinetic energy by the bottom of the swing, meaning that:  $mgh = \frac{1}{2}mv^2 \Rightarrow gh = \frac{1}{2}mv^2 \Rightarrow v^2 = \frac{2g}{m}h \Rightarrow v^2 \propto h$ . This means that changing the mass of a pendulum will not affect its velocity and period, and increasing or decreasing its height will also increase or decrease its velocity so that the period is the same. Thus, this data and this calculation show that there is no effect of the amplitude or mass of the pendulum on its period. (The slight positive slopes of these two graphs can be accounted for under the “potential errors” section below.) At a radius of  $0.6200\text{m}$ , the period is roughly  $1.54\text{s}$ , independent of amplitude or mass.

When radius is changed, there is a clearer positive correlation. I ran a linear, polynomial, exponential, and power regression on the data, and it seems that a power regression with an equation of  $\text{period} = 1.92 \times \text{radius}^{0.472}$  fit best, with a correlation coefficient  $r^2 = 0.993$ . (Because the power is very close to  $0.5$ , we can approximate it as a square-root correlation.) This makes sense, because as the radius gets closer to zero, the period should also approach zero. A linear or exponential correlation would not make sense because they would give a positive period for a zero-radius pendulum, and a logarithmic correlation would not make sense because it would give a negative period for a positive radius close to zero.

By these reasonings, the period of this pendulum can be roughly modelled by the equation  $\text{period} = 2sm^{-0.5} \times \sqrt{\text{radius}}$ , where period is measured in seconds and radius is measured in meters.

### Potential Errors

We had one potential outlier in our data: the first trial that we conducted. This was the asterisk-marked trial, and its values seem low and cause both the period-mass and period-amplitude graphs to have a little slant, when it makes sense that they should not (see above in data analysis). This single trial included the only two time measurements that were below  $15.7\text{s}$ , in both of these tables, when all of the other values were in the low- to mid- $16\text{s}$  region. Unfortunately, because this trial included all of the “initial conditions” of the variables we were conducting, it appears in all three data tables. This is probably because we were not used to measuring the period yet and stopped the time before the pendulum reached the top again. Re-measuring this one trial would probably correct the slightly-positive slopes in both of the first two graphs.

Another possible source of error is with the unaccounted friction and mass of the string. We assumed that the pendulum is roughly frictionless, but as the amplitude (and thus the speed) of the pendulum mass increases, or as we add masses and increase the surface area of the object, there is a slight increase in air resistance. This may cause slightly longer period times for the trials with higher amplitudes or masses (which may be the source of the slight positive slopes in either of these graphs). Similarly, we assumed the string was massless, but its mass may slightly increase the overall mass of the pendulum and change the center of mass of the pendulum, especially if the added masses are small,

causing unexpected results. We can avoid this by using larger masses, so that the mass of the string is more negligible.

### Conclusion

We learned that changing the amplitude and mass of a (frictionless) pendulum will have no effect on its period, but that changing the radius has a square-root correlation with the period length.

## **Series and Parallel Lab Report**

Lab Partners: Jack E., Kai K.

Purpose: To discover how to set up light bulbs and resistors in series and parallel and investigate current and resistance in the current.

Procedure:

Using a voltage source and multiple resistors, we set up circuits in parallel and in series, with two or three resistors. First, the voltage source was set to 10V, and its actual voltage was measured and recorded. Then, two resistors were set up in parallel with the power source, and their stated resistances from the color bands and the circuit's current was measured. This was repeated for a circuit with two resistors in parallel, three resistors in series, and three resistors in parallel.

### Data

#### Two Resistors in Series

Measured Voltage (V)	Resistor 1 Stated Resistance ( $\Omega$ )	Resistor 2 Stated Resistance ( $\Omega$ )	Measured Current (mA)	V/I Equivalent Resistance ( $\Omega$ )	Calculated Equivalent Resistance ( $\Omega$ )	Equivalent Resistance Percent Error (%)
10.05	10000	2200	0.829	12123	12200	-0.63
10.05	10000	330000	0.030	335000	340000	1.47
10.05	1000000	330000	0.008	1256250	1330000	5.55

\* resistor colors: 10k $\Omega$ : brown black orange gold; 330k $\Omega$ : orange orange yellow gold; 1M $\Omega$ : brown black green gold

#### Two Resistors in Parallel

Measured Voltage (V)	Resistor 1 Stated Resistance ( $\Omega$ )	Resistor 2 Stated Resistance ( $\Omega$ )	Measured Current (mA)	V/I Equivalent Resistance ( $\Omega$ )	Calculated Equivalent Resistance ( $\Omega$ )	Equivalent Resistance Percent Error (%)
10.05	10000	2200	5.64	1782	1803	-1.16
10.05	10000	330000	1.038	9682	9706	-0.25
10.05	1000000	330000	0.041	245122	248120	-1.21

#### Three Resistors in Series

Measured Voltage (V)	Resistor 1 Stated Resistance	Resistor 2 Stated Resistance	Resistor 3 Stated Resistance	Measured Current (mA)	V/I Equivalent Resistance	Calculated Equivalent Resistance	Equivalent Resistance Percent

	(Ω)	(Ω)	(Ω)		(Ω)	(Ω)	Error (%)
10.05	15000	2200	10000	0.375	26800	27200	-1.47

\* resistor colors: 15kΩ: brown green orange gold; 2200Ω: red red red gold; 10kΩ: brown black orange gold

### Three Resistors in Parallel

Measured Voltage (V)	Resistor 1 Stated Resistance (Ω)	Resistor 2 Stated Resistance (Ω)	Resistor 3 Stated Resistance (Ω)	Measured Current (mA)	V/I Equivalent Resistance (Ω)	Calculated Equivalent Resistance (Ω)	Equivalent Resistance Percent Error (%)
10.05	15000	2200	10000	6.31	1593	1610	-1.06

### Calculations

Observed equivalent resistance (by Ohm's Law) =  $\frac{Voltage}{Current}$

Calculated equivalent resistance for series circuits:  $R_{eq} = R_1 + R_2 (+ R_3)$

Calculated equivalent resistance for parallel circuits:  $R_{eq} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} (+ \frac{1}{R_3})}$

(where  $R_{eq}$  is the circuit's equivalent resistance,  $R_1$  is the resistance of the resistor 1,  $R_2$  is the resistance of resistor 2, and  $R_3$  is the resistance of resistor 3 (for the three-resistor circuits))

Percent error =  $\frac{\text{measured equivalent resistance} - \text{calculated equivalent resistance}}{\text{calculated equivalent resistance}} \times 100\%$

### Example Calculations

Observed equivalent resistance (two resistors in parallel trial 1):  $R = \frac{10.05V}{0.000829A} = 12123\Omega$

Calculated equivalent resistance for series (three resistors):  $R_{eq} = 15000\Omega + 2200\Omega + 10000\Omega = 27200\Omega$

Calculated equivalent resistance for parallel (three resistors):  $R_{eq} = \frac{1}{\frac{1}{15000\Omega} + \frac{1}{2200\Omega} + \frac{1}{10000\Omega}} = 1610\Omega$

Percent error (three resistors in parallel):  $\frac{1593\Omega - 1610\Omega}{1610\Omega} \times 100\% = -1.06\%$

### Analysis

#### Data and Error Analysis

The calculated equivalent resistance values were fairly close to the observed values. Even with very large resistances, we had one trial that had a 5.55% percent error, while the rest had a percent error of less than 1.5% (in magnitude).

One potential source of error is that proper significant figures were not used in the calculations, mostly because some of the values only had one significant figure (large stated resistances and small measured

currents). But this would not have changed the fact that the measured data were so close to the theoretical resistances, and using proper sigfigs would probably decrease the percent errors due to rounding.

Another possible source of error is that we did not measure the resistors using the multimeter during each trial, instead using their stated resistances to calculate the theoretical equivalent resistances. However, because all of the resistors used had a gold tolerance ( $\pm 5\%$  resistance), we don't expect the measured resistances of the resistors to be far off from what the stated values.

### Conclusion

The equivalent resistances of circuits set up with multiple resistors set in series or in parallel can be accurately calculated either with:

- Ohm's law, if the current and voltage drop over the resistor are known; or
- the equations for the equivalent resistances of series and parallel circuits.

## Simple Harmonic Motion Lab

Lab Members: Jacob Lenes, Michael Klein-Wassink, Chris Gomolak

### Objectives

- To measure the position and velocity as a function of time for an oscillating mass and spring
- To compare the observed motion to the mathematical model of simple harmonic motion
- To determine the effects of changing mass and amplitude on period and maximum velocity

### Procedure

The experimental setup consists of a rod clamped perpendicular to the top of a ring stand and clamped to a spring, which hangs down from the rod. A mass hanger is attached (and taped) to the rod, and a paper plate is taped to the bottom of the mass hanger for better visibility for the LabQuest distance sensor. The LabQuest distance sensor is pointer straight up at the paper plate from the tabletop.

In part one, we determined the spring constant by measuring the mass of the mass hanger, finding the change in length of the spring with and without the mass hanger on it, and then using Hooke's Law.

In parts two through four, we used the known mass, amplitude, and spring constant to calculate the expected parameters for the sinusoidal equation that would model the SHM. Then, using a LabQuest distance sensor, we measured the vertical position of the graph as a function of time for ten seconds, used a sinusoidal curve fit, and compared the observed values to the expected (calculated) values.

Between the different trials, we tested two different amplitudes (0.050m and 0.100m) and two different masses (0.1539kg and 0.2539kg) to test the effect of changing the mass and amplitude on the period and velocity of the SHM.

### Data and Reflections

#### Part 1: Determining the Spring Constant

Distance the spring stretched:	0.0640 m
Mass of mass hanger:	0.050 kg
Spring constant (k):	7.66 $\frac{N}{m}$

#### Part 2: Control Trial

##### *Predictions*

Total mass:	0.1539 kg
Amplitude:	0.050 m
Calculated maximum velocity:	0.3526 $\frac{m}{s}$
Expected value for B:	7.053
Calculated expected period:	0.8908 s
Calculated expected frequency:	1.123 Hz

##### *LoggerPro Data*

Period (indicated by graph): 1.00 s

Sinusoidal wave parameters (from graph):

A (amplitude): 0.0455

B: 6.28

D: 0.432

LoggerPro x-t curve fit equation:  $x=0.0378 \sin(6.372t+3.7226)+0.43191$

LoggerPro v-t curve fit equation:  $v=0.2253 \sin(6.349t+5.334)+0.001703$

### Reflections

The predictions for A, B, period, and D were very close to the values given by the LoggerPro graph and equation. We observed that the velocity was zero when the displacement was at an extreme (maximum or minimum value), and that the velocity was at an extreme when the displacement was zero. The velocity vs. time also fits a sine curve (the equation is shown above). The B-value of the velocity-time curve is very similar to the B-value of the position-time curve, indicating that the periods of both functions are equal. However, our predicted maximum velocity of 0.3526m/s was much higher than the observed 0.2260m/s from the v-t curve fit equation, and this is probably due to a high air resistance (see Error Analysis section).

## Part 3: Trial with Increased Amplitude

### Predictions

Total mass: 0.1539 kg

Amplitude: 0.100 m

Calculated maximum velocity:  $0.7053 \frac{m}{s}$

Expected value for B: 7.053

Calculated expected period: 0.8908 s

Calculated expected frequency: 1.123 Hz

### LoggerPro Data

Period (indicated by graph): 0.95 s

Sinusoidal wave parameters (from graph):

A (amplitude): 0.0895

B: 6.61

D: 0.432

LoggerPro x-t curve fit equation:  $x=0.07696(6.3185t+3.702)+0.4314$

LoggerPro v-t curve fit equation:  $v=0.4539 \sin(6.2861t+5.3741)+0.00632$

### Reflections

Again, our predictions for the A, B, D, and period were very close to the observed values. The velocity-time graph again fit a sine-curve (the equation is shown above). Changing the amplitude did not affect the period (a change of 0.05s after the change in amplitude, likely due to human error), but it did affect the maximum velocity. The maximum velocity of the doubled amplitude was roughly double that of the first trial (0.4539m/s as opposed to 0.2253m/s for the first trial).

#### Part 4: Trial with Increased Mass

##### *Predictions*

Total mass:	0.2539 kg
Amplitude:	0.050 m
Calculated maximum velocity:	0.2746 $\frac{m}{s}$
Expected value for B:	5.49
Calculated expected period:	1.144 s
Calculated expected frequency:	0.8739 Hz

##### *LoggerPro Data*

Period (indicated by graph):	1.25 s
Sinusoidal wave parameters (from graph):	
A (amplitude):	0.0445
B:	5.027
D:	0.285
LoggerPro x-t curve fit equation:	$x = 0.0427(5.0305t + 3.888) + 0.2791$
LoggerPro v-t curve fit equation:	$v = 0.2029 \sin(5.006t + 5.543) + 0.003299$

##### *Reflections*

Again, our predictions for the A, B, D, and period were very close to the observed values. The velocity-time graph again fit a sine-curve (the equation is shown above). Changing the mass affected the period and the maximum velocity. The observed period for the 0.2539g mass was 1.25s and the observed maximum velocity was 0.2031m/s, compared to the 1.00s period and 0.2270m/s observed maximum velocity for the 0.1539g mass.

#### Calculations

##### *Variables*

A = amplitude, k = spring constant, m = mass of mass hanger and added masses

##### *Hooke's Law*

$$\text{Spring constant: } k = \frac{F}{x}$$

##### *SHM Equations*

Value for B:	$B = \omega = \sqrt{\frac{k}{m}} = \frac{2\pi}{T}$
Maximum velocity:	$v_{max} = AB$
Period:	$T = \frac{2\pi}{B}$
Frequency:	$f = \frac{1}{T}$

### *Example Calculations from Parts 1 and 2*

$$k = \frac{0.050 \text{ kg} \times 9.8 \text{ ms}^{-2}}{0.0640 \text{ m}} = 7.66 \frac{\text{N}}{\text{m}}$$

$$B = \sqrt{\frac{7.66 \text{ Nm}^{-1}}{0.1539 \text{ kg}}} = 7.053 \text{ s}^{-1}$$

$$v_{\max} = 0.050 \text{ m} \times 7.053 \text{ s}^{-1} = 0.3526 \frac{\text{m}}{\text{s}}$$

$$T = \frac{2\pi}{7.053 \text{ s}^{-1}} = 0.8908 \text{ s}$$

$$f = \frac{1}{0.8908 \text{ s}} = 1.123 \text{ Hz}$$

### Error Analysis

While most of our expected (calculated) values for A, B, and period were very close to the observed values from the LoggerPro curve fit, our expected values for the maximum velocity were all much higher than the observed values. This is probably due to a high air resistance from the paper plate that caused the motion to significantly slow down, when ideally there would be no friction and no slowing down. This corresponded with a graph whose amplitude visually quickly decreased. If we were to repeat this lab without the paper plate, but still managed to get an accurate distance reading from the LabQuest distance sensor, then we would probably get a maximum velocity that is much closer to the expected value.

### Summary

We learned how to measure the position and velocity of an object in SHM using the LabQuest, and how to use the SHM equations to calculate expected values for the period, B, and maximum velocity with a known amplitude and mass. We learned how changing the amplitude and mass of the object in SHM affects its period and maximum velocity. The amplitude has no effect on period, but has a proportional relationship with maximum velocity. The mass has an direct correlation with the period (larger mass means a longer period), and an inverse relationship with maximum velocity (larger mass means a lower maximum velocity).

### Conclusion

The amplitude of an object oscillating in SHM is proportional to its maximum velocity and has no effect on its period, while the mass affects both the period (directly correlating) and the maximum velocity (inversely correlating).

NAME: \_\_\_\_\_

**Statistical Mechanics**  
 presentation and vocabulary sheet by Jonathan Lam

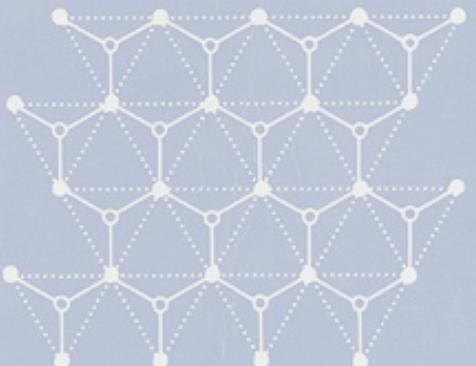
Term / Person	Definition / Significance
statistical mechanics	the quantitative study of systems with many variables or particles via statistical methods, especially when many degrees of freedom are present; often applied to thermodynamics
degree of freedom / dimension	a variable in a system, such as three-dimensional position or number of particles
thermodynamics	the study of mechanical energy, especially heat
stochastic	describing something with inherently random nature, for which statistics is a good tool to analyze it
statistical ensemble	the probability distribution of all possible states of a system; statistical mechanics chooses the most probable state
statistical equilibrium	when a statistical ensemble contains all past and future phases of the system
microcanonical (NVE) ensemble	a classification of statistical ensemble with a fixed number of particles and amount of energy
canonical (NVT) ensemble	a classification of statistical ensemble with a fixed number of particles but variable amount of energy
grand canonical ( $\mu$ VT) ensemble	a classification of statistical ensemble with a variable number of particles and amount of energy
Daniel Bernoulli	pioneer of the Kinetic Theory of Gases, the first model that predicted large numbers of particles moving in stochastic motion
Rudolf Clausius	known for work with thermodynamics, derived equation for mean free path of a particle; first basic probabilistic equation
James Maxwell	improved Clausius's equation for MFP; wrote the first statistical distribution, the Maxwell-Boltzmann distribution for velocity of particles, and the root mean square velocity
Ludwig Boltzmann	worked closely with Maxwell, generalizing his equations to non-equilibrium systems; famous H-theorem for the Second Law of Thermodynamics
Josiah Gibbs	introduced the statistical ensemble and generalized Boltzmann's work to all mechanical systems (not just thermodynamics)

Ever wondered what percentage of oxygen molecules travel over 341m/s (land speed record)?

Ever wondered what percentage of  
oxygen molecules travel over 341m/s  
(land speed record)?

(probably not)

EXACTLY  
SOLVED MODELS  
IN STATISTICAL  
MECHANICS



R. J. BAXTER

M. SCOTT SHELL

Thermodynamics

and

Statistical  
Mechanics

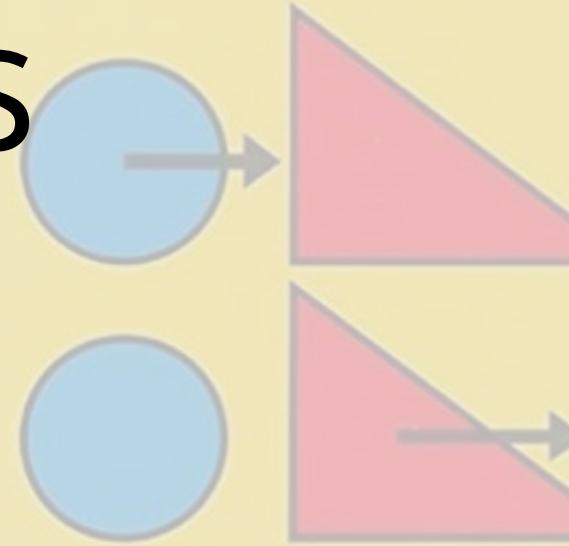
An integrated approach

# STATISTICAL MECHANICS

has the answer!

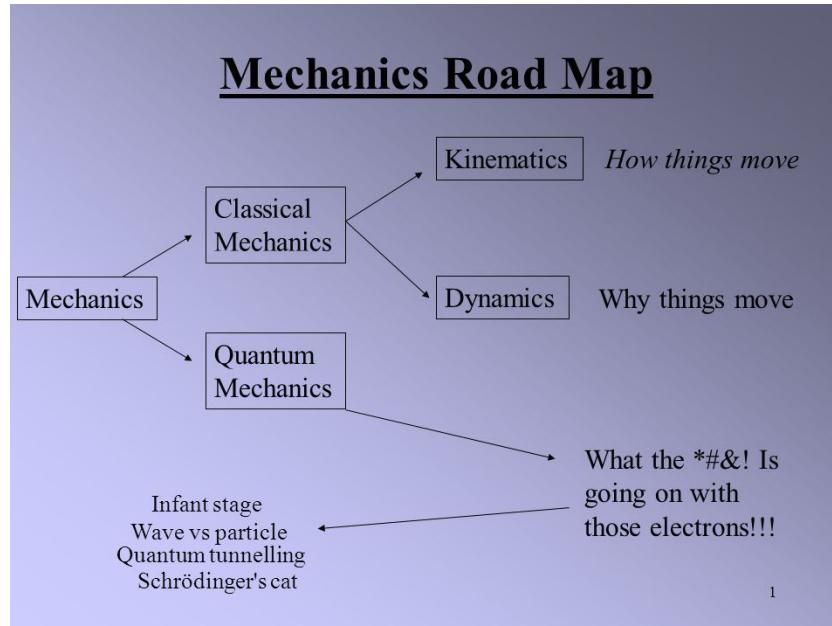
The Principles  
STATISTICAL  
MECHANICS

Richard C. Tolman



# (CLASSICAL) MECHANICS

Mechanics is “a branch of physical science that deals with **energy and forces** and their effect on bodies” (Merriam Webster)



# (CLASSICAL) MECHANICS

Mechanics is “a branch of physical science that deals with energy and forces and their effect on bodies” (Merriam Webster)

Much of our class focused on mechanics, but on a macroscopic scale

# (CLASSICAL) MECHANICS

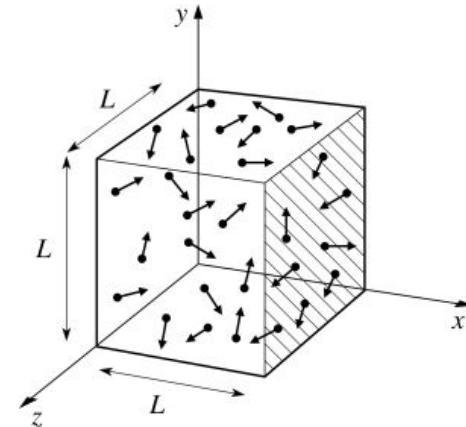
Mechanics is “a branch of physical science that deals with energy and forces and their effect on bodies” (Merriam Webster)

Much of our class focused on mechanics, but on a macroscopic scale

We dealt with experimentally-based models that used rely on the predictable nature of objects

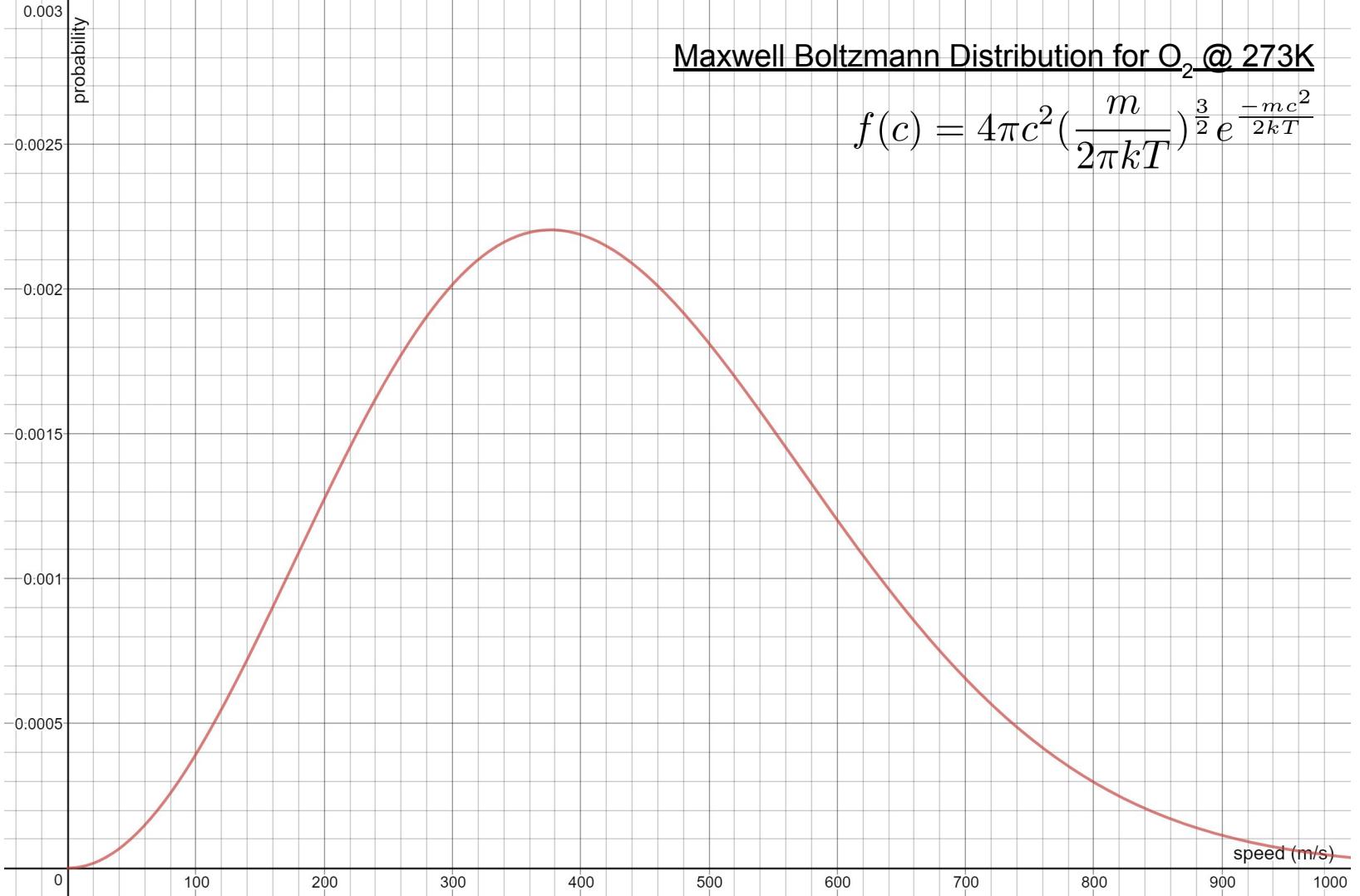
# PROBLEMS WITH THIS KIND OF MECHANICS

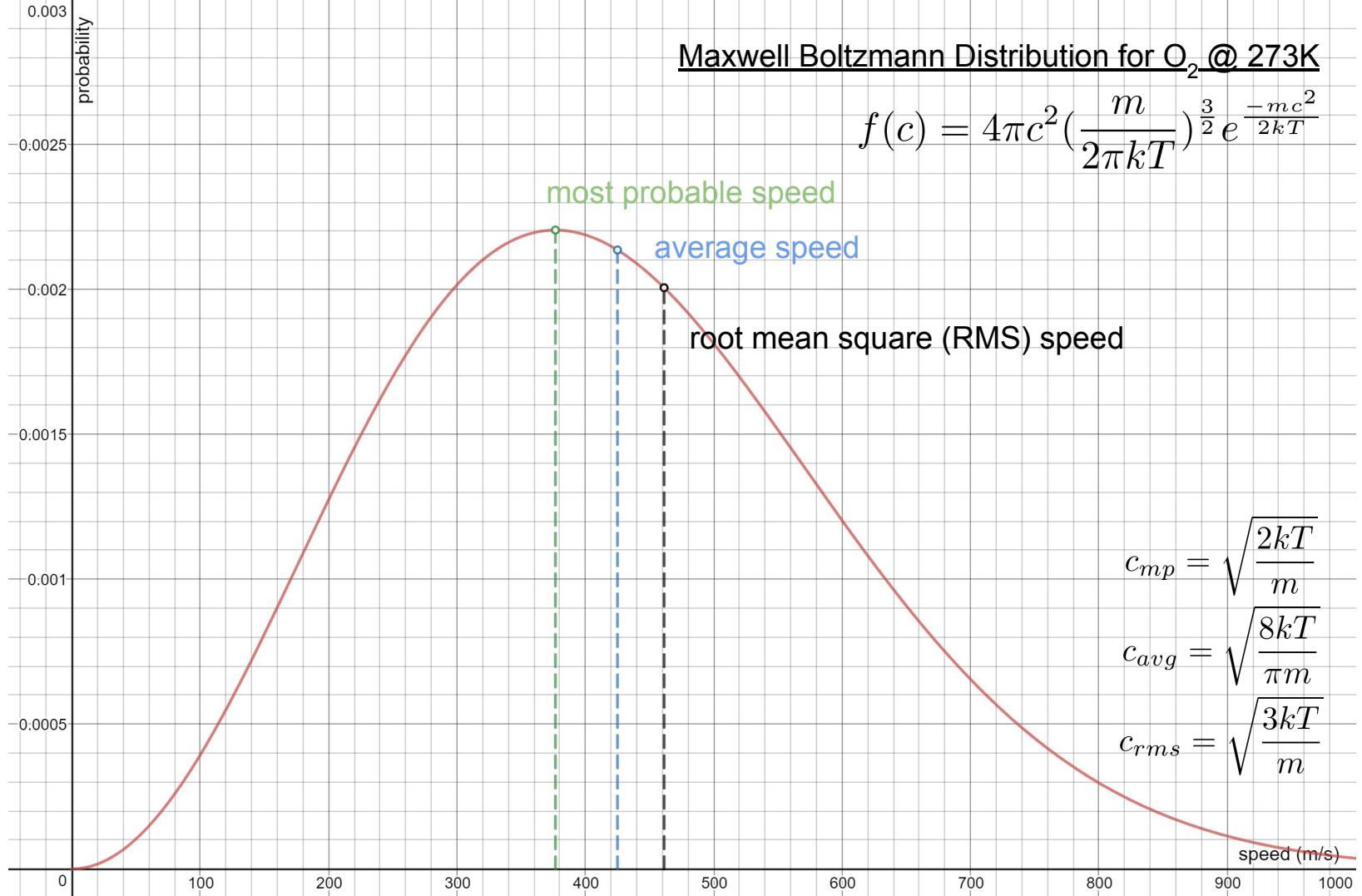
- The objects studied in class were reasonably sized
- The number of objects and variables studied in class were reasonable
- There is always some variation to physical objects, which becomes more apparent at a microscopic level

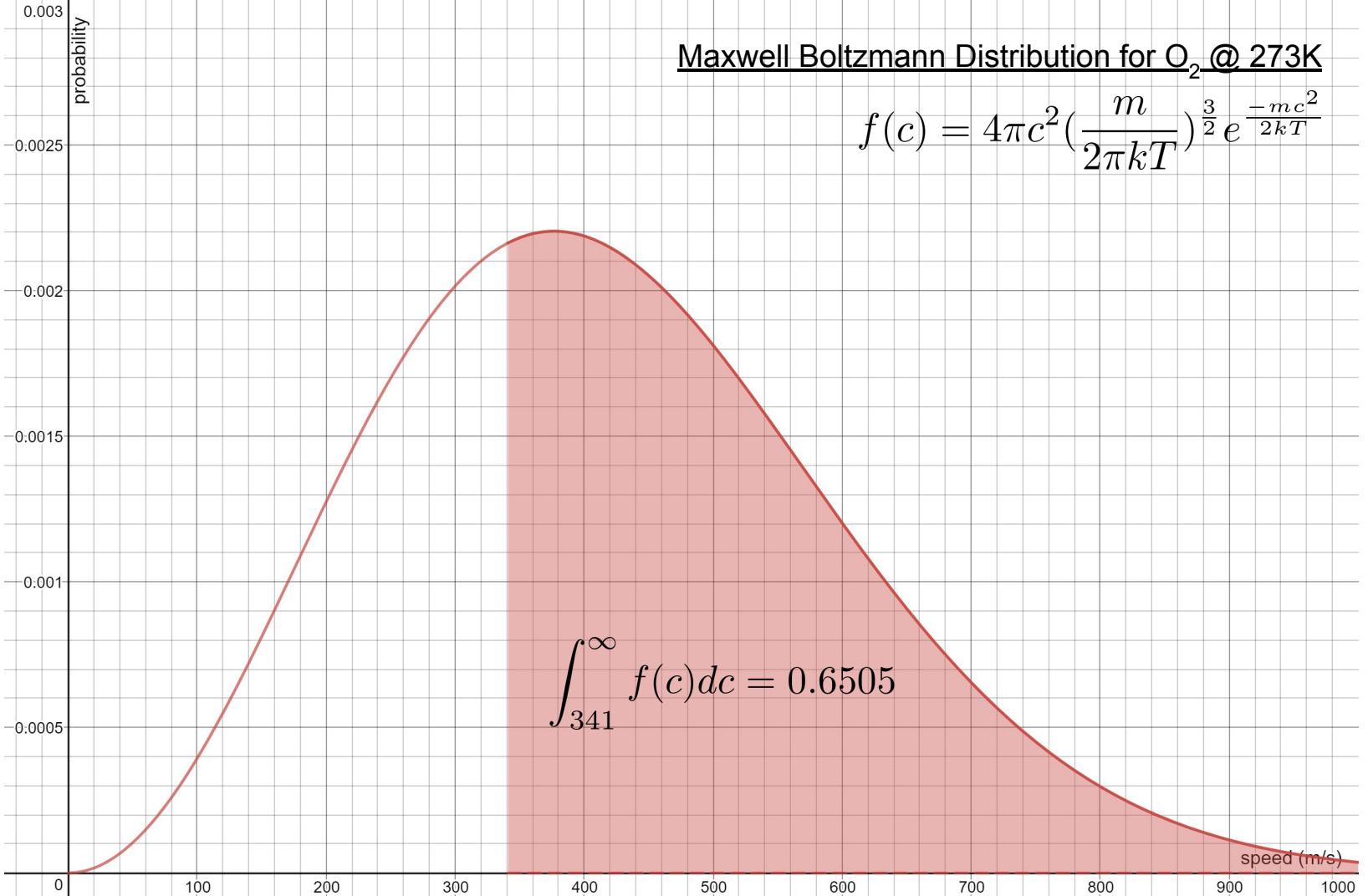


Let's bring back this question...

Ever wondered what percentage of oxygen molecules travel over 341m/s  
(land speed record)?

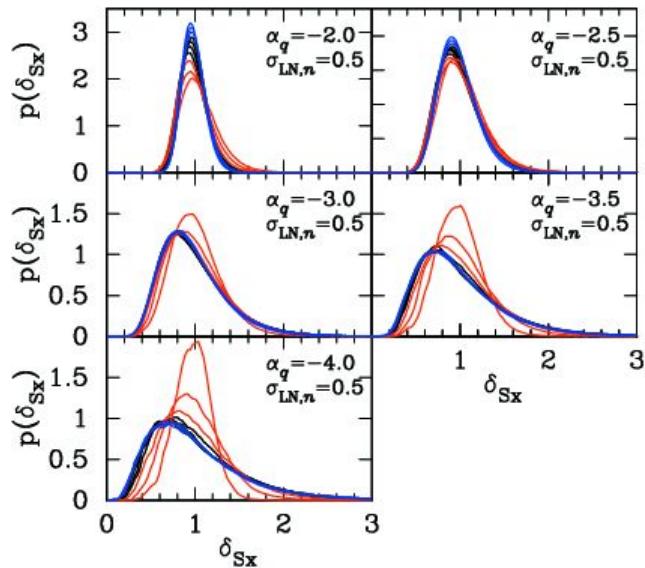






# STATISTICS TO THE RESCUE!

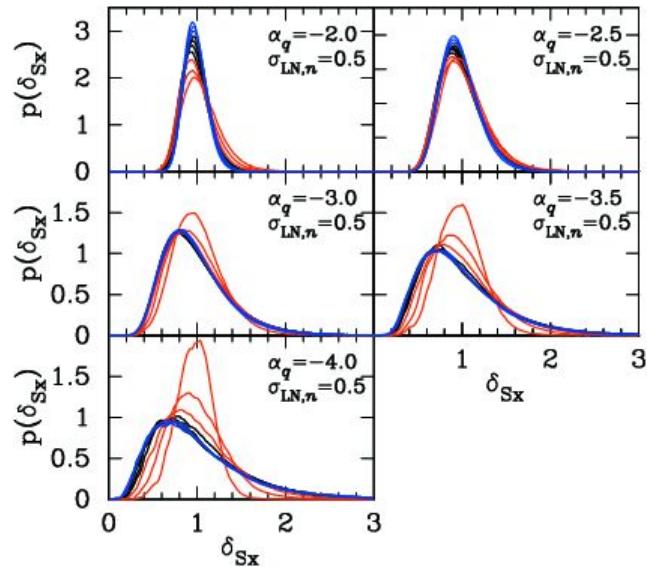
Statistical physics uses probability theory to provide mathematical models to problems with many variables, and can deal with problems in many other fields of science, economics, and the social sciences.



# STATISTICS TO THE RESCUE!

Statistical physics uses probability theory to provide mathematical models to problems with many variables, and can deal with problems in many other fields of science, economics, and the social sciences.

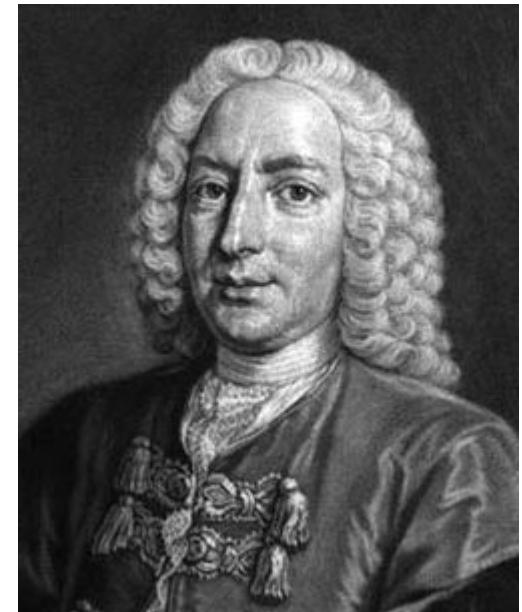
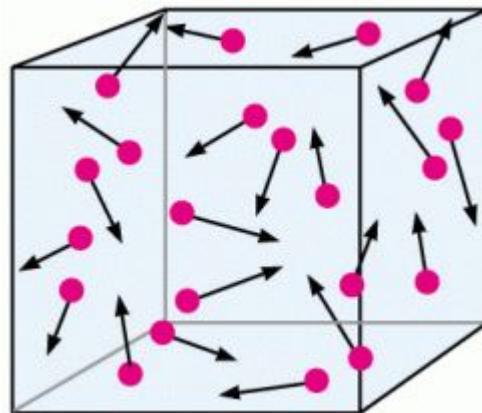
Statistical mechanics (specifically) deals with mechanics, especially in thermodynamics (statistical thermodynamics).



# HISTORY

# DANIEL BERNOULLI (1700-1782)

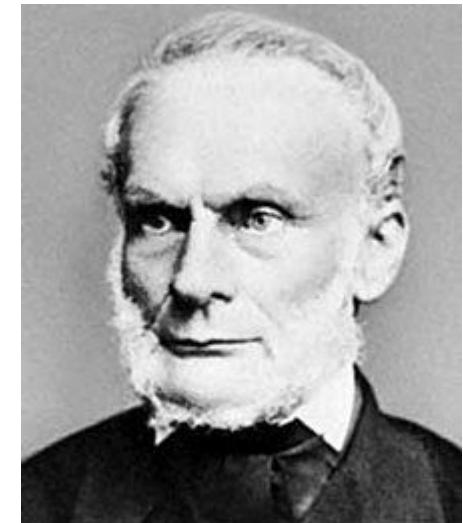
- pioneer of the Kinetic Theory of Gases, the first model that predicted large numbers of particles moving in stochastic motion



# RUDOLF CLAUSIUS (1822-1888)

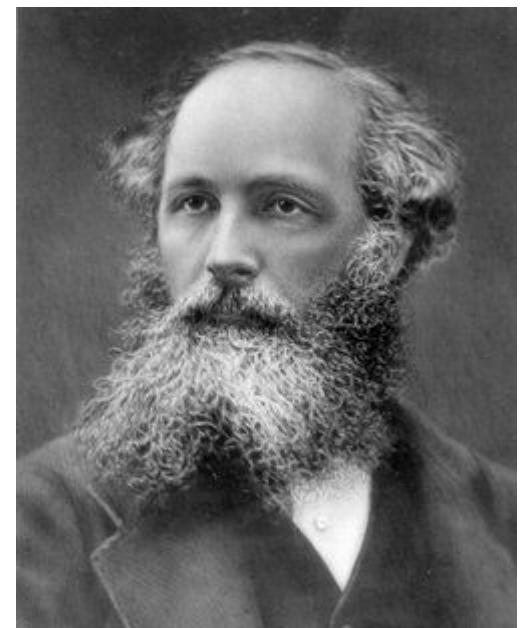
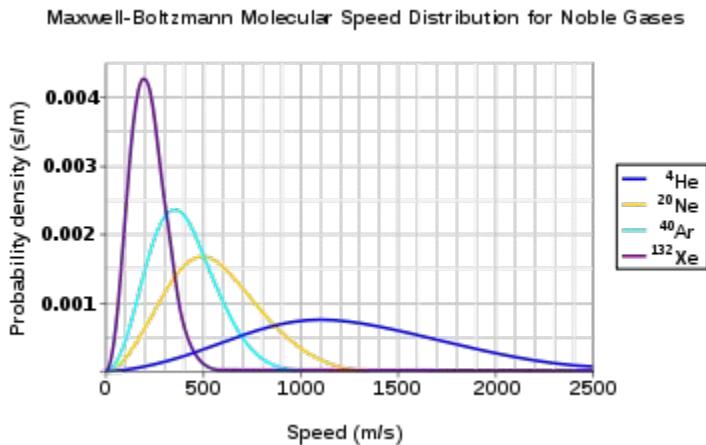
- known for work with thermodynamics
- derived equation for mean free path of a particle, the first basic probabilistic equation

$$\text{Mean free path estimate} = \frac{\text{Distance traveled}}{\text{Volume of interaction}} = \frac{\overbrace{\bar{v}t}^{\text{Mean distance per collision}}}{\overbrace{\pi d^2 \bar{v} t n_v}^{\text{Number of molecules per unit volume}}} = \frac{1}{\pi d^2 n_v}$$



# JAMES MAXWELL (1831-1879)

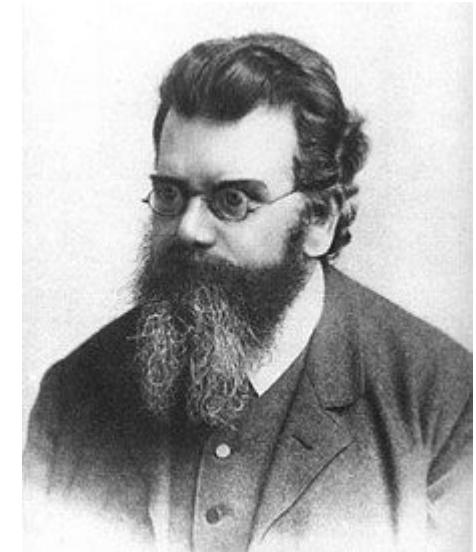
- improved Clausius's equation for MFP
- wrote the first statistical distribution, the Maxwell-Boltzmann distribution for velocity of particles
- discovered root mean square velocity



# LUDWIG BOLTZMANN (1844-1906)

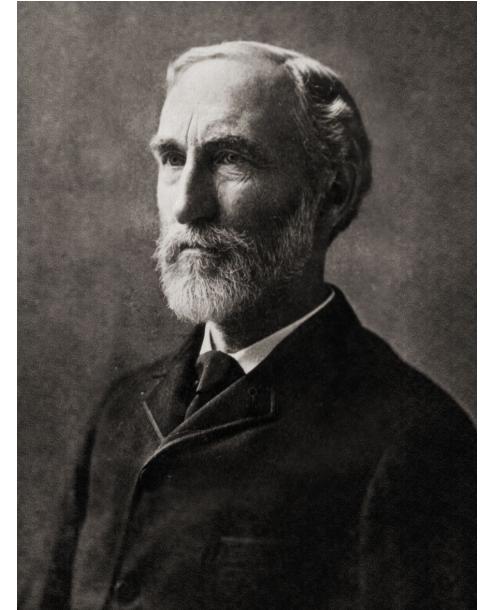
- worked closely with Maxwell
- generalizing Maxwell's equations to non-equilibrium thermodynamics
- famous H-theorem “proof” for the Second Law of Thermodynamics

$$H(t) = \int_0^\infty f(E, t) \left( \ln \frac{f(E, t)}{\sqrt{E}} - 1 \right) dE.$$



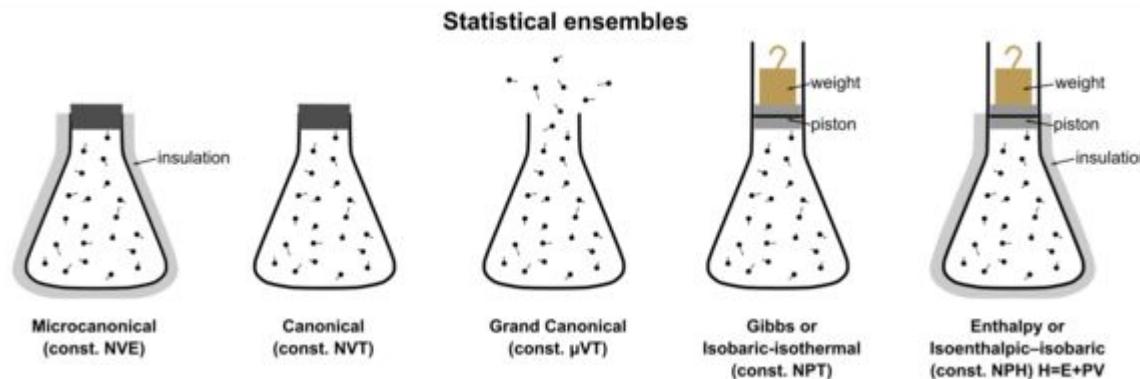
# JOSIAH GIBBS (1839-1903)

- introduced the **statistical ensemble** that generalized Boltzmann's work to all **mechanical systems** (not just thermodynamics)



# THE STATISTICAL ENSEMBLE

- five main classes of statistical ensemble
- each has its own mathematical model, defined by what is kept constant and what is variable



# THE CANONICAL ENSEMBLE (NVT)

- particles (N), volume (V), and temperature (T) constant
- energy can be freely exchanged with a large heat reservoir
- generalized form of a Boltzmann distribution

$$P = e^{\frac{F - E}{kT}}$$

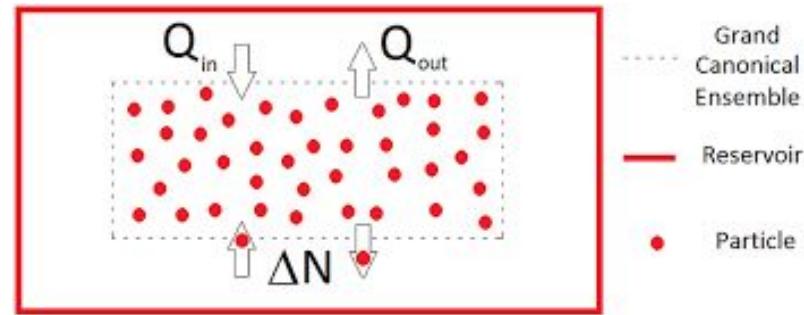
$$F(N, V, T)$$

$$\langle p \rangle = -\frac{\partial F}{\partial V}$$

$$S = k \langle \log P \rangle = \frac{\partial F}{\partial T}$$

$$d\langle E \rangle = T dS - \langle p \rangle dV$$

$$\langle E^2 \rangle - \langle E \rangle^2 = kT^2 \frac{\partial \langle E \rangle}{\partial T}$$



# EXAMPLES IN THERMODYNAMICS

Equilibrium:

- show the properties of a material

Nonequilibrium:

- internal heat transfer in a material
- friction and energy dissipation
- electric currents created by a voltage imbalance
- spontaneous chemical reactions

# EXAMPLES OUTSIDE THERMODYNAMICS

- ensemble weather forecasting
- plotting gravitational orbits
- economic theory
- evolution and dynamics of neural networks

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# WORKS CONSULTED anyways

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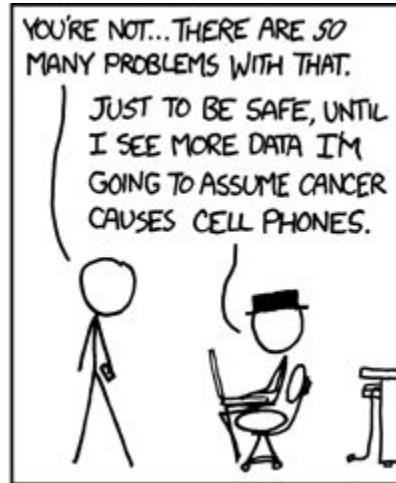
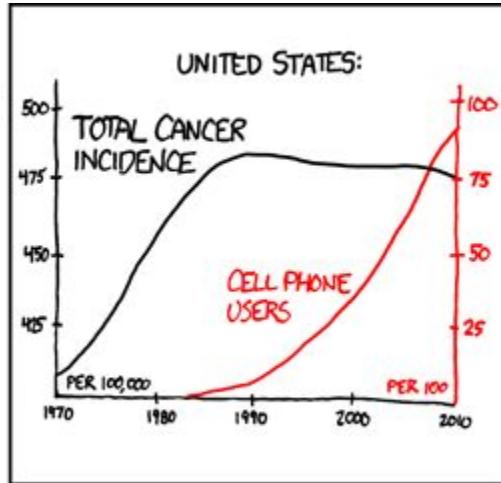
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source: xkcd 925: "Cell Phones"



TL;DR:

statistics gets a lot more mathy than stat. class

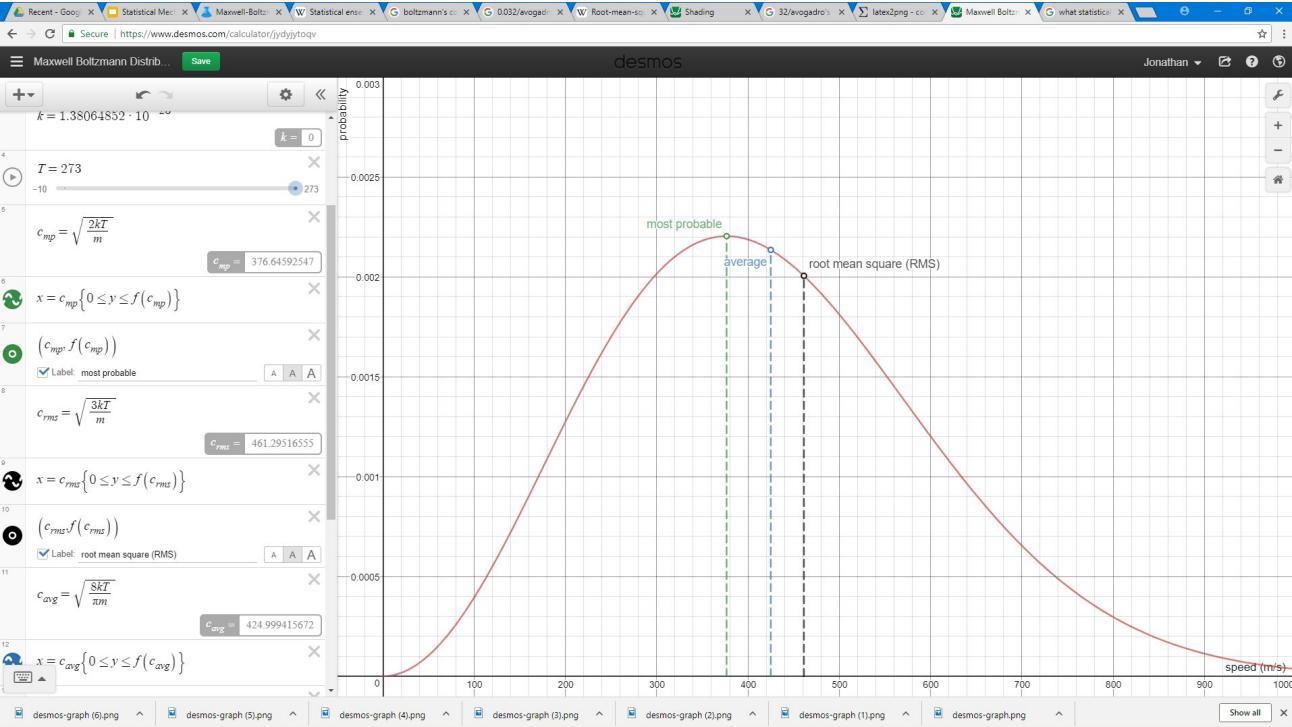
THANKS FOR WATCHING! ~ jonlam

$$\int_{341}^{\infty} f(c)dc = 0.6505 \quad \int_{341}^{\infty} f(c)dc \quad int_a^b 2dt \quad c_{mp} = \sqrt{\frac{2kT}{m}} \quad c_{avg} = \sqrt{\frac{2kT}{m}} \quad c_{avg} = \sqrt{\frac{8kT}{\pi m}} \quad c_{rms} = \sqrt{\frac{8kT}{\pi m}} \quad c_{rms} = \sqrt{\frac{3kT}{m}} \quad f(c) = 4\pi c^2 (\frac{m}{2\pi kT})^{\frac{3}{2}} e^{-\frac{mc^2}{2kT}}$$

$$f(c) = 4\pi c^2 (\frac{m}{2\pi kT})^{\frac{3}{2}} exp(-\frac{mc^2}{2kT}) \quad f(c) = 4\pi c^2 (\frac{m}{2\pi kT})^{\frac{3}{2}} \quad f(c) = 4\pi c^2$$

$$\frac{\partial P = e^{\frac{F-E}{kT}}}{\partial F} \quad \frac{\partial P = e^{\frac{F-E}{kT}}}{\partial E} \quad \frac{\partial P = e^{\frac{F-E}{kT}}}{\partial T} \quad \frac{\partial P = e^{\frac{F-E}{kT}}}{\partial V} \quad \frac{\partial P = e^{\frac{F-E}{kT}}}{\partial N} \quad \frac{\partial P = e^{\frac{F-E}{kT}}}{\partial V, T} \quad \frac{\partial P = e^{\frac{F-E}{kT}}}{\partial N, T} \quad \frac{\partial P = e^{\frac{F-E}{kT}}}{\partial N, V} \quad \frac{\partial P = e^{\frac{F-E}{kT}}}{\partial N, V, T}$$

$$P = e^{\frac{F-E}{kT}} F(N, V, T) \quad P = e^{\frac{F-E}{kT}} F(N, V, T) \quad P = e^{\frac{F-E}{kT}} F(N, V, T) \quad F(N, V, T) \quad y = \sum_{i=0}^{10} x_i$$



(also LaTex and  
Desmos are cool)

## Statistical Mechanics: An Introduction

Statistical mechanics uses statistical methods to mathematically model the behavior of systems with many particles and many variables (degrees of freedom)—and therefore many approximations and calculations—which makes it difficult, if not impossible, to measure or model physically. The most common use for this explaining and quantifying macroscopic observations (e.g., laboratory results) with statistical mathematical models of the system in question. It works by using statistical ensembles: multiple probability functions for the same system.

The field describes the movement (“mechanics”) of a massive number of particles. It falls into the more general field of statistical physics, which deals with stochastic processes with a large number of particles or other variables, including in chemistry, biology, neurology, and sociology. Its main application deals with statistical mechanics, and the main application of statistical mechanics is in the field of thermodynamics, so often the term “statistical physics” or “statistical mechanics” refers directly to “statistical thermodynamics.” This paper will focus on historical significance with the Kinetic Theory of Gases and statistical thermodynamics. It is important to begin with the history of this field to understand its importance.

The origins of statistical mechanics lie in the Kinetic Theory of Gases, originally developed by Daniel Bernoulli in the early 1700s. Bernoulli was the first to believe that gases were a collection of many small particles moving at a very high speed, and he discovered the association between the kinetic energy of the particles and heat. Both are remarkable: first, because the Atomic Theory, formalized by John Dalton still had a few decades to come; and because the common theory for heat was that it was a form of matter called “caloric.” For these reasons, Bernoulli’s work on the Kinetic Theory of Gases was largely unnoticed, but it established the framework for later scientists, and the first to introduce a large system of rapidly moving particles, which is the exigence for statistical mechanics.

After the Caloric Theory was challenged, the Kinetic Theory of Gases lived on in sporadic works by scientists such as John Herapath and James Joule, until Rudolf Clausius (already reputed for his work with thermodynamics) took note of it in the 1850s, a century after Bernoulli. Clausius and Karl Krönig deduced that gas particles move randomly in straight lines until they hit other particles. This went against the common conception that gases move in

relatively predictable and uniform motion, but rather in random motion modelled by probability, another important pillar of statistical mechanics. Clausius derived the mean free path of a particle, or the average distance it travels before collision, in the equation:

$$l = \frac{3V}{4N\pi\sigma^2}$$

where  $l$  is the mean free path,  $N$  is the number of gas molecules,  $V$  is the volume, and  $\sigma$  is the approximate diameter of the gas molecules. This equation was refined by James Maxwell only a year later. Maxwell made another important step by assuming totally random motion of the particles, including velocities (before him, while the paths of the particles were assumed to be random, their speeds were assumed to be relatively constant). He developed the first probability distribution in physics for the velocities of the gas molecules:

$$f_0(v) = n \left( \frac{m}{2\pi kT} \right)^{3/2} e^{-\frac{mv^2}{2kT}}$$

where  $v$  is the velocity,  $n$  is the density,  $m$  is the mass,  $k$  is Boltzmann's constant, and  $T$  is the temperature. Closely associated with Maxwell's work is Ludwig Boltzmann, who generalized Maxwell's equations for non-equilibrium systems. He developed a non-equilibrium single particle distribution function that predicts the number of particles at a given position, at a given velocity, and at a specific time. This single-particle distribution function was further used to describe other probabilistic phenomena, for example, his famous Boltzmann equation that describes how a fluid changes over time based on the movement of its particles, as well as the famous H-theorem (not shown below), which results in the following:

$$\frac{dH[f]}{dt} \leq 0$$

$$S(t) = -kH[f]$$

$$\frac{dS(t)}{dt} \geq 0$$

where  $S$  is the thermodynamic entropy. This describes the second law of thermodynamics, and has a basis in the work of Maxwell, as well as the foundational theories in randomness and large numbers of particles introduced by Clausius and Bernoulli.

A final notable chapter in the history of statistical mechanics is the generalization of statistical mechanics to more mechanical systems by Josiah Gibbs in the late 19th century. His work allowed the same reasoning applied in thermodynamics to also be applied to non-gaseous

and non-microscopic (macroscopic) systems. Later, after the invention of quantum mechanics, Gibbs' work was easily adapted to quantum systems in addition to the classical systems that Gibbs and his precursors had dealt with.

Gibbs' generalized view of statistical mechanics dealt with statistical *ensembles*: statistical distributions of all possible states of a system. These distributions represent the many possible outcomes of experiments or simulations of a similar system, and the mathematical model is created for the most likely state. These ensembles can also be used to describe equilibrium: the statistical mechanics definition of equilibrium is when the statistical ensemble of a system contains all of its possible past and future states; i.e., no evolution in a system.

Gibbs observed and delineated a few classes of statistical ensembles, which are defined by the dimensions kept constant:

**The Microcanonical (NVE) Ensemble:** This ensemble comprises a fixed number of particles (N), volume (V), and energy (E), which can be visualized by an insulated container.

**The Canonical (NVT) Ensemble:** This ensemble comprises a fixed number of particles (N), volume (V), and temperature (T), but a variable amount of energy, which can be visualized by a non-insulated container connected to an arbitrarily large “heat bath” for energy transfer.

**The Grand Canonical ( $\mu$ VT) Ensemble:** This ensemble comprises a variable number of particles and energy, which can be visualized by an open container. Instead, what is constant is the chemical potential ( $\mu$ ), volume (V), and temperature (T), which are necessary for calculations to be made.

Two more main classes of statistical ensembles were discovered after Gibbs, the isoenthalpic-isobaric (NpH) and isothermal-isobaric (NpT) ensembles. These can be represented as the weighted sum of a similar canonical ensemble.

For the sake of brevity, only a short discussion of the canonical ensemble will be discussed, as it is often used for its simplicity (its constants are easier to measure). Each possible microstate is assigned a probability:

$$P = e^{\frac{E-F}{kT}}$$

where P is the probability, F is the Helmholtz free energy, k is Boltzmann's constant, E is the energy, and T is the absolute temperature. It can describe a system of any size in equilibrium with a heat bath, as long as the heat bath is considerably large and there is no other energy interaction except with the heat bath. If these conditions are met, certain properties arise, such as that the canonical ensemble average (predicted state) has the minimum free energy and the highest entropy of any state in the ensemble, which makes sense due to the fundamental tendency of systems to reach higher-entropy and lower-energy states. The canonical ensemble also is associated with several equations that apply to all such systems, such as:

$$\text{Average pressure: } \langle p \rangle = -\frac{\partial F}{\partial V}$$

$$\text{Gibbs entropy: } S = -\frac{\partial F}{\partial T}$$

$$\text{First law of thermodynamics: } d\langle E \rangle = TdS - \langle p \rangle dV$$

Together, these equations often describe a generalized Boltzmann distribution, many of which were generalized by Gibbs. The generalized Boltzmann distribution is the most applicable of the statistical ensembles, applying to many types of systems (gas particles, electromagnetic modes in cavities, polymers), but there also exists the Ising model that uses the canonical ensemble and is important for particle interactions in ferromagnetism and phase transitions.

Statistical physics has led to quantitative descriptions of superfluidity, superconductivity, turbulence, structures of different phases of matter, liquid crystals, and critical phenomena. Many modern particle experiments are based solely on statistical, mathematical representations. It is in this field that scientists have been able to really apply physics where numbers could not work.

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# **Descriptive Statistics of a Survey of Seniors of the Class of 2018 and Faculty in the JBHS Class of 2018**

AP Statistics Second Quarter Project

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Benjamin El-Wardany

Rahul Kiefer

Jonathan Lam

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## PART 1

COMPLETED IN CLASS

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## PART 2

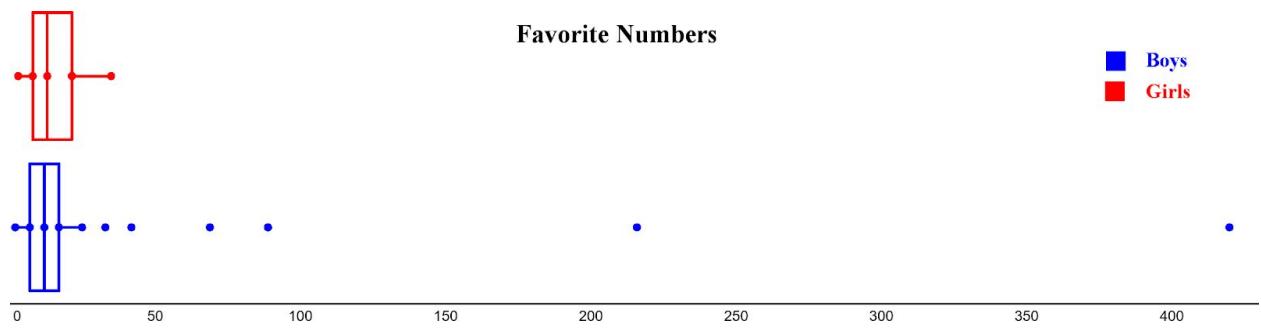
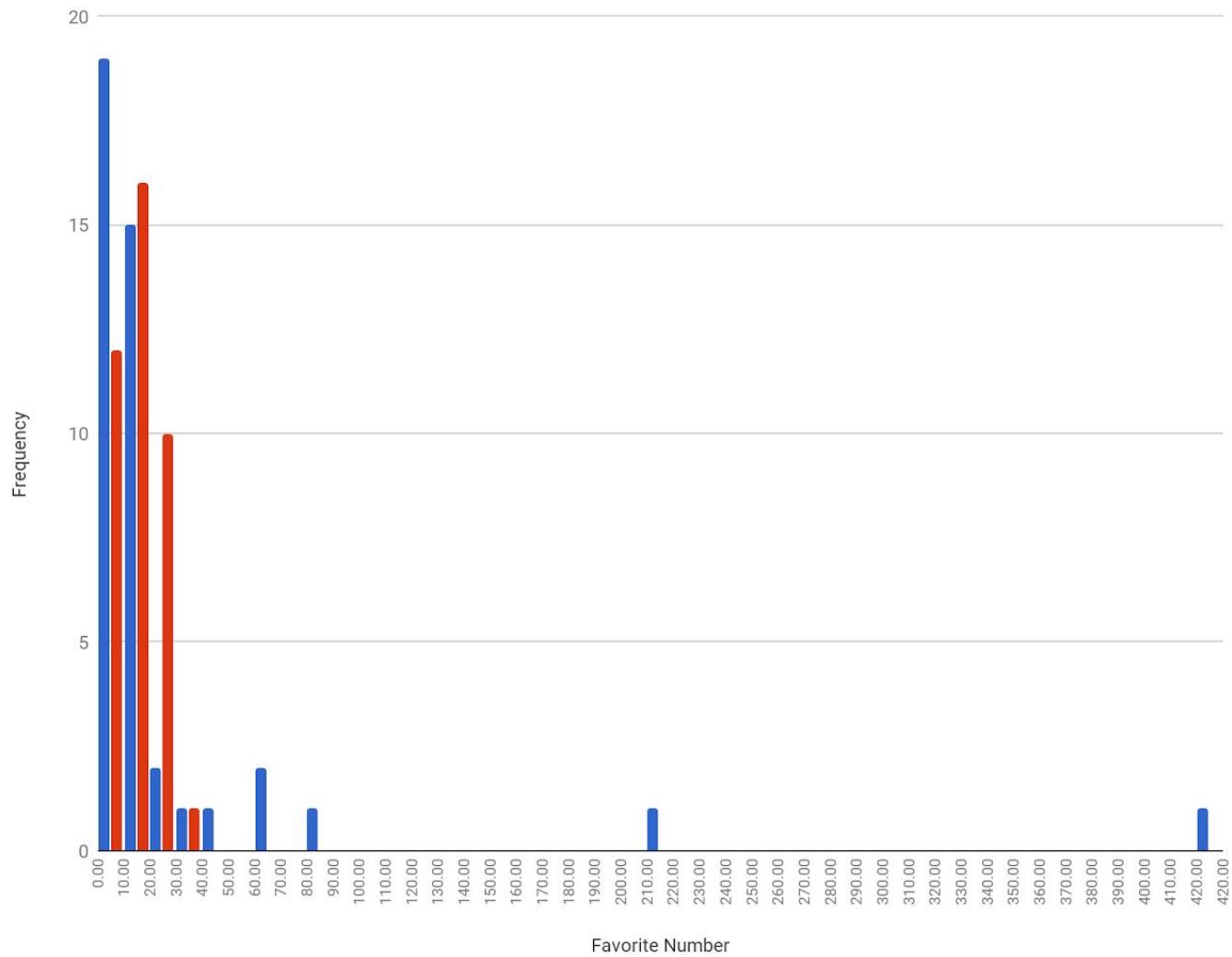
TASK 1: QUANTITATIVE VARIABLE

What is your favorite number? (frequency table)		
Number	Frequency	
	Males	Females
2	2	0
3	1	1
4	4	2
6	1	2
7	5	3
8	4	3
9	2	1
10*	1	0
11	1	3
12	3	2
13	2	3
14	1	2
15	1	0
16	2	5
17	3	0
18	1	1
21	1	1

22	○	3
23	○	1
25	1	○
26	○	1
27	○	3
29	○	1
33	1	○
35	○	1
42	1	○
69	2	○
89	1	○
216	1	○
420	1	○

\* interpreted from: "Well, on Saturday it is 10 because I like that number, but on most days of the week is 1 cause Im the best ever. No one can stop me. But overall my favorite number is 10, so yes 10."

What is your favorite number?



## Numerical Summary

	Min.	Q1	Med.	Q3	Max.	IQR	$\bar{x}$	$S_x$
Males	2	7	12	17	420	10	30.4884	70.4311
Females	3	8	13	21.5	35	13.5	14.8718	7.9676

Outlier test:

Males: outliers at 33, 42, 69, 69, 89, 216, 420

$$\text{Lower fence: } Q_1 - 1.5\text{IQR} = 7 - 1.5(10) = -8$$

$$\text{Upper fence: } Q_3 + 1.5\text{IQR} = 17 + 1.5(10) = 32$$

Females: no outliers

$$\text{Lower fence: } Q_1 - 1.5\text{IQR} = 8 - 1.5(13.5) = -12.25$$

$$\text{Upper fence: } Q_3 + 1.5\text{IQR} = 21.5 + 1.5(13.5) = 41.75$$

Because the distribution of the males and females differed greatly in some of their features, we decided to analyze each one separately.

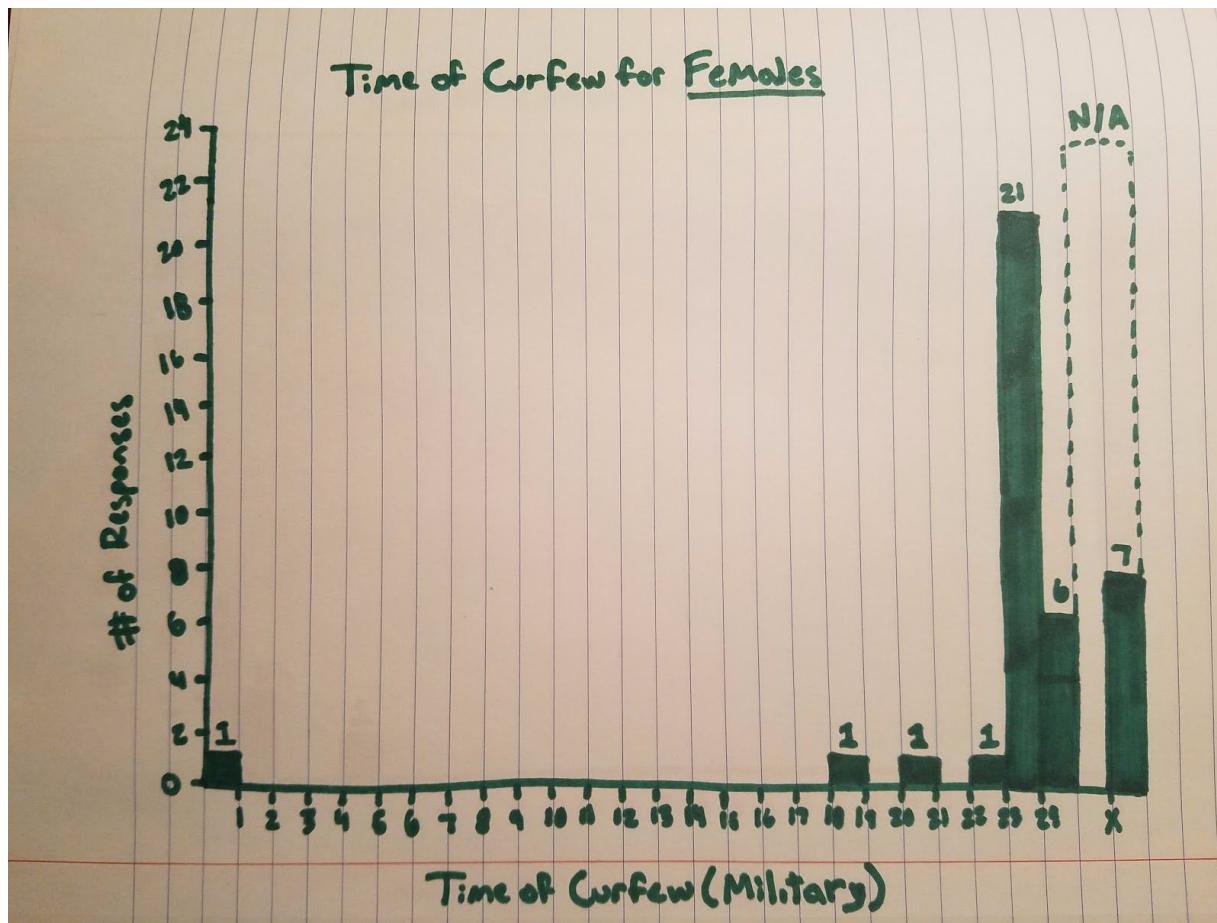
The shape of the distribution of favorite numbers is heavily skewed right and unimodal, with a mode at 0 to 9 for males and a mode at 10 to 19 for females. The median for males is 12, which is similar to the females' median of 13. Both demonstrated a small IQR (10 for males and 13.5 for females), but there was a great difference in range. For females, there were no outliers nor gaps and the range was 33. For males, there were 7 high outliers, including 6 high outliers, drastically increasing the mean and standard deviation and making the graph much more asymmetric. The range is 418 (13 times as great as that of the females). Thus, while the middle 50% of both distributions are tightly clustered around the 0-19 numbers, the distribution for males has some very high outliers and a great spread, while the spread and range of females is relatively small.

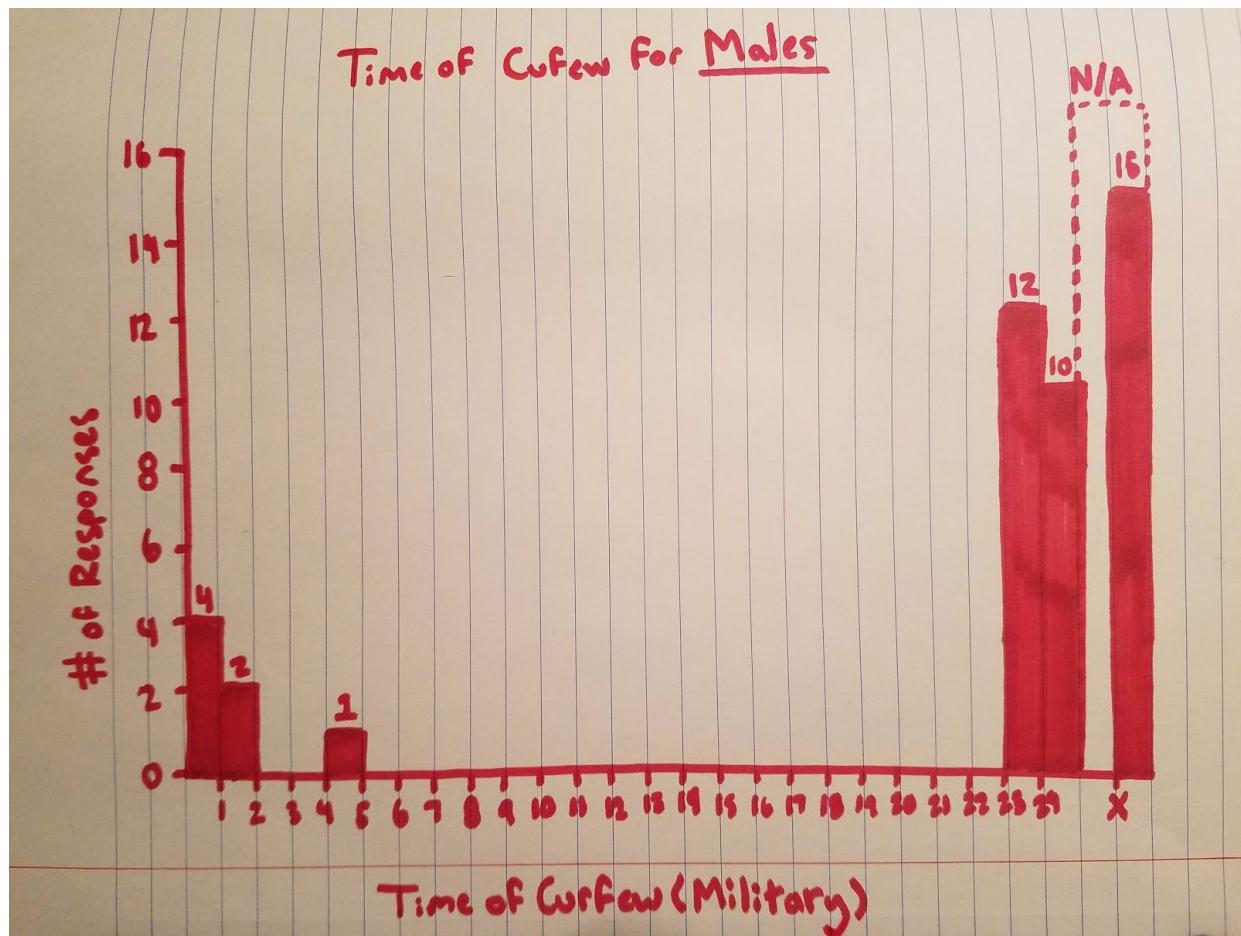
## TASK 2: CATEGORICAL VARIABLE

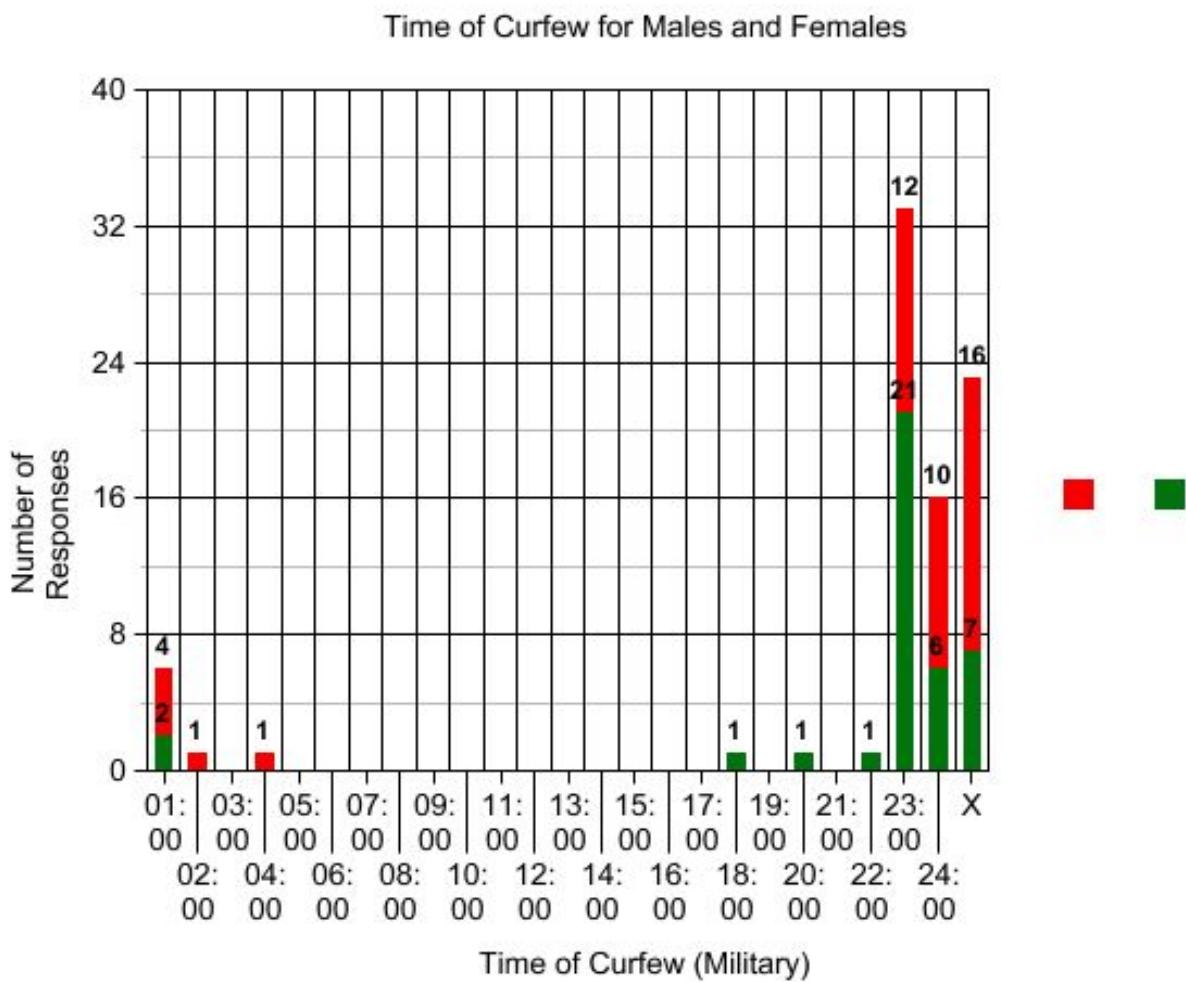
Curfew on weekends (responses)			
Males		Females	
response	interpreted	response	interpreted
12 p.m.	24:00	"whenever I want"	X
"12 at nighttime"	24:00	"no curfew"	X
"none"	X	"11 if I'm driving"	23:00
11	23:00	11:00 PM	23:00
11	23:00	10:00	22:00
"no curfew"	X	11:00	23:00
1:30 a.m.	1:00	11:00	23:00

"N/A"	X	11:00	23:00
12:00-12:30	1:00	1	1:00
11:00	23:00	12-1	1:00
12:00	24:00	11	23:00
12	24:00	8	20:00
11:30	23:00	11:30	23:30
"Don't have one"	X	11	23:00
1	1:00	11	23:00
"none"	X	11	23:00
"none"	X	12:30	1:00
"don't know"	X	11	23:00
"none"	X	11:00 PM	23:00
"none"	X	n/a	X
2:00 AM	2:00	11:00 PM	23:00
11:00 PM	23:00	12:00 AM	24:00
11	23:00	12:00 AM	24:00
11	23:00	6 (am/pm?)	18:00
12	24:00	12:00 AM	24:00
"when I want"	X	11:00 PM	23:00
2	2:00	11pm (CT law) n/a otherwise	23:00
"dont have one"	X	11	23:00
12	24:00	11	23:00
NA	X	"don't have one"	X
1	1:00	11	23:00
11:30	23:00	11	23:00
≈12	24:00	none	X
12ish	24:00	don't have one	X
none	X	11:30	23:00
1	1:00	11	23:00
11	23:00	"don't have one"	X
4	4:00	12	24:00

11	23:00		
12	24:00		
11	23:00		
"never"	X		
N/A	X		
11	23:00		







## Chi-Squared Test For Independence

### Hypotheses:

- Null: Gender and Curfew Time are independent of each other
- Alternate: Gender and Curfew Time are not independent of each other

### Conditions:

- Counted Data Condition: There are counts for individuals for 2 categorical variables: Curfew Time and ~~Gender~~ Gender
- Randomization: We were given randomly selected students to survey so we can believe that the sample is representative of the population
- Expected Cell Frequency:

4	1	2.71	2.2	There are not at least 5 expected values in each cell
2	0	1.08	.91	
1	0	.54	.45	
0	1	.54	.45	
0	1	.54	.45	
0	1	.54	.45	
12	21	17.89	15.11	
10	6	8.67	7.33	
16	7	12.47	10.53	

Although the Expected Cell Frequency condition is not met, we will proceed to the Chi-squared test with  $\chi^2$  df of 8

### Mechanics:

$$\chi^2 = 14.2875$$

$$P = .07957$$

$$df = 8$$

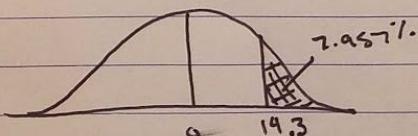
$$df = (r-1)(c-1)$$

$$(9-1)(2-1)$$

$$(8)(1) = 8$$

$$\frac{(4-2.71)^2}{2.71} + \frac{(1-2.2)^2}{2.2} + \dots + \frac{(7-10.53)^2}{10.53}$$

$$P\text{-value} = P(\chi^2 > 14.2875) \approx .07957$$



### Conclusions

Since our P-value of .07957 is less than .1, we reject the null hypothesis that Gender and Curfew Time are independent of each other. Therefore we have evidence to support the Alternate Hypothesis, which states that Gender and Curfew Time are not independent of each other.

### TASK 3: AGE OF CARS COMPARISON

- Change statistics from “year of car” to “age of car” ( $2018 - \text{year of car}$ )
- Make back-to-back stem and leaf plot

**Ages of Cars** Back-to-Back Stem and Leaf Plot

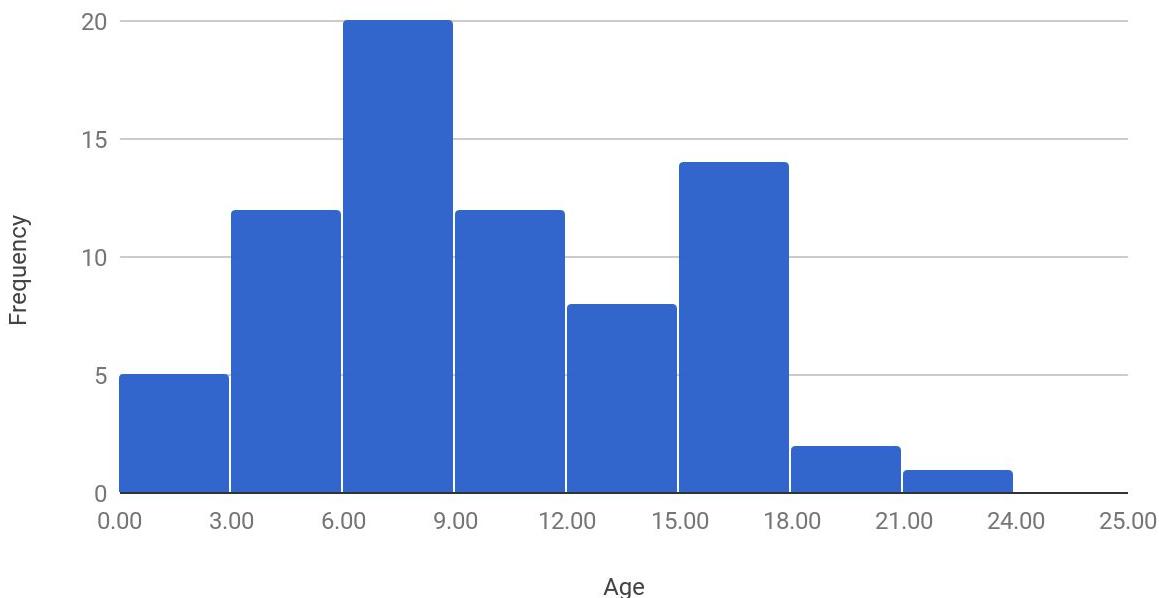
Students	Staff
4 4 4 4 4 4 3 3 3 2 2 1 1 1	○ ○ 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4
9 9 8 8 8 8 8 7 7 7 7 6 6 6 6 6 6 5 5 5	○ ○ 5 5 5 5 5 5 5 6 6 6 6 6 6 6 6 7 7 7 7 8 8 9 9
4 4 4 4 3 2 2 2 1 1 1 1 0 0 0 0 0	1 ○ ○ ○ 1 1 1 1 1 1 1 1 1 1 1 3 3 3 3 3 4
9 8 7 7 7 7 7 6 6 6 6 6 6 5 5	1 5 5 6 9
3 2 2	

Key: | ○ represents a 2008 model car\*

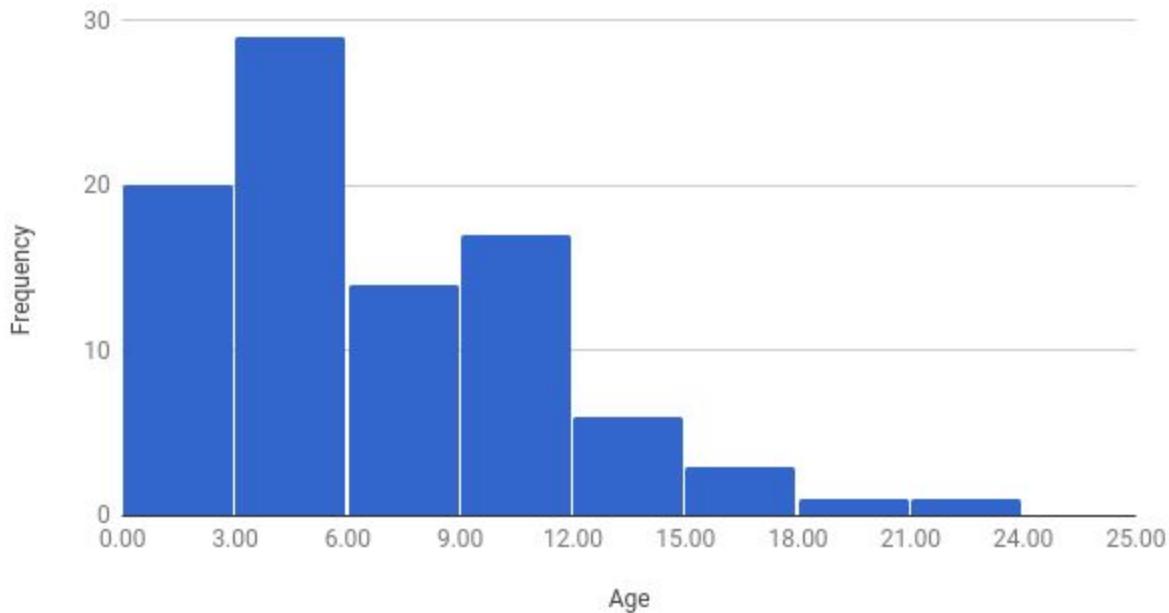
74 student responses were usable, 12 were unusable (“N/A” or “Don’t drive”), 10 were nonresponse. 91 staff responses were recorded (all usable), 54 were nonresponse.

\* age of car is calculated by 2018 minus the car’s make year. Responses that were a range of years (e.g., 2015-2016) or half-years (e.g. 2016.5) were rounded down before subtracting from 2018.

### Age of Cars (Seniors)



## Age of Cars (Staff)



### Numerical Summary

	Min.	Q1	Med.	Q3	Max.	IQR	$\bar{x}$	$S_x$
Students	1	6	8.5	14	23	8	9.5541	5.1820
Staff	0	3	5	10.5	22	7.5	6.2956	4.6113

Outlier test:

Students: No outliers

$$\text{Lower fence: } Q_1 - 1.5\text{IQR} = 6 - 1.5(8) = -6$$

$$\text{Upper fence: } Q_3 + 1.5\text{IQR} = 14 + 1.5(8) = 26$$

Staff: Outlier at 22

$$\text{Lower fence: } Q_1 - 1.5\text{IQR} = 3 - 1.5(7.5) = -8.25$$

$$\text{Upper fence: } Q_3 + 1.5(\text{IQR}) = 10.5 + 1.5(7.5) = 21.75$$

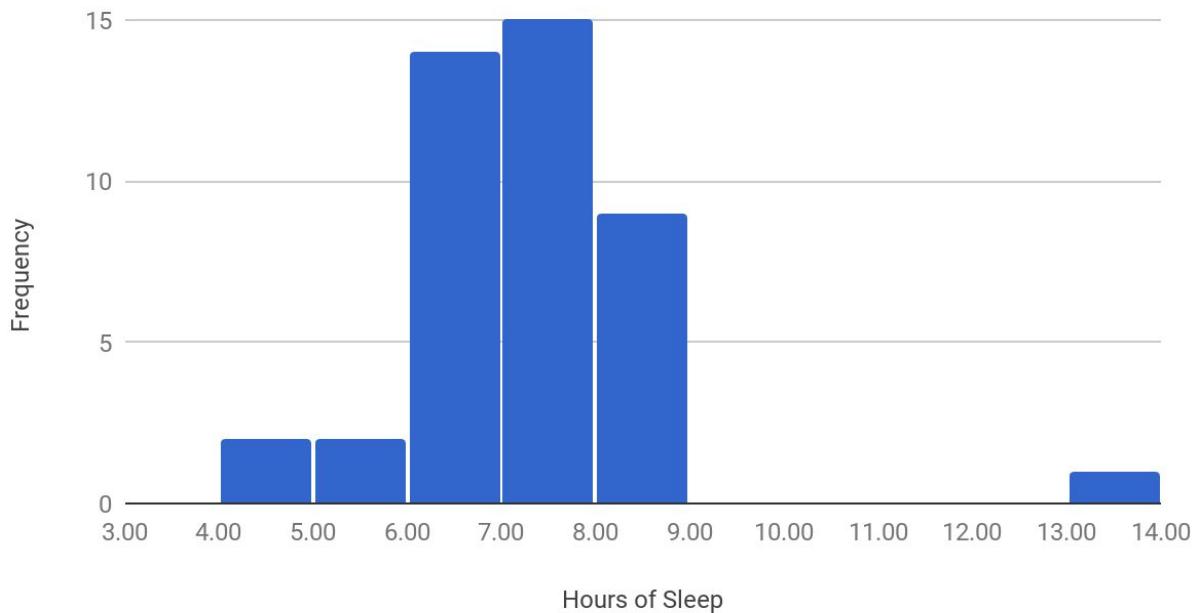
Both the distribution of ages of cars driven by students and staff to school are skewed right and bimodal. The ages of cars held by students has a large peak at 6 to 8 years old, and a smaller peak at 15 to 17 years old. The modes for the ages of cars driven by staff are farther left, with a larger mode at 3 to 5 years old and 9 to 11 years old, and it is skewed more strongly right. The median of the ages of the cars students drive to school is greater than that of the staff, 8.5 years old on average compared to 5 years old. The spread of the car age distributions are very similar: the IQR of the students' cars' ages is 8 years, as compared to 7.5 years for the staff, and the minimum and maximum ages for the students are only one year apart from those of the staff. There are no gaps in either distribution, no outliers in the students'

distribution, and only one outlier out of the staff's distribution at 22 years old. Overall, the distributions of the ages of the cars students and staff drive to school have a similar shape (skewed right with two differently-sized modes) and similar range (middle 50% lies within 7.5 to 8 years), but the distribution of the staff is shifted left from that of the students. In other words, the average age of a staff's car is smaller than that of a student's by approximately 3.5 years.

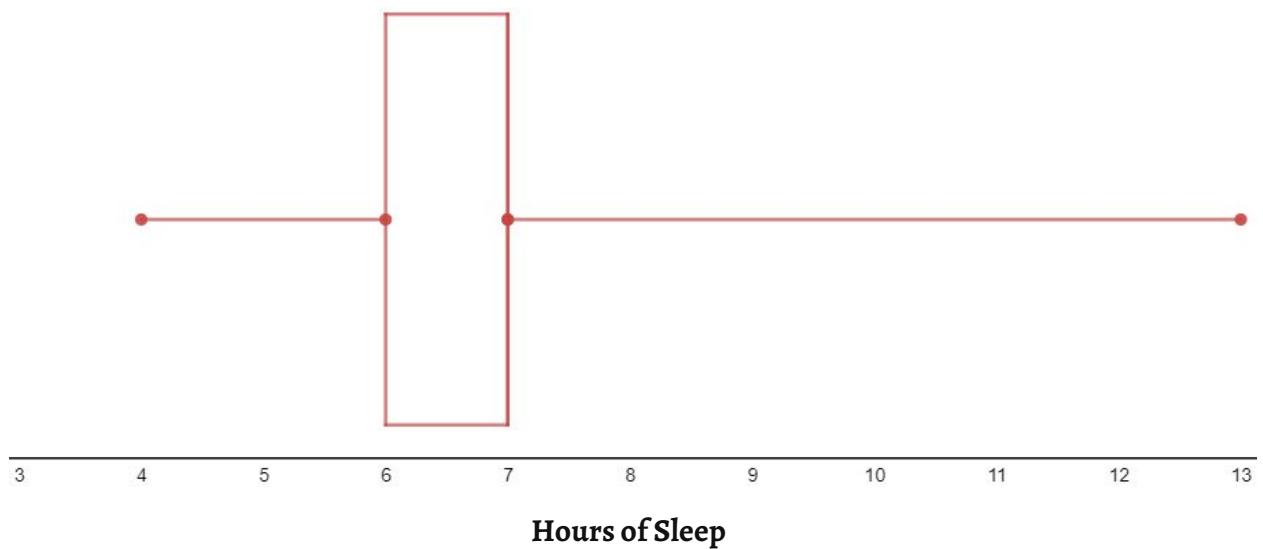
TASK 4: QUANTITATIVE AND CATEGORICAL VARIABLE

Hours of Sleep Per School Night (frequency table)		
Response (hours)	Frequency	
	Males	Females
3.5	0	1
4	2	0
5	2	2
6	10	12
6.5	5	0
7	15	12
7.5	0	1
8	8	7
8.5	0	1
8.8	1	0
13	1	0

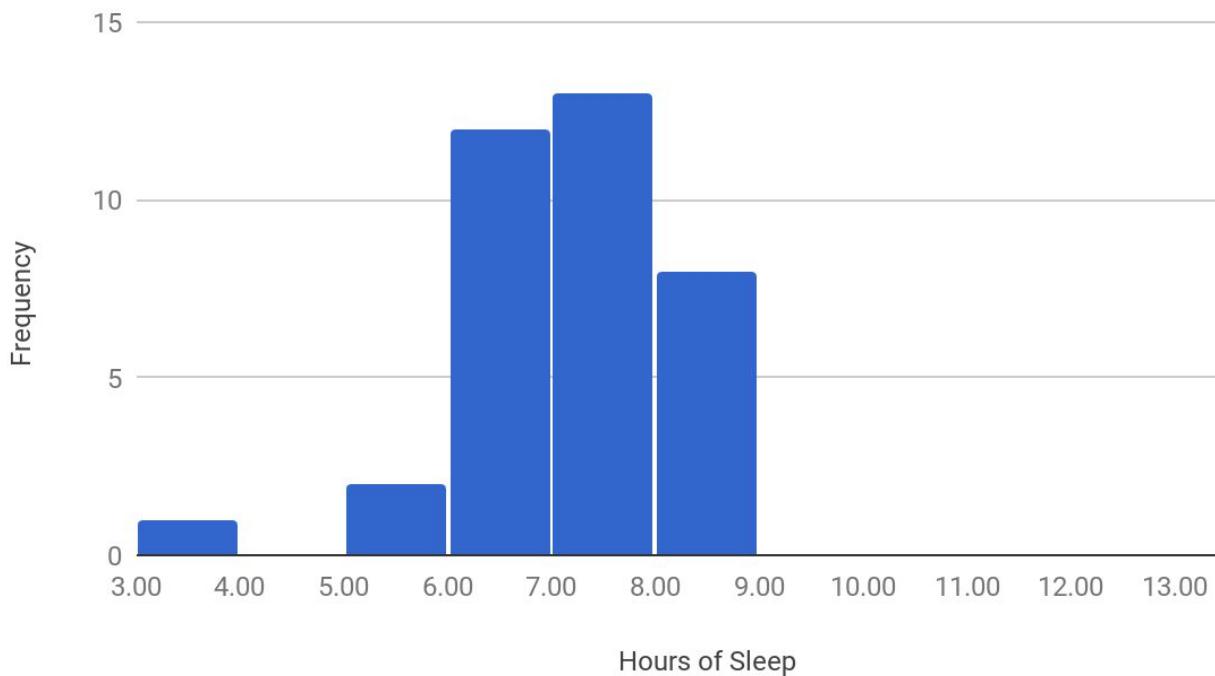
## Hours of Sleep for Males



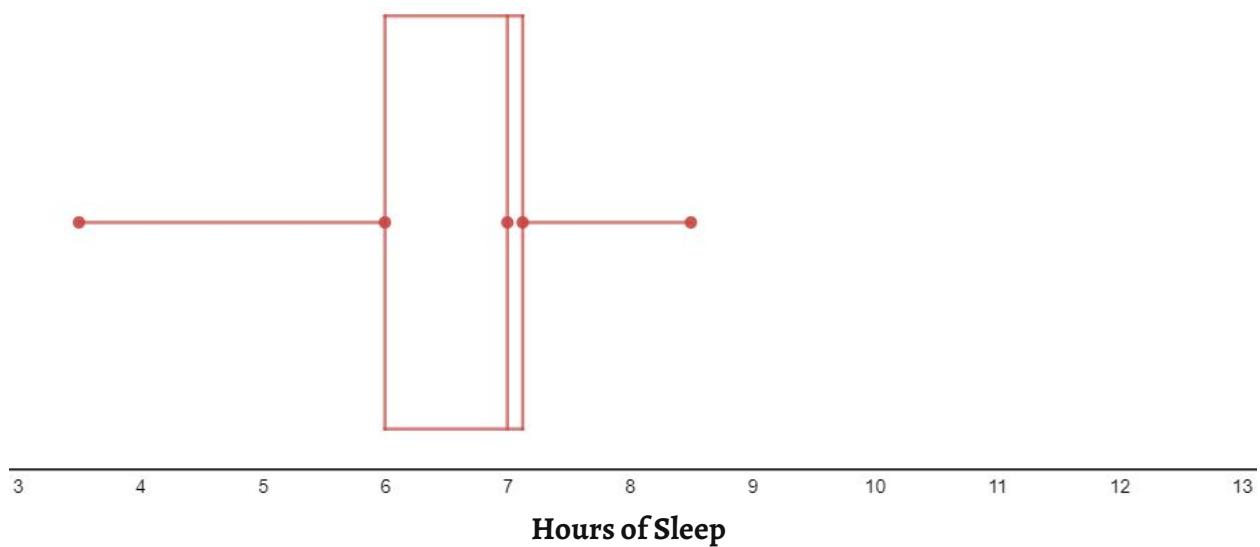
## Box Plot for Males



## Hours of Sleep for Females



## Box Plot for Females



### Numerical Summary

	Min.	Q1	Med.	Q3	Max.	IQR	$\bar{x}$	$S_x$
Males	4	6	7	7	13	1	6.8477	1.3933

Females	3.5	6	7	7	8.5	1	6.6711	1.0350
---------	-----	---	---	---	-----	---	--------	--------

Outlier test:

Males: outliers at 4, 4, 8.8, 13 hours

$$\text{Lower fence: } Q_1 - 1.5\text{IQR} = 6 - 1.5(1) = 4.5$$

$$\text{Upper fence: } Q_3 + 1.5\text{IQR} = 7 + 1.4(1) = 8.5$$

Females: Outlier at 3 hours

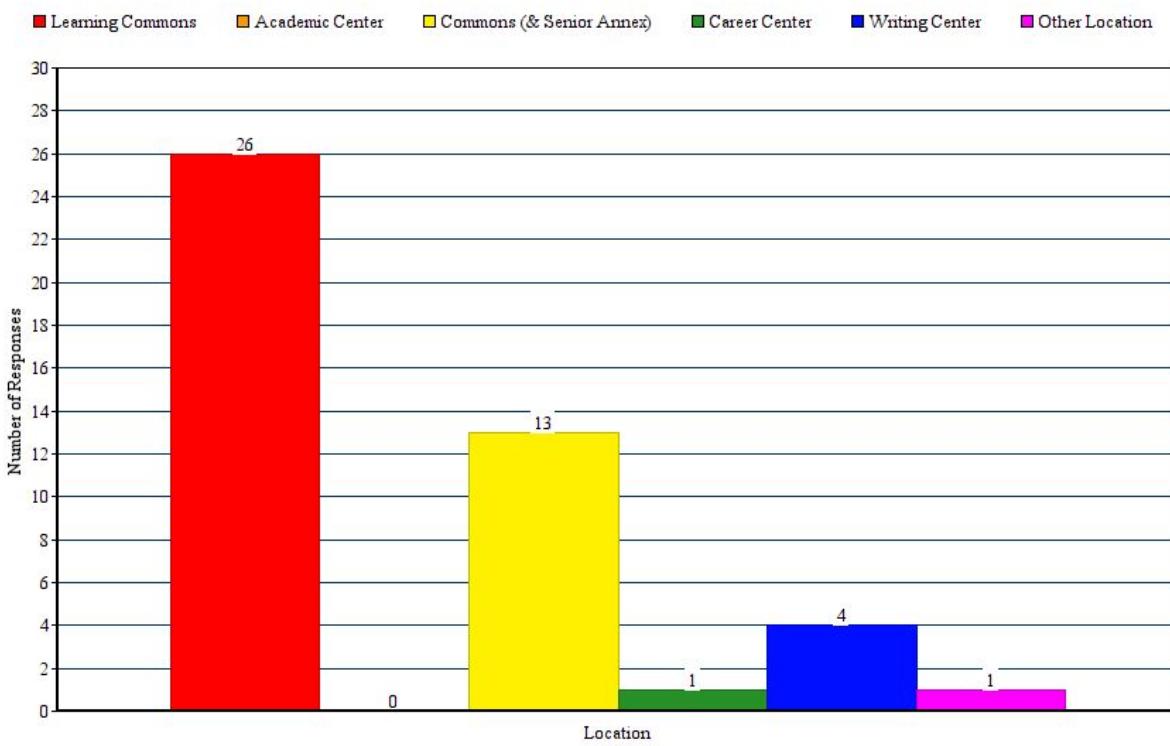
$$\text{Lower fence: } Q_1 - 1.5\text{IQR} = 6 - 1.5(1) = 4.5$$

$$\text{Upper fence: } Q_3 + 1.5\text{IQR} = 7 + 1.5(1) = 8.5$$

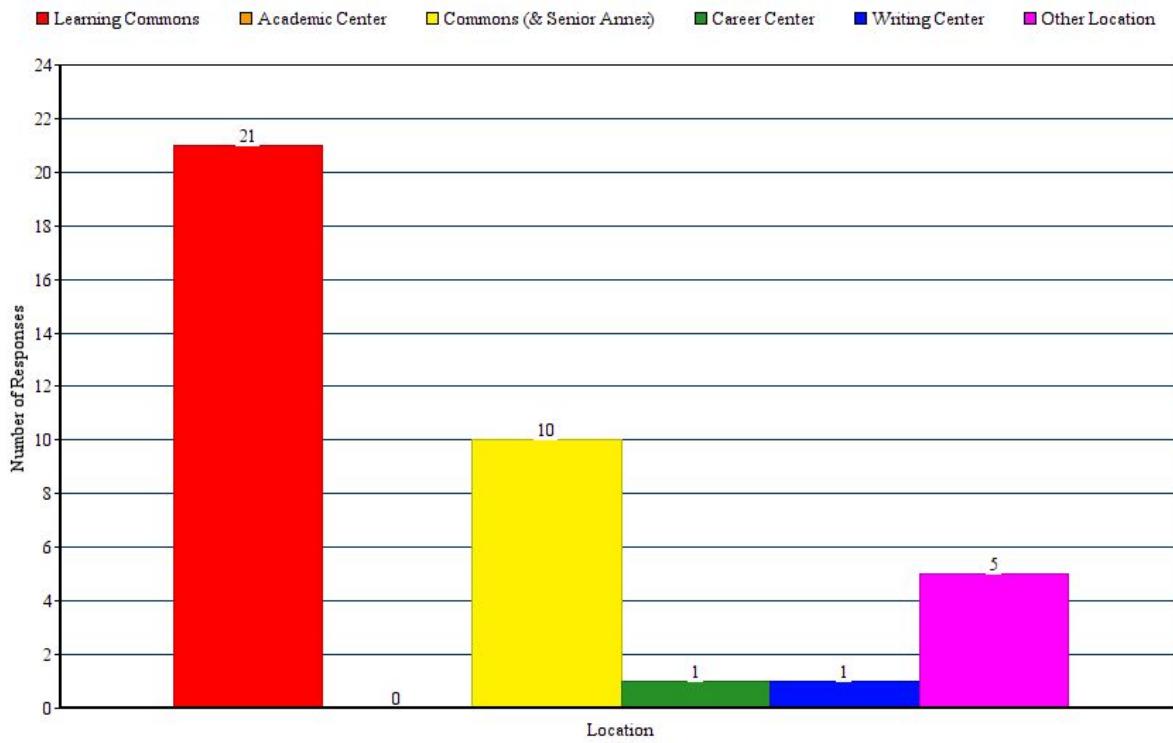
For males, the distribution of hours of sleep is unimodal with a mode at 7 and is skewed to the right, while for females the distribution is unimodal with a mode at 7 and skewed to the left. For males, the median is 7 hours with an IQR of 1, and for females, the median and IQR are the same. There are outliers of 4, 8.8, and 13 hours for males; and of 3 hours for females (see outlier tests above). When we disregard the outliers, the median values for hours of sleep for both males and females are equal (as well as  $Q_3$  values), suggesting that the number of hours of sleep for someone should not depend on their gender.

Where Do You Go For Study Hall? (two-way table)						
	Learning Commons	Academic Center	Commons (& Senior Annex)	Career Center	Writing Center	Other Location
Males	26	○	13	1	4	1
Females	21	○	10	1	1	5

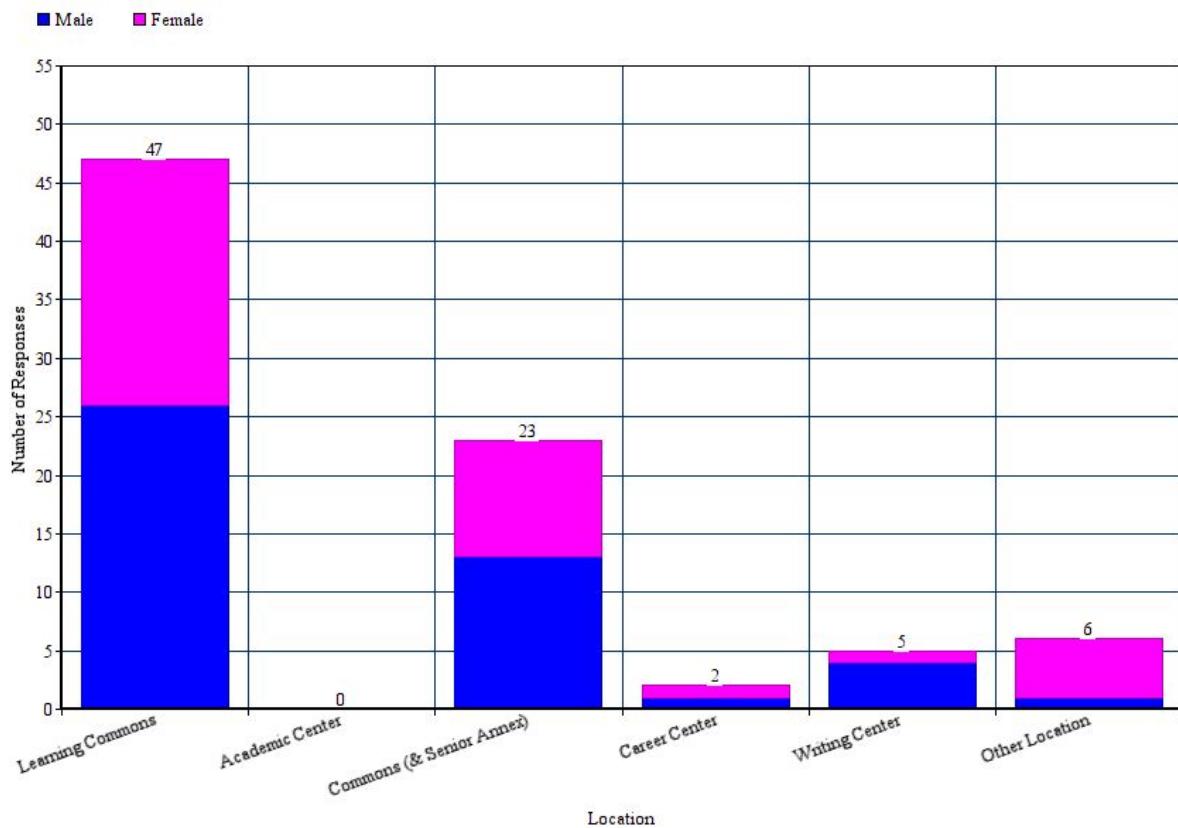
Where Do You Go For Study Hall? (Male)



Where Do You Go For Study Hall? (Female)



Where Do You Go For Study Hall?



## Chi - Square Test for Independence

### I. Hypothesis

$H_0$ : Gender and study hall location are independent of each other.

$H_a$ : Gender and study hall location are not independent of each other.

### II. Assumptions and Conditions

Counted Data Condition: There are counts of individuals for two categorical variables: gender and study hall location.

Independence Assumption

Randomization Condition: We were given that a SRS was used. Therefore, we believe this sample is representative of the population.

Sample Size Assumption

Expected Cell Frequency Condition

Observed Counts	[ 26 0 13 1 4 1 ]	Expected: [ 25.482 0 12.470 1.084 2.711 3.253 ]
	[ 21 0 10 1 1 5 ]	[ 21.518 0 10.530 0.916 2.289 2.747 ]

There are not at least 5 expected values in each cell.

We cannot run a chi-square test for independence because the chi-square statistic is undefined.

## TASK 5: SURVEY TECHNIQUE ANALYSIS

### Reducing selection and response biases

In order to reduce selection bias, we selected students from a list of all of the JBHS 2018 seniors using an SRS. Because all of the students from the senior class were from the list that the SRS, no student had a different chance of being selected than any other.

To reduce response bias, we reviewed the questions in the survey before it was sent out to try and change any language that we thought favored one answer choice over another. Students were also instructed to inform the survey respondents that they were allowed to leave their surveys anonymous and submit the answers directly to Mrs. Sopko's mailbox so that the surveyor could not see his or her responses. These measures were taken to avoid giving the responder any embarrassment or other pressure that would cause them to provide false responses.

Despite our efforts to reduce response bias, there was still problems with the wording of the survey that was sent out that caused inconsistencies between responses. For example, one of the responses to the question, "How many schools did you apply early?" was: "all." We should have specified that a numerical answer should have been inputted. Similarly, one answer for the question "What is your favorite number?" was: "Well, on Saturday it is 10 because I like that number, but on most days of the week is 1

cause I'm the best ever. No one can stop me. But overall my favorite number is 10, so yes 10." While this does give a number (10), it clearly is not a simple, numerical answer we were looking for and takes some time to interpret. All of the categorical questions had an "other" option for everyone that did not fit into the categories provided, but the quantitative questions that did not apply to all students (e.g., "What time is your curfew on weekends?" for students who do not have curfews or "What year is the car that you drive to school most often?" for students who do not drive to school) were missing "other" options. Students sometimes replied "I don't know," "other," "don't drive," "N/A," "don't have one," "when I want," etc., complicating the analysis of the results. Lastly, we should have standardized the inputs for the quantitative survey questions by specifying exactly how numbers should have been formatted, such as military time or hours. Arbitrary results such as "12" or "8" may mean either A.M. or P.M. time, and for some the sleep question, some people answered in minutes while the majority answered in hours.

#### *Nonresponse bias*

To reduce nonresponse bias, AP Statistics students were tasked with delivering their surveys to their intended recipients and follow up to make sure the survey was completed. Even though not all of the students were able to personally deliver the surveys to their recipients, the majority were able to reach the survey respondents via other students or other means.

Question	Number of Recorded Responses	Number / % of Nonresponse
What is your main writing utensil?	82	14 / 14.6%
What brand of macaroni and cheese do you prefer?	82	14 / 14.6%
On average, how many hours do you sleep per night on school nights (Sunday-Thursday)?	81	15 / 15.6%
On weekends, what time is your curfew?	82	14 / 14.6%
Where do you most frequently go for study hall?	83	13 / 13.5%
How many schools did you apply to early (early action/early decision)?	84	12 / 12.5%
What type of chocolate do you prefer?	85	11 / 11.5%
On average, how many hours on a school night (Sunday – Thursday) do you spend on homework? Studying included.	83	13 / 13.5%
What is the year of the car you drive to school most often? (students)	86	10 / 10.4%
What is the year of the car that you drive to Barlow most often? (staff)	91	54 / 37.2%

How many AP courses will you have taken by the end of high school?	83	13 / 13.5%
How many cars do the people you live with own?	83	13 / 13.5%
What is your favorite number?	82	14 / 14.6%

Of the 96 student surveys, we had an average of 13.5% nonresponse (an average of 13 missing responses), and 37.2% nonresponse for the single-question staff survey. There was also some variation between the number of responses in the student surveys (presumably human error from the data collation), ranging between 81 and 86 recorded student surveys for each question.

In other words, about 6/7 of the responses for students were collected, so that we are confident with our results because a large majority of the responses were collected. However, because the data does not indicate which individuals were not reached, it is difficult to interpret if certain parts of the student population may have been underrepresented and how that might have affected the results, and therefore we are not completely confident with our results.

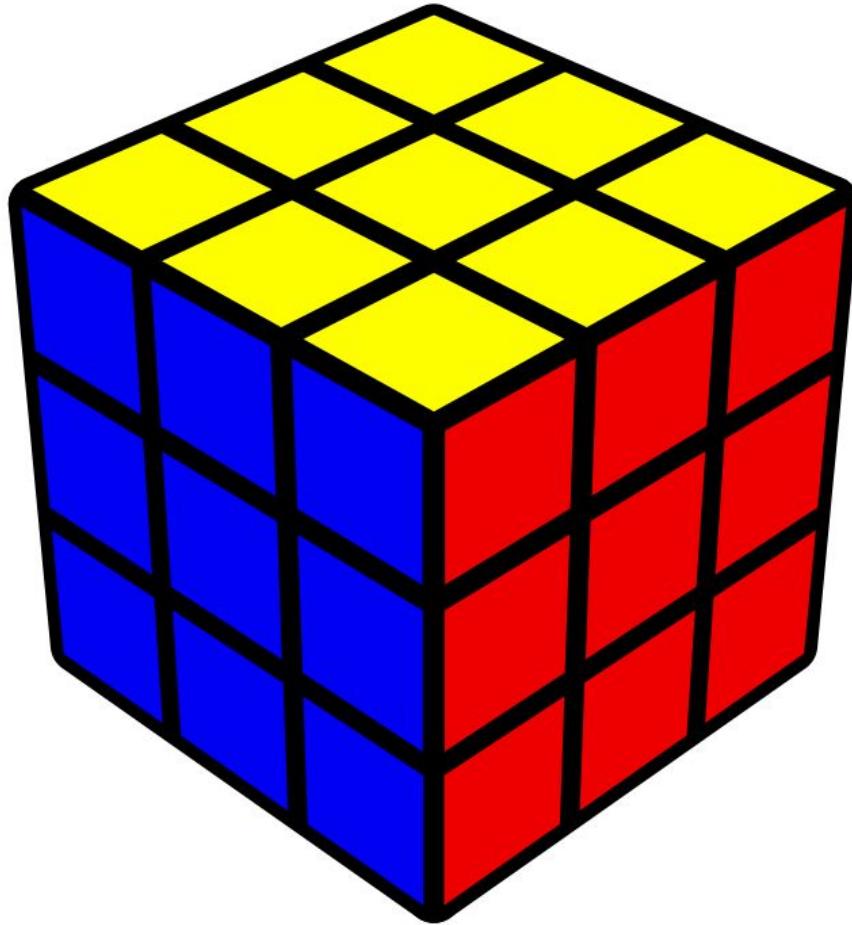
The students had no control over the staff survey, which was sent out by email and prone to voluntary response bias. The high nonresponse (over one-third nonresponse) indicates that we cannot strongly trust the results of the survey.

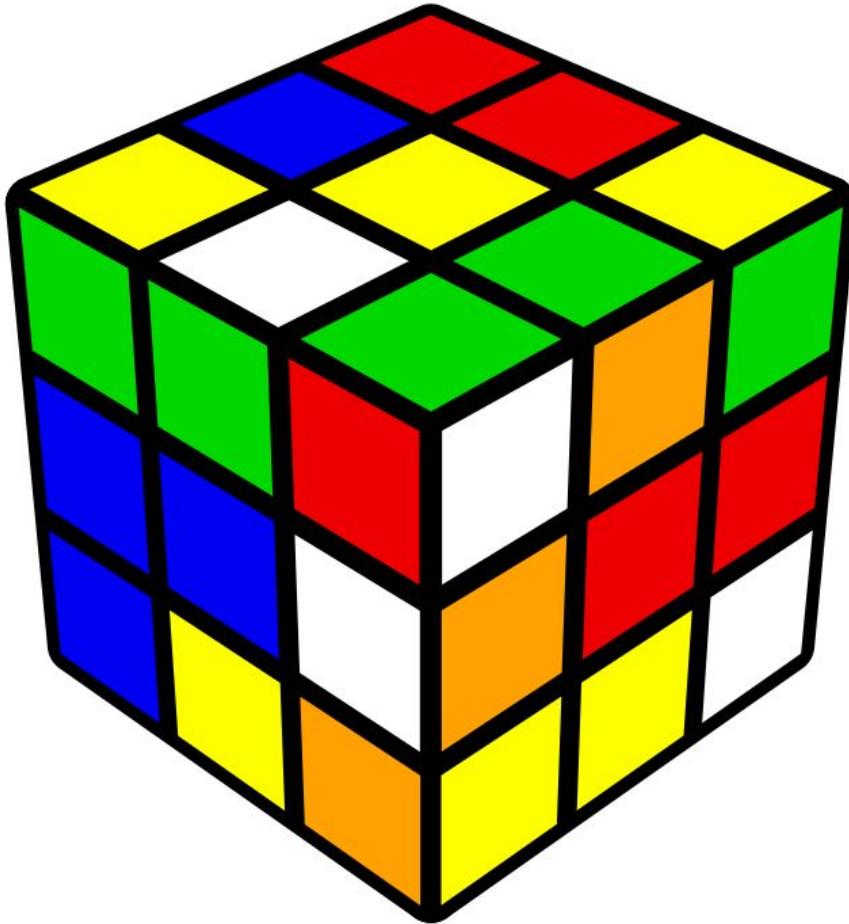
#### *Validity of the survey and improvements*

Because we collected a large portion of the responses (with 13.5% nonresponse) for the students and carried out necessary measures to try and reduce nonresponse and response bias, we are pretty confident in the results of the student survey. There is error in the collation of the results and there may be underrepresentation of some parts of the student population, but the fact that we collected the majority of the surveys and had mostly interpretable responses means that the conclusions drawn are mostly valid.

One step to fix the some of the response bias by indicating the type of response (i.e., time to the nearest hour, numeric value, etc.) and covering all possible cases to receive more homogeneous, usable results.

For staff surveys, because of the high voluntary response bias, the same cannot be said. A better approach would have been to follow up with the survey respondents, either by repeated emailing or in person, to make sure the survey was filled out.





# STATISTICAL ANALYSIS OF THE TIMES OF DIFFERENT RUBIK'S CUBE SCRAMBLERS

Jonathan Lam

# 1

THE PROJECT

# PROJECT OVERVIEW

- Rubik's cube solving is fun
- Speed-Rubik's cube solving is more fun
- “Scramblers”: programs that provide a random scramble, time the solve, and more
- Focusing only on the scrambles -- is there a difference?

D L' F2 B' U2 D B U L F B' R B U D R' U L' D L'



□ . □ □



**Ruwix**

Times Statistics Graph Scramble

Scramble type: 3x3x3 random state: ready Scramble length: Session: Home

Scramble: L2 R2 D2 B2 D' R2 B2 U2 F2 D' R' B L2 B' U' R B' U' L' get last scramble

show timer options ready that time was: no penalty +2 DNF | leave comment

times (last-import): state: (idle) number of times: 0/0 best time: 0.00 worst time: DNF session avg: DNF (g = -1.00) session mean: DNF

CFOP F2LOLL PLL Solver Simulator

Scramble type: 3x3x3 random state: ready Scramble length: Session: Home

Scramble: L2 R2 D2 B2 D' R2 B2 U2 F2 D' R' B L2 B' U' R B' U' L' get last scramble

show timer options ready that time was: no penalty +2 DNF | leave comment

times (last-import): state: (idle) number of times: 0/0 best time: 0.00 worst time: DNF session avg: DNF (g = -1.00) session mean: DNF

qqTimer

WCA 3x3x3 last/next scramble

R2 F2 L2 D2 F' D2 F2 D2 L2 F2 U R B2 D' R' B L R' B2 U2

0.00

ao5: - ao12: - csTimer

Session 1 current best time - solve: 0/0 mean: DNF time ao5 ao12

# SCRAMBLERS

**cubetimer.com**

00:00.00

A free, online Rubik's Cube Timer for speedcubing. Hit your **Stopwatch** to start/stop. Click here for more info.

See More

AdChoices 3x3 Cube Cube 8 Speed Cube Rubik's Cube Timer Videos | Links | Email Me!

Scramble: R2 F2 U2 D2 B2 L2 R2 D2 F2 B2 U2 R2 D2 B2 L2 R2 D2 F2 R2 U2 D2 B2 R2 D2 F2 U2 D2 R2 L2 F2 R2 U2 D2

Average: ~0.00 Best: ~0.00 Avg R: ~0.00 Best R: ~0.00 Avg B: ~0.00 Best B: ~0.00 Avg L: ~0.00 Best L: ~0.00

Inspection Timer: 0s inspection play sound after inspection

L2	F	L2	B	R
U'	L	R'	D	R2
B2	L	U2	R2	U'
L2	B'	R'	D	U2
B'	L'	R'	B'	D'

New Scramble

mine

3x3x3 08/04/2017

Solves: 12/12 Current: 29.03

	Time	Ao5	Ao12
Mo3	27.93	21.37	
Ao5	25.11	21.59	
Ao12	24.51	24.51	
1	21.41	-	-
2	25.05	-	-
3	28.21	-	-
4	24.94	-	-
5	19.83	23.80	-
6	25.98	25.32	-
7	24.35	25.09	-
8	20.58	23.29	-
9	19.19	21.59	-
10	26.18	23.64	-
11	28.57	23.70	-
12	29.03	25.11	24.51

Block Keeper

0.00

Drawn Scramble

# 2

THE PLAN

# PROJECT PLAN

- time myself using scrambles from the scramblers
- create t-intervals for the times for every scrambler (6 tests)
- create t-tests for the difference of means between every two scramblers (15 tests)
- run a chi-square homogeneity test on the times (1 test)

# DATA COLLECTION

1. generate and save 50 random scrambles from each source
2. write a program that shows me a randomly chosen scramble of all the random scrambles (but don't show the scrambler)
3. time the scramble, and save with the others from the same scrambler
4. repeat 2 & 3 until all scrambles are exhausted

```

let fs = require('fs');
// source: https://stackoverflow.com/a/12506613
var stdin = process.stdin;
stdin.resume();
stdin.setEncoding('utf8');
// on any data into stdin
stdin.on('data', function(key) {
  // ctrl-c ( end of text )
  if(key === '\u0003') {
    process.exit();
  }
  // if 'd' (delete) is pressed in state 2, delete last scramble
  if(key === 'd'\u000a' && state === 2) {
    state = 0;
    REPEAT! (x300)
    console.log('time not saved');
    generateScramble();
  }
  // when enter is pressed change state
  if(key === '\u000a') {
    switch(state) {
      case 0: startTimer(); break;
      case 1: endTimer(); break;
      case 2: saveTime(); break;
    }
    state = (state + 1) % 3;
    if(state === 0) {
      generateScramble();
    }
  }
});
// source: https://stackoverflow.com/a/34970550
function clock(start) {
  if(!start) return process.hrtime();
  var end = process.hrtime(start);
  return Math.round((end[0]*1000) + (end[1]/1000000));
}
// get data
let data = require('./scrambles.js');
// timer code
let state = 0, start, duration;
/**
 * state = 0 means waiting to start
 * state = 1 means timer running
 * state = 2 means waiting to save
 */
// start timer by beginning the duration
let startTimer = () => {
  start = clock();
  process.stdout.write('time started');
};

// end timer by getting duration and printing out the time
let endTimer = () => {
  duration = clock(start);
  process.stdout.write(duration/1000 + '\n[d]elete? ');
};

// save time
let saveTime = () => {
  // get scramble, remove from scrambles array
  let scramble = data[scramblerIndex].scrambles.shift();
  // save scramble locally
  if(data[scramblerIndex].solved === undefined) {
    data[scramblerIndex].solved = [];
  }
  data[scramblerIndex].solved.push({
    scramble: scramble,
    duration: duration,
    date: new Date().getTime()
  });
  // save scramble in file
  fs.writeFile('./scrambles.js', `module.exports = ${ JSON.stringify(data, null, 2) }`, e => { if(e) throw e });
};

// get a scramble and generate first scramble
let scramblerIndex;
let generateScramble;
(generateScramble = () => {
  // disregard data with zero scrambles left
  let filteredData = data.filter(scramblerData => scramblerData.scrambles.length > 0);
  // choose random scrambler
  scramblerIndex = data.map(scramblerData => scramblerData.name).indexOf(filteredData[Math.floor(Math.random() * filteredData.length)].name);
  // display the first scramble from the chosen scramble
  // format it so that multiple spaces are replaced with one
  process.stdout.write('\n' + data[scramblerIndex].scrambles[0].replace(/\s+/g, ' ').trim());
})();

```

display only  
the  
scramble

save time with  
scrambler

# THE TIMER

(the code)

choose  
random  
scrambler

Scramble: D R' B F2 R2 B2 F' R2 L U' R2 D2 B D2 R F2 L' F' R2 F L2 F B2  
U' F2

Time: 15523ms

Scramble: B2 D' L' U B' F2 R' U D2 L' F' L2 D' L2 B2 R' B' F D2 F D2 L'  
B R2 B2

Time: 17232ms

Scramble: R2 B' F2 D2 F L2 F2 R' L F2 B D F' U2 L U F2 B2 U' F R2 D2 B2  
U' F'

Time: 18951ms

(never see the scrambler name)

**THE TIMER**  
(what I see)

# 3

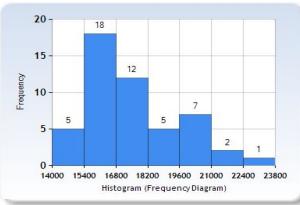
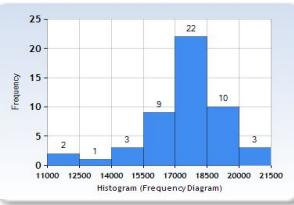
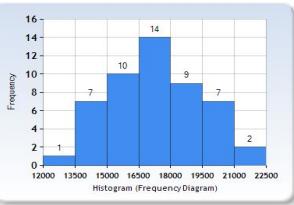
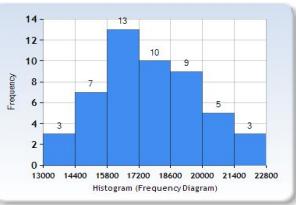
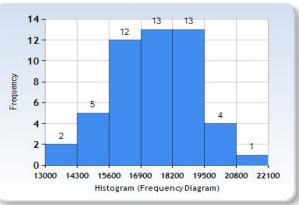
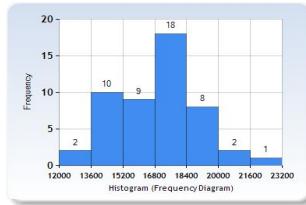
THE DATA AND MECHANICS

# DATA!

Ruwix	18508,19802,17046,12521,18110,17893,16111,17069,17811,14780,14944,15219,20841,16004,17548,19191,14331,14776,17776,17123,17984,17215,14821,14770,12088,18092,18179,13888,22141,18938,15704,16224,18208,14658,14350,18574,18810,19963,16436,14500,21465,18031,17063,19094,15328,16286,15715,17755,17998,17604
csTimer	21527,16090,16121,19067,17365,18176,16230,13369,17076,16649,18205,18043,19348,18390,18334,19616,19657,15319,16353,20489,18003,18602,17336,16294,17735,16670,18778,18555,14278,19161,17545,14921,15945,18167,16978,19787,18878,14813,19291,18950,16926,19277,17019,15470,16235,16623,15361,16139,17711,16456
cubeTimer	18051,19179,18005,14741,20726,19110,13744,17996,16158,17187,22304,17786,18730,19133,22709,15167,19869,16951,16905,15419,16529,17316,19639,16158,14825,13578,21659,15330,19667,15204,20024,20110,17446,17789,18866,16285,15482,17974,20252,20272,16958,17890,16646,16467,14249,17620,16699,19422,16272,16081
qqTimer	15729,18207,20934,21946,18151,17069,16971,15961,18737,16747,15408,12117,17421,15869,17921,16822,17264,18474,18957,19981,15945,17518,19506,18419,16927,19694,18598,15437,19704,17467,21481,15787,20975,14805,13865,19977,14706,17047,15269,14936,15469,15004,19174,17509,14299,13731,19007,14588,17806,17094
mine (not random-state)	18420,16905,16975,15965,17225,18394,17735,17775,18876,17204,16659,16195,19714,13781,20146,11272,17098,18932,16824,14985,11582,18306,18847,17926,20014,17515,17821,19039,18209,18175,18256,17568,18138,17163,18183,17417,18746,16646,19844,18196,20750,14874,16419,19052,19719,17708,17656,15323,18823,16642
Block Keeper	23602,16596,15674,17163,16388,18423,21041,16706,17744,19304,16912,14614,20829,17385,17940,19439,17417,16498,15714,21015,14795,15851,15100,14681,16667,17756,15847,16835,16131,15535,16776,16781,16811,19857,16595,19413,17219,19623,15677,20465,20264,16371,20363,18883,16008,14491,16727,20183,17227,17797

# DATA!

Scrambler	Mean	SD	Outliers/Gaps/Skew?
Ruwix	16985.72	2149.81	
csTimer	17466.56	1685.43	
cubeTimer	17651.58	2158.61	
qqTimer	17248.60	2174.67	
mine (not random-state)	17512.74	1880.30	three left outliers
Block Keeper	17542.66	2021.24	slight skew right



# T-INTERVAL (RUWIX, 95% CONFIDENCE)

## Conditions

- Independence assumption: It can be assumed that the times of different solves are mutually independent of one another.

# T-INTERVAL (RUWIX, 95% CONFIDENCE)

## Conditions

- Independence assumption: It can be assumed that the times of different solves are mutually independent of one another.
- Randomization condition: The scramblers were randomly assigned by a program.

# T-INTERVAL (RUWIX, 95% CONFIDENCE)

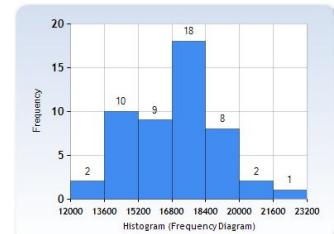
## Conditions

- Independence assumption: It can be assumed that the times of different solves are mutually independent of one another.
- Randomization condition: The scramblers were randomly assigned by a program.
- 10% condition: 50 solves is less than 10% of all possible scrambles using this scrambler.

# T-INTERVAL (RUWIX, 95% CONFIDENCE)

## Conditions

- Independence assumption: It can be assumed that the times of different solves are mutually independent of one another.
- Randomization condition: The scramblers were randomly assigned by a program.
- 10% condition: 50 solves is less than 10% of all possible scrambles using this scrambler.
- Nearly Normal condition: A histogram of the data appears nearly Normal (unimodal and roughly symmetric), and the sample size is large.



# T-INTERVAL (RUWIX, 95% CONFIDENCE)

## Mechanics

$$\bar{x} = 16985.72$$

$$df = n-1 = 49$$

$$t_{49}^* = 2.0095$$

$$SE = SD/\sqrt{n} = 2149.81/\sqrt{50} = 304.03$$

$$CL = \bar{x} \pm t_{49}^* \times SE = 16895.72 \pm 2.0095 \times 304.03 = (16284, 17172)$$

# T-INTERVAL (RUWIX, 95% CONFIDENCE)

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$$df = n-1 = 49$$

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$$SE = SD/\sqrt{n} = 2149.81/\sqrt{50} = 304.03$$

$$CL = \bar{x} \pm t_{49}^* \times SE = 16985.72 \pm 2.0095 \times 304.03 = (16374, 17596)$$

## Interpretation

We are 95% sure that the true mean for my solves using a scramble from the Ruwix scrambler is between 16.374 and 17.596 seconds.

# 95% CONFIDENCE T-INTERVALS (SUMMARY)

Ruwix: (16374, 17596)

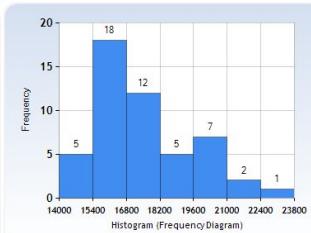
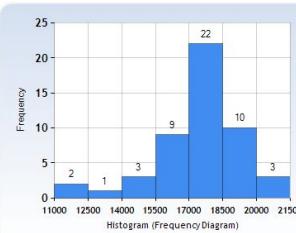
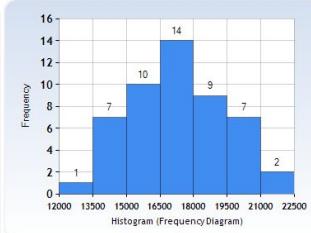
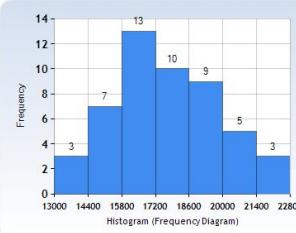
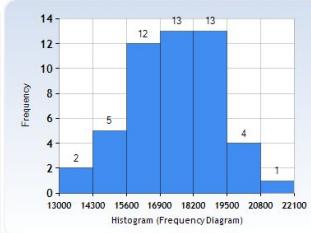
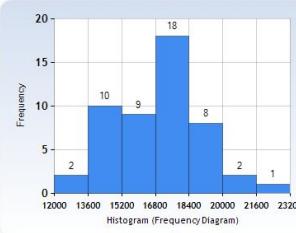
csTimer: (16988, 17946)

cubeTimer: (17038, 18265)

qqTimer: (16631, 17867)

mine: (16978, 18047)

Block Keeper: (16968, 18117)



# T-TEST FOR THE DIFFERENCE OF MEANS

## Hypotheses:

Null Hypothesis ( $H_0$ ): There is no statistical difference between the means of the solve times of Ruwix and csTimer scrambles.

Alternate Hypothesis ( $H_A$ ): There is a statistical difference between the means of the solve times of Ruwix and csTimer scrambles.

# T-TEST FOR THE DIFFERENCE OF MEANS

## Conditions:

Independence Assumption (already checked)

Nearly Normal Assumption (already checked)

Independent Groups Assumption: The times from one scrambler are independent of the times from another scrambler.

# T-TEST FOR THE DIFFERENCE OF MEANS

## Mechanics:

$$\bar{x}_1 = 16985.72; \bar{x}_2 = 17466.56; \bar{x}_1 - \bar{x}_2 = -480.84$$

$$df = 92.72 \text{ (from calculator)}$$

$$SE(\bar{x}_1 - \bar{x}_2) = \sqrt{(\text{var}(\bar{x}_1)/n_1 + \text{var}(\bar{x}_2)/n_2)} = \sqrt{(2149.81^2/50 + 1685.43^2/50)} = 386.33$$

$$t_{92.72} = (-480.84 - 0) / 386.33 = -1.244$$

$$p = P(t_{92.72} < -1.244 \cup t_{92.72} > 1.244) = 0.2164$$

# T-TEST FOR THE DIFFERENCE OF MEANS

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$$t_{92.72} = (-480.84 - 0) / 386.33 = -1.244$$

$$p = P(t_{92.72} < -1.244 \cup t_{92.72} > 1.244) = 0.2164$$

## Conclusion:

Since the p-value is greater than the alpha-level of 0.05, we fail to reject the null hypothesis. Therefore, there is no evidence of a statistical difference between the means of the Ruwix and csTimer solve times.

# T-TEST FOR TWO MEANS (SUMMARY)

Ruwix vs. csTimer	$t = -1.245$ $p = 0.2164$	csTimer vs. Block Keeper	$t = -0.2044$ $p = 0.8384$
Ruwix vs. cubeTimer	$t = -1.545$ $p = 0.1255$	cubeTimer vs. qqTimer	$t = 0.9300$ $p = 0.3547$
Ruwix vs. qqTimer	$t = -0.6079$ $p = 0.5447$	cubeTimer vs. mine	$t = 0.3429$ $p = 0.7323$
Ruwix vs. mine	$t = -1.305$ $p = 0.1951$	cubeTimer vs. Block Keeper	$t = 0.2604$ $p = 0.7951$
Ruwix vs. Block Keeper	$t = -1.335$ $p = 0.1851$	qqTimer vs. mine	$t = -0.6497$ $p = 0.5174$
csTimer vs. cubeTimer	$t = -0.4778$ $p = 0.6339$	qqTimer vs. Block Keeper	$t = -0.7004$ $p = 0.4854$
csTimer vs. qqTimer	$t = 0.5601$ $p = 0.5767$	mine vs. Block Keeper	$t = -0.07664$ $p = 0.9391$
csTimer vs. mine	$t = -0.1293$ $p = 0.8974$		

# CHI-SQUARE TEST FOR HOMOGENEITY

## Hypotheses

Null Hypothesis ( $H_0$ ): There is no statistical difference between the distributions of times between different scramblers.

Alternative Hypothesis ( $H_A$ ): There is a statistical difference between the distributions of times between different scramblers.

# CHI-SQUARE TEST FOR HOMOGENEITY

**Data** (re-expressed as categories)

Time (s)	Ruwix	csTimer	cubeTimer	qqTimer	mine	Block Keeper
11-14	12	4	5	8	5	4
15	4	4	5	10	2	7
16	5	13	12	4	8	15
17	13	7	9	10	13	9
18	9	12	4	7	14	2
19-23	7	10	15	11	8	13

# CHI-SQUARE TEST FOR HOMOGENEITY

## Conditions:

Counted Data Condition: The data are adjusted to be counts of different categories.

Randomization Condition: The data were randomized using the experiment.

Expected Cell Frequency Condition: The data had been modified so that there are at least five expected counts in every cell. Expected frequencies:

Times	Ruwix	csTimer	cubeTimer	qqTimer	mine	Block Keeper
11-14	6.33	6.33	6.33	6.33	6.33	6.33
15	5.33	5.33	5.33	5.33	5.33	5.33
16	9.50	9.50	9.50	9.50	9.50	9.50
17	10.17	10.17	10.17	10.17	10.17	10.17
18	8.00	8.00	8.00	8.00	8.00	8.00
19-23	10.67	10.67	10.67	10.67	10.67	10.67

# CHI-SQUARE TEST FOR HOMOGENEITY

**Mechanics:**

$$\chi^2 = 46.19$$

$$df = (r - 1)(c - 1) = 25$$

$$p = P(\chi^2 > 46.19) = 0.006109$$

# CHI-SQUARE TEST FOR HOMOGENEITY

## Mechanics:

$$\chi^2 = 46.19$$

$$df = (r - 1)(c - 1) = 25$$

$$p = P(\chi^2 > 46.19) = 0.006109$$

## Conclusion

Because the p-value is less than the alpha-level of 0.05, we reject the null hypothesis. Therefore, we have evidence to suggest that there is a statistical difference between the distributions of the times of different scramblers.

# CHI-SQUARE TEST FOR HOMOGENEITY

???

# CHI-SQUARE TEST FOR HOMOGENEITY

???

- ▶ **Beware large samples.** Beware *large* samples?! That's not the advice you're used to hearing. The chi-square tests, however, are unusual. You should be wary of chi-square tests performed on very large samples. No hypothesized distribution fits perfectly, no two groups are exactly homogeneous, and two variables are rarely perfectly independent. The degrees of freedom for chi-square tests don't grow with the sample size. With a sufficiently large sample size, a chi-square test can always reject the null hypothesis. But we have no measure of how far the data are from the null model. There are no confidence intervals to help us judge the effect size.

# TL;DR

**We (probably) didn't find any statistically significant results!**

Which means it doesn't matter which timer I use, because they don't make me faster or slower.

# TL;DR

**We (probably) didn't find any statistically significant results!**

Which means it doesn't matter which timer I use, because they don't make me faster or slower.

The end. Thanks for watching.

## Annotated Bibliography — English IV

Allen, Woody. "The Kugelmass Episode."

"The Kugelmass Episode" is a short story by Woody Allen about a man who ruins his life with a greedy passion for a more exciting life, a path that leads him further and further into lying until he meets his demise. The main idea is that one always has a better life in reality than one with unchecked pleasure. For example, while Kugelmass experiences a calm albeit uneventful life, his fairytale life with Emma Bovary results in "ruin and alimony; jail. For adultery with Madame Bovary, [his] wife will reduce [him] to beggary"; in the end, he even gets consumed by the calamity bound to happen by his messing with fate. The plot is somewhat analogous to that of *Hamlet*: Hamlet descends deeper and deeper into his revenge, hoping for a better opportunity to strike down King Claudius, but his closest friends around him die as he gets tangled further in his lies.

Atwood, Margaret. "Gertrude Talks Back."

Atwood's poem "Gertrude Talks Back" is a humorously literal response to a scene from Shakespeare's *Hamlet* that emphasizes the importance of unsuspecting characters in any plot. Atwood's Gertrude character cleverly portrays the differences caused by a change in perspective: amidst her husband's death and her new marriage, Gertrude is more concerned with the state of the "student slum pigpen in Wittenburg," laundry, or the "bloat king" insult to King Claudius— every event is registered differently from each person and therefore it can be told as a different story from each perspective. Hamlet assumes that the others around him interpret his father's death with the same horror as he does; Atwood's interpretation is that "it was [Gertrude]" who murdered King Hamlet, and Hamlet's assumption is fatally incorrect. Stephen Crane explores Man's incorrect assumption that the universe cares about every living purpose in "A Man Said to the Universe"— Crane asserts that any indication that our interest in the universe is clearly a unfound and not mutual, similar to Hamlet's assumption about Gertrude.

Burt, Stephens. "Why People Need Poetry."

Stephen approaches the meaning of poetry in his TED talk "Why People Need Poetry" from a very existential, practical perspective. His main contention is that, because of the inevitable fact that "we are all going to die" and it is not possible to capture every historical perspective, poetry fills in those gaps: specifically, it allows people "to remember something or someone, to celebrate or to look beyond death or to say goodbye," to have communication with other humans reach past physical barriers of time and space. An analogous example we explored in class is Gardner's response to Susie West, which demonstrates the kind of dialogue that poetic writing can have between the reader and the author that Burts talks about.

Camus, Albert. "The Myth of Sisyphus."

Albert Camus explores what goes on in Sisyphus's mind in his essay, "The Myth of Sisyphus." One interesting idea he declares is that "if this myth is tragic, then it is because the hero is conscious." No story is tragically meaningful if there is an unrealistic sense of hope around every corner, with no peep of reality found along the way; for Sisyphus, while there is the mindless act of pushing the rock up the hill, there is also the short, sweet moments when he watches the stone roll back down and he is free from his

toil, able to think freely. Camus argues that, as Sisyphus descends to his rock and has a moment to believe that he can control his fate, “he is superior to his fate.” This is very similar to what Christopher Nelson describes in his essay, “Barnacles: Liberal Education and the Art of Becoming Unstuck”: liberal education creates a spark of realization in people that their fate is still uncertain and that no person is doomed to the destiny of a mindless, barnacle.

Collins, Billy. “Everyday Moments Caught in Time.”

“Everyday Moments Caught in Time” is a humorous TED talk given by poet Billy Collins about the role of poetry versus video (visual media) as means of expression. A main idea of the talk is that poetry is not necessarily used to capture the boldest stories (like ardent love tales, Homer’s epics), but is rather an imaginative method of communication. He writes grammatically-correct poems, about everyday trivia such as “poetic amnesia,” the custom to “never … leave a box of wooden strike-anywhere matches just lying around the house,” and to get through “To [His] Favorite 17-Year-Old High School Girl.” This clearly contrasts with the style and theme of Ferlinghetti’s poem “Constantly Risking Absurdity,” which indicates that poetry, like acrobatics, ought to be risky by nature.

Collins, Billy. “Thesaurus.”

“Thesaurus” is a poem by Billy Collins that discusses the idea that no words are truly synonyms because of the unique, subtle connotations that every word carries. A corollary to this idea is that the most interesting and captivating word usage is when “weddings … between perfect strangers” take place—where exact and unexpected choice plays a role in creating original meaning—rather than the more ordinary “congregations with their relatives”—where synonyms make the text redundant. The slight connotations that come with different “synonyms” is an example of the use of *symbolic language* that Langer describes in “Language and Thought”—the “fine shades of meaning” between synonyms are unique ideas associated with each word that, when used effectively, greatly distinguish human language from that of other intelligent beings.

Crane, Stephen. "A Man Said to the Universe."

“A Man Said to the Universe” is a pithy poem bringing to mind a sense of universal indifference that is the root of so many people’s’ despair and perhaps the rise of nihilistic philosophies. The fact that a person’s existence does not register “a sense of obligation” to the universe means that existence does not automatically merit importance, so that no human is born more important than another; one must pave his own meaningful path that should not depend on the help of the universe or other greater consciousness; all a person can do create meaning locally, for themselves or others. The poem “Tell all the Truth but tell it slant—” implies that one meaningful way to live life is by the action of telling the truth, which contains an “infirm Delight” (Dickinson 3) that must “dazzle gradually \ Or every man be blind” (Dickinson 7-8); in other words, one way to live to create meaning for oneself and others is by teaching.

Crane, Stephen. "The Wayfarer."

“The Wayfarer” is a poem by Stephen Crane that illustrates that the path to truth is always inconvenient and perhaps even dangerous, which explains why many people choose an easier, alternate path (that presumably leads someplace other than truth). By realizing that the path to truth “was thickly grown with weeds,” and then on further inspection, “that each weed \ was a singular knife,” means that finding

truth becomes increasingly difficult as you ponder achieving it; truth is something that should be confronted honestly and without fear of the minor cuts and scrapes that come along the way. An interesting example of a character who has found truth is Gertrude in “Gertrude Talks Back”—she berates Hamlet for his insolence but also reluctantly reveals her own truth and can live without fear or shame; following Crane’s metaphor, it’s as if she ran down the path of weeds without even noticing that they were knives.

Dickinson, Emily. "Tell all the Truth but tell it slant--."

Dickinson’s succinct poem “Tell all the Truth but tell it slant--” warns people to always reveal the truth gradually to the audience, as if a sudden reveal of the truth could be dangerous “As Lightning to the Children.” Her metaphor concerning lightning means that the Truth, without “explanation kind” or “Circuit” (circular language), can easily overwhelm or be misinterpreted by a person and therefore put the listener in a worse situation than if they had not heard any part of the truth at all. This is represented in Mary Oliver’s “The Journey,” in which the pathway to truth is not instantaneous and overwhelming, but a gradual, difficult journey. However, in “The Journey,” the path to truth is portrayed more as an effort by the learner of truth than a teacher, as is suggested in Dickinson’s poem.

Ferlinghetti, Lawrence. “Constantly Risking Absurdity.”

“Constantly Risking Absurdity” is a poem likening the actions of a poet to those of an acrobat: skillful, precise, imperiling. A less-obvious aspect of both skills that Ferlinghetti emphasizes is that both must “perforce perceive taut truth” before advancing—in other words, that what a poet writes must be their certain truth, no manner of falsity within—and that every step taken with said truth goes towards “that still higher perch where Beauty stands and waits.” The last step to obtaining beauty is to master the “death-defying leap” she takes, still observing Truth all the while. Influenced by the Shaper, Grendel follows a similar path: he always searches for his own truth (whether that be from learning from the dragon, or from Wealtheow’s beauty, or from Hrothulf or Beowulf) and takes risks to attack the heroes as a component of his search for self-purpose.

Joyce, James. "Eveline."

“Eveline” is a short story in a collection called *Dubliners* by James Joyce about a tough decision to stay with her family and endure her sometimes-irrational father, or leave everything behind for her passionate love for her fiancé. A key theme is the confusion between the joys and horrors of freedom: toward the conclusion of the story she felt the wondrous “seas of the world” that she was going to travel with her sailor fiancé “would drown her”; that world of so many possibilities and uncertainty is less desirable than her current life, which was “a hard life — but ... she did not find it a wholly undesirable life.” In “Traveling Through the Dark,” Stafford also encounters a ethical problem to try and save the baby deer or not, but his decision did not have the influence of other witnesses to confuse him, and therefore his solution came much quicker and easier than Eveline’s.

Gardner, John. *Grendel*.

In Gardner’s novel *Grendel*, a monster undergoes a mental journey through various philosophies (from nihilism to Machiavellianism to the theories of various philosophers) based on his observations of the life of a civilization, causing phases of malice and restraint that allow the reader to redefine what it means to

be a monster. In this text, Gardner presents the idea that because “tedium is the worst pain” (138), challenge (whether it be friendly or fatal, like Unferth or Beowulf to Grendel) is *always* the better alternative to a boring, redundant life. This book relates to the TED talk “Why People Need Poetry” because it explains poetry’s role in bringing alive the perspective and emotions of people that are otherwise accessible; in *Grendel*, Grendel only begins to appreciate and feel more human emotions such as self-consciousness when he is influenced by the Shaper’s song.

Gardner, John. “Letter to Susie West.”

Gardner explains some of the misconceptions and acknowledges some of the correct assumptions that students in Susie West’s class wrote to him in letters about his novel *Grendel*, especially about the roles of certain characters in his novel. For example, he how he qualifies “David’s ... comment on man’s role as a theory maker,” in which he partially adds onto this idea, noting the evil of “justifying one’s behavior because it makes other people better” (i.e., a Devil’s Advocate) but also the benefit that “man can only learn control of nature and himself by making up theories” — a two-sided, more complex, truer claim than David’s original one. Showing Gardner’s knowledgeable perspective on his book is similar to Tom Matriq’s video, “What is Truth?”: much of what the students say is true, but Gardner (who is the character with a greater sense of truth) can always clarify or qualify the student’s claims, bringing them closer to the truth.

Heaney, Seamus. “Blackberry Picking.”

Seamus Heaney’s poem, “Blackberry Picking,” is the sad reality of a poor blackberry farmer, who is faced with a rotting harvest. Heaney creates a drastic juxtaposition in the phrase “lovely canfuls smelt of rot” that exemplifies the theme of the poem: that the blackberries, whose “flesh was sweet” was so easily destroyed by “a rat-grey fungus,” that the sweetest things can most quickly turn sour. Seamus’s concluding realization that “I hoped they’d keep, knew they would not” directly contrasts with O’Brien’s view of “truth” — in the farmer’s case, the rotting is a simple and direct truth, and he decides to express it so, unlike O’Brien. This makes O’Brien’s prose seem a romanticization of the truth, and that a cold, bare tragedy has a similarly numbing, but perhaps more hopeless, effect.

“Interview with Tim O’Brien.”

In his interview, Tim O’Brien offers some answers about the real history of the stories in his book and how he came at some of the fictional experiences that appeared. The large majority of his story did not really happen, to the surprise of the interviewers. This interview is important because it shows much of O’Brien’s motivation to write the book: he says that “wars are no longer coming into our living rooms in the way Vietnam once did ... Our current wars seem almost sanitized” -- in other words, he felt compelled to write about a sensitive topic simply by the merit that it was important to him and that his view wasn’t widely known. While this might seem a bit obvious, it is the kind of narrow focus that Mary Oliver emphasizes in her poem “The Summer Day,” in which she writes about human’s purpose in nature because that is her deep, under-published concern.

Kipling, Rudyard. “If.”

“If” is a practical piece of advice, presumably given from a parent figure to his or her child at an adolescent stage, written by Rudyard Kipling. It warns the child mostly to be able to tolerate the many

difficulties that may come their way with moderation. For example, the child should know both to “trust yourself” (3) and “make allowance for … doubting too” (4), and “dream-- and not make dreams your master” (9); balance is key, and a person should never learn to go completely one way or the other on the spectrum of trust, dreams, or any of the other emotions Kipling advises. This poem brings into mind Gregory Orr’s poem, “Like Any Other Man,” because Orr presents two extreme situations (vulnerability and aggression) that humankind always has to balance between.

Langer, Susanne K. “Language and Thought.”

“Language and Thought” is an essay by Susanne Langer exploring the role of language in distinguishing human intelligence from other forms of intelligence by the human ability to interpret “symbols” as opposed to simple “signs.” An interesting point that Langer makes is that humans have not only the gift for this elevated sense of intelligence, but we have “a biological need … the constant need of *conceiving*” (2) what happens, and that this process of constant expression begins as soon as a person begins to dream. This explains the motive behind writing poetry based on commonplace events such as those by Billy Collins in “Everyday Moments Caught in Time”— he finds obligation to write about these subjects because of this fundamental need Langer describes.

Matriq, Tom. “What is Truth?”

Tom Matriq explores the definition of truth through a hypothetical situation that exposes that no truth is absolute. He studies a situation in which “no one is lying,” and yet most of the people are incorrect — an apparent paradox that he explains with the concept that no truth is truly absolute but always relative to the information given, because there is always some aspect that can be more true (e.g., a two-colored ball, lighting, etc.). This relates to Nelson’s “barnacles”— a person without the open-mindedness to pursue a liberal education by studying more knowledgeable people and discovering that there is always a higher degree of truth. It also relates to Plato’s Allegory of the Cave, in which the reality of the chained people are the shadows, and they have no way to tell that their reality is only a limited sense of the reality of the people casting the shadows.

Mueller, Lisel. “Things.”

“Things” is a poem describing human nature’s tendency to attribute human qualities to nonhuman items to make them more appealing to everyday life. A main idea Mueller presents us that humans subconsciously attribute different human characteristics to (i.e., personify) objects based on context: people may personify furniture to be more amiable when “[they] grew lonely” (1); may personify dull objects because “[they] loved graceful profiles” (12); and give scarier notions such as caves and storms human characteristics “so [they] could pass into safety” (20). This sort of context-aware reasoning is not present in Collins’s poem “Thesaurus,” in which words are mechanically assigned synonyms, often ignoring subtle connotations (i.e., context).

Nelson, Christopher B. “Barnacles: Liberal Education and the Art of Coming Unstuck.”

“Barnacles: Liberal Education and the Art of Coming Unstuck” is an essay describing the effects of a lack of a so-called “liberal education”— i.e., an education by exemplars. It argues that barnacles refused to get “scraped” because they forget “how much more is possible, how spacious and open life can be” because being a barnacle simply and “effectively solves many of life’s problems, like where it’s going to

sleep, how it's going to get food, what it should do during the day, or whether it should visit its relatives." In other words, barnacles become self-content with automatically making easy decisions in life that they forget what it means to challenge themselves. This idea of tedium relates to "Things" by Lisel Mueller, because people tend to generalize objects and forget to carefully observe every object as they come, much like how barnacles forget the joy of overcoming every obstacle as a challenge.

O'Brien, Tim. *The Things They Carry*.

The Things They Carry is a very compelling series of "true war stories" written about fabricated experiences of the Vietnam War. A major conviction of O'Brien's is that there is a difference between "happening-truth" and what is actually true: in fact, the entire premise of the novel is that it is not written about real events but instead about events that O'Brien created to recreate the true experience, because "in war you lose your sense of the definite, hence your sense of truth itself, and therefore it's safe to say that in a true war story nothing is ever absolutely true" (78). This connects to Ferlinghetti's "Constantly Risking Absurdity," because in his poem "truth" is some beautiful, unreachable entity that must be obtained by making risky, non-practical, acrobatic tricks, far outside what usually happens ("happening-truth").

Oliver, Mary. "The Journey."

Mary Oliver's poem "The Journey" is the mental battle of a person who is enlightened by the truth, which is the ability to listen to one's inner voice and not depend on the opinions of others. A main point that Oliver makes is that finding truth is a purely individual feat, and that a person can only save "the only life that you could save," i.e., themselves. One cannot help the "voices around you \ [that] kept shouting \ their bad advice," but rather distance themselves from those negative pressures to save themselves. Eveline is a character who could not find the truth (i.e., isolate and listen to only her own voice rather than those of others); she tries to fulfill her mother's will to manage the home, her brothers' will to stay home, and her fiancé's will to find love, and is torn apart without knowing what *she* really wanted.

Oliver, Mary. "The Summer Day."

Mary Oliver's poem "The Summer Day" is a philosophical discussion on what it means to exist: what to observe, what to learn, what is worth the time. Because Oliver chooses to focus on a single grasshopper for the majority of the poem means that she wants to demonstrate that, to make the most of "[their] one wild and precious life," people should pay deep attention to the things that interest them, rather than spreading themselves on topics that don't interest them. Mary Oliver, who writes many thoughtful poems on nature, decides not to deviate from her focus of the grasshopper, "stroll[ing] through the fields," and "kneel[ing] down in the grass." The problem with this philosophy is that it always feels as though there is not enough time; stressful situations such as O'Brien's during the Vietnam War don't always allow for focus on important or interesting matter, so Oliver's poem is mostly relevant during free time.

Oliver, Mary. "Wild Geese."

"Wild Geese" is a poem by Mary Oliver that explores the idea of a person's purpose in a seemingly uncaring universe. Her thesis is that a person doesn't have to do any sort of universal good in their existence, but that they should simply be true to themselves and others, as she calls to the reader

soothingly, "You only have to let the soft animal of your body love what it loves. Tell me about your despair, and I will tell you mine." While this does not contradict the Universe's uncaring statement in "A Man Said to the Universe" by Stephen Crane, it adds a human level of understanding, that nature (the "sun and clear pebbles of the rain" and the "wild geese") may never understand the philosophical, existential predicaments of Man and that it is not our purpose to have other beings understand.

Orr, Gregory. "Like Any Other Man."

Gregory Orr's poem, "Like Any Other Man," is a short poem about the apparent paradox of human nature's vulnerability. He states that every man inherently has "a knife in one hand" and a (likely self-inflicted) "wound in the other," signifying that Man realizes the danger of using violence as a means of solving problems but refuses to stop using it. This idea contributes to the sort of careless, nihilistic air in Mary Oliver's poem, "Wild Geese," in which she begins with "You don't have to be good": the knife is a problem for Man but not something that will affect the universe's general intentions.

Sandburg, Carl. "They All Want to Play Hamlet."

"They All Want to Play Hamlet" is a poem by Carl Sandburg about the allure of playing the role of Hamlet in the play. It has a theme of irony, because the people who want to play Hamlet do not truly understand what it means to "see their fathers killed" or "their mothers in a frame-up to kill," but they want the role because they want to recite the "slow wise, keen, beautiful words" that gives Hamlet's role such a sagacious feeling. This directly contrasts with how Mary Oliver proposes that people should live their lives in her poem "Wild Geese," "let[ting] the soft animal of your body love what it loves" and "tell[ing] about your despair." Because it is likely that no person has gone through the same combination of love and despair as Hamlet, no person can ever accurately portray the role of Hamlet.

Shakespeare, William. *Hamlet*.

Shakespeare's play *Hamlet* is a play about the tragedy that ensues when revenge based only on passion and honor is sought. One theme is the distribution of a person's trust and loyalty: Hamlet's is clearly allocated to a greater degree to his close friends than his family, and this causes both his family's destruction and his own. Especially strong is his dislike and disconnect with his mother, for who he believes "a beast, that wants discourse of reason, \ Would have mourn'd longer [after her husband's death]" (1.2.153-154). Kugelmass is alike to Hamlet in this manner, and from this comes his downfall: his trust of Persky and magic become greater than his love to his wife, to the point that his quality of living in reality diminishes to untrust and depression.

Stafford, William. "Traveling Through the Dark."

This poem by William Stafford recounts a quick decision made by the narrator to end the unborn foal's life to save it further complication and misery: an ethical choice. It brings to mind the level of interaction between Man and Nature in a modern context: purely pragmatical. His decision to throw the doe and its unborn child is based on the fact that "to swerve might make more dead" and that it was late at night with no help nearby; he might have been able to save the infant deer by contacting professional help, but he takes the convenient route of removing the deer from the road. There is a contrast between this logical approach and that of Man against other Men, such as in "The Charge of the Light Brigade"—

people sometimes charge almost towards certain death for sometimes very simple or illogical contentions, honor and loyalty; interactions with Nature are often more thoughtful.

Stromme, Craig J. "The Twelve Chapters of Grendel."

"The Twelve Chapters of Grendel" is an analysis of the different philosophies that Grendel discovers in different parts of John Gardner's novel *Grendel*. The important takeaway is that Stromme explains that the philosophies are not "presented in a uniform format," as they are not concrete, systematic ways of thinking; instead, each philosophy is part of a "search ... for the best way to live in the world," and Grendel's ability to completely switch philosophies makes his life a very dynamic one. Also interesting is how he can house multiple philosophies at once, sometimes even conflicting ones (e.g., that human beauty is something both sacred and laughingly trivial), makes him realize that no philosophy is the entire truth, as Tom Matriq suggests in his video "What is Truth?"

Tennyson, Alfred Lord. "The Charge of the Light Brigade."

Alfred Lord Tennyson's poem "The Charge of the Light Brigade" is a dramatic depiction of the bravery of soldiers who were misled in the Battle of Balaclava, resulting in high casualties due to the soldiers' fidelity even in the face of a low chance of survival. This in turn leads to the main idea that the level of heroism the soldiers exhibit is directly correlated with the ability to follow orders against their instincts: because their military commands were absolute and it was "Theirs not to make reply, \ Theirs not to reason why, \ Theirs but to do and die," the soldiers are branded with a mark of heroism. This relates to the prickly path to truth that is expressed in Stephen Crane's "The Wayfarer": because attaining truth through a path of weeds or knives is dangerous, it usually happens by the unwilling, torturous walk prompted by the encouragement and support of friends and family.

## The Truth Exercise: Living Life at a Target Intensity

English IV Final Synthesis

## Abstract

A truth is a way of living: a rule that a person truly believes and uses to govern his or her life. Therefore, it is important that a person develops new truths to advance in life, especially in difficult times. However, while human nature directs worry-free people to be more open-minded to other peoples' opinions and people afflicted with a crisis to shrink into a reclusive state, this is actually the opposite of how a person should act. It's important that people should strive to develop their own opinions independently of others as often as possible, when they are not under adverse emotional, physical, or intellectual stress that would affect the process of developing truths. During a difficult time, it is important to reach out to close people and have them instill truths unto the person in need. The latter case is not as productive as the first in terms of creating original understandings of the world, but it is necessary to avoid overwhelming the brain. It then follows that the best time to discover new understandings for oneself are in times of "trained crisis," when the person has built up the mental forbearance to cope with a repeated, stressful environment.

This paper aims to develop a mindful, optimal way of living, in which a person makes the most of their mental capacity by consciously weighing the words of themselves against those of the people around them.

## The Truth Exercise: Living Life at a Target Intensity

*A discussion of truth.*

In the modern world, truth is not so important. Everyday courtesy (“How was your day?” or “I like your shirt!”) are often mere words with little intent behind them, and white lies run abundant to save the trouble of long explanations. When something is said to be “true,” it often means that it has a basis in indisputable STEM theories or in historical events.

But in the broader sense, truth is something that a person believes or knows most strongly about a topic. It may not be the absolute, correct truth (i.e., a scientific or “happening” truth), but it is a definite opinion. While there certainly exists the correspondence and pragmatic theories of truth that form a large part of many people’s systems of beliefs (that is, knowledge about the physical world), many truths exist on the spiritual and emotional levels. Finding one’s own truths (i.e., developing opinions) is a fundamental goal because it allows a person to make personalized, thoughtful choices that cater to the most important aspects of life, whether that means writing, socializing with friends, becoming the President, or even something as whimsical as learning to Rubik’s cube blindfolded.

In other words, finding truths is the process of internalizing, of learning and choosing to believe that new knowledge. It involves both the intake of information, and the acceptance of the knowledge as undeniably correct. Stereotypical truths include physical observations of the world, which would seem indisputable. But to some, religion and cultural values may seem almost as sturdy, and every person most certainly has personal values that they hold to be unchanging and real. A person’s truth can be that diamond is very hard, that God is real, that their livelihood is upheld by their sole parent. Or it could be that Big Brother is always watching through one-way mirrors and surveillance cameras, and that he or she would grow up to be an intelligence agent working against the government. Whatever a person is absolutely convinced about, whether it be by a scientific basis, a cultural folklore, or pure instinct.

As a result of this broadness, truths don’t have to be *real*, in the tangible sense, but it should almost feel so to the person who holds that truth. In his novel, *The Things They Carried*, Tim O’Brien stresses that in *true* war stories (a type of *true* life stories) “you lose your sense of

the definite, hence your sense of truth itself, and therefore it's safe to say that in a true war story nothing is ever absolutely true" (O'Brien 78). His situation pertains to the Vietnam War, but the wars of fighting depression and other mental illnesses, struggling to keep financial stability, and moving past a family death can be just as real as combat, and this definition of truth still applies.

And of course, no two people hold the same truths. Discovering truths (i.e., learning and understanding it for oneself) is a truly personal experience. It might seem that teaching, or any form of indoctrination, would instill the same exact knowledge on all the pupils, but the different details that every student emphasizes in their mind and their personalities change the way they understand it, and whether or not they perceive the learning as truth.

In the spirit of this personal-ness, no specific truths will be discussed henceforth, but rather the moments of discovery that are most prone to truth generation.

It's important to remember that there is a clear purpose of having truths. A person without any truths will perform mechanically, without any conviction or moral judgement to guide their work. Truth can be used directly to affect judgement on everyday decision-making, to define a person's life, and is especially important to find a meaningful solution to difficult times. For example, recovering from a past malefaction and jailtime requires a strong sense of remorse. The convict has to make that remorse their truth, their reality, something to keep in mind in every waking moment of every day. No amount of scientific knowledge or statistics will get a person past a difficult point in their life if a person is not convinced to accept it: improvements can only happen on a person's own power.

The problem then lies in *how* a person should generate the most meaningful truths. If a person chooses only to rely on their friends-- a convenient source of easy, positive encouragement-- then their advice may be based too much on other people's opinions. At worst, as seen in stereotypical movie renditions of high school cliques, brainwashing of a herd mentality completely overrules the individual. But if a person decides entirely to rely on themselves to discover truths, then it may be entirely too much mental pressure, especially during times of mourning or extreme mental stress, causing breaks in confidence or health. This leads to a general rule of thumb: it is often better to avoid relying on the advice of others and focus on finding one's own path to truth; however, if there is some crisis-- a heavily emotional,

intellectual, or physical strain— people should seek the truth of others more than they do their own. Given that a person’s life is generally some combination of weighty and unimportant matters, this rule should provide a balanced, meaningful way to discover truth.

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*Case 1: people not in crisis should put some effort into contemplating their actions to find the most meaningful, not the most simple, option.*

From a rural and unexciting background, Madame Emma Bovary from Woody Allen’s “The Kugelmass Episode” always wished for glamorous, exquisite adventures. Similarly, Sidney Kugelmass felt that his busy, metropolitan life was too much of a bore, and wanted an unsophisticated escape and a passionate romance. It would seem a lucky coincidence and a perfect fit that the two are united.

But problems quickly arise; first a few, then many all at once. Kugelmass sees “ruin and alimony; jail” (Allen 4), problems that never came up in his apparently dull life. He has to put up with “sneaking around town … not to mention a hotel tab that reads like the defense budget” (4), which is problematic enough that he has to consider starting his life over under a new identity. And the problem is reciprocated for Madame Bovary, who becomes both angry at Kugelmass and worried that her husband will be concerned about her.

And while it would seem reasonable to assume that Madame Bovary and Kugelmass would learn from such a dear mistake, Madame Bovary is known to have multiple extramarital affairs, and Kugelmass asks Persky for another fairytale favor after his affair. Both are driven to their demises by further risky affairs.

The reason for this is simple. In “The Wayfarer” by Stephen Crane, the path to truth—in Madame Bovary’s and Kugelmass’s case, the satisfaction they wish for—is depicted as a path smothered with weeds, or even knives. “Doubtless there are other roads” (Crane 11) thinks the narrator, but the inverse doesn’t even cross his mind: doubtless there are other means to cross this path. Doubtless that a person can snip the weeds or roll a carpet over the knives or simply wear steel-toed boots and a heavy jacket. But that would require too much preparation, too much

extra thinking. In the busy life of the 21<sup>st</sup> century adult, there never seems to be adequate time set aside for planning time after work, school, social gatherings, and family are scheduled.

But this effort is always a better deal than having to fix cheap, lazy mistakes. Consider an analogy: perhaps the Wayfarer is lost in a heavy jungle, and needs to find a source of drinking water. He knows there is an ancient, pristine oasis a little below the surface in a heavily-wooded and rooted area, but he thinks that he will find help before he needs a steady source of water. So instead he drinks from puddles on the surface. After exhausting the puddles, he becomes desperate and begins to dig a hole to make a well, but just after he reaches it, he dies from the infections caused by his consumption of contaminated water.

If truth is the well or the thorny path, then its greatest demerit (which is also its merit) is that its troubles are superficial, whether it be thorns or dirt. The problem with alternative paths is that they appear less malicious, but they can be full of traps. It's always the same: a person can buy cheap third-party software to do an expensive task, only to realize a randomware virus was concealed within it, or a person could skip all of their math homework for time's sake, and then pay dearly when he realizes that he has to pass the class to graduate. Taking the easy way out, as Kugelmass and Emma Bovary do, always has its sneaky consequences.

An alternative for Kugelmass would be to talk through his problems with the psychologist or his wife. Fix his marriage. But while his psychologist gives sensible advice, his conclusion is that “[he’s] an analyst, not a magician” (Allen 2), after which Kugelmass hopes for a magician. Ironically, the magician Persky later complains to Kugelmass, “I’m a magician, not an analyst” (5). Kugelmass heedlessly seeks a quick solution from others, not committing his relationships because loyalty is not his truth. The statements by his analyst and Persky indicate that nobody can help Kugelmass but himself, but he never tries. But the setting of Kugelmass in the heart of the Big Apple creates a mood of the constant activity: he feels that something should *happen*, and is overly action-oriented without a corresponding anchor in thought.

Emma is not blameless either. Her husband, known to be simple, honest, and loyal, doesn’t deserve her infidelity. Either she should work out a divorce for her high-profile dates or attempt to make her own relationship work. Given her abundance of time, she has no excuse to not work on solving her own relationship problems.

And Kugelmass's and Madame Bovary's troubles seem very trivial in comparison to those of John Gardener's monster Grendel, from the novel of the same name. Grendel is an interesting character in that his truth differs greatly from the philosophies of the people in Hrothgar's kingdom. Because no one wants to trust Grendel or accept him in any way, he has no choice other than to create his own principles. The problem is that the philosophies that Grendel subscribes to are those that surface naturally: he does not put any effort into synthesizing them. It is his natural urge to clean up the humans' wasteful mess after war and to terrorize them every now and then. After his encounter with the dragon, one piece of the dragon's advice is to continue terrorizing the humans as he had been doing, but this is terribly convenient to Grendel because it involves no change in his lifestyle. Furthermore, the pessimistic nihilistic view imparted by the dragon is already very similar to that of Grendel's. The reason that Grendel is defeated by the humans is that every time a new truth—a different, human perspective—is offered to him, he cowers away, unable to accept or understand it. Once is when Wealtheow demonstrates beauty to Grendel, and another is when Beowulf expresses an optimistic nihilistic view. Grendel is unable to accommodate these philosophies, and is destroyed not only physically, but also (perhaps more permanently) ideologically.

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*Case 2: people in crisis need to find alternative truths, either in a friend or in literature.*

Sometimes a person needs to make up their own truth to survive a crisis situation, so long as the person does not reject other philosophies as Grendel does. This is often the case in war, when a person must distance themselves from the violence, the cruelty, the sheer disgust of the fighting. In *The Things They Carried*, Tim O'Brien writes that he tells war stories that are not "happening truth," but rather a "story truth" that feels more genuine. In other words, often the depiction of a single, real event cannot convey everything that a person feels. According to O'Brien, a story can reveal much more by emphasizing or recreating everything that conveys the *essence* of the truth into a single instance or story. . He writes about people with such precision that they cannot be fictionalized, yet they are: at least, the people are. The things they carry are not. It's similar to Emily Dickinson's poem, "Tell all the truth but tell it slant —", which states that "the Truth must dazzle gradually / or every man be blind" (Dickinson 7-8). In many ways

too much of a truth can be disillusioning. Suppose O'Brien writes instead about the dozens of dead men he sees, including the few that he saw himself kill; death becomes familiar and the war is not what it means to a person at the front.

To survive the war, O'Brien shares an intimate relationship with the other men in his platoon. They share their truths and he his. Usually, this comes in the form of stories. His life is accepted by the others, and he accepts theirs, even stories "that swirl back and forth across the border between trivia and bedlam" (O'Brien 85) about girlfriends gone wild in Vietnam and sanity-depriving jungle music. There is no other choice in the war—communication is a natural form of coping. This is true of other situations of prolonged hardship—for example, the extended hostage situation in Ann Patchett's *Bel Canto* caused the unlikely friendship between the hostages and terrorists that even caused love affairs between the two parties. Months of intimacy cause a friendship past tolerance, past intimacy: something more along the lines of clear, pure understanding. While the hostages and the terrorists have completely different roles, they become a homogenous group to survive. The terrorists and the hostages, like the soldiers, are saved by their ability to understand that everyone else shares their pain. It's a different kind of group mentality than that of cliques, one that is forced and more intimate.

This is the opposite reaction to and outcome of the midlife crisis. According to Christopher Nelson, people who become complacent with themselves and simple decisions, without an effort to reach out to new liberal ideas or new people, are often those who go into the midlife crisis. They lack inspiration or understanding and become human barnacles. While finding a barnacle-like life may appear to solve many simple, tangible problems (after all, living stuck to a rock barnacle-style with a family means "no runaway children, no injudicious bungee-jumping, no family members getting lost while conducting dangerous expeditions into unknown regions" (Nelson 1)), it only does so much before it begins to wear on a person's mental well-being after the "barnacle cements its own prison" (Nelson 1). Grendel, for example, is perhaps experiencing a midlife crisis, fiddling with tedium and a lack of understanding with others. Out of their frustration with communication, characters like Grendel often end up becoming even more reclusive, relying further on themselves to try to find truth, but crisis causes

a mental desperation and lack of creativity. Knowing the hardships of others is the best inspiration in dull times. Trying to find truth by oneself drives the mind crazy.

It's the battle between secrets and time.

When does a person learn to share all of their secrets?

Eveline, from James Joyce's collection of short stories, *Dubliners*, decides to keep quiet her entire conflict between staying home to familial responsibilities or escaping with her fiancé. Rather than trying to talk with her friends and family (at least her brothers, if she has fallen out of terms with her father), any of whom would have some outside insight that would aid her choice. But she debates the choice between family duties and the respect for her own love life ceaselessly until her inaction makes the choice for her. Time runs out, and her secrets win.

But Eveline is still relatively lucky that she is forced to make a decision. But take it to the extreme and experience the tragedy of Hamlet. Hamlet has the conviction to kill the king throughout the entire play, but stalls. He tells himself that he wants to be reasonable, when in reality he wishes to find just the right moment to attack so that he doesn't injure the mental health of him or his friends. Unfortunately, no such situation arrives, and he doesn't receive any advice from his unknowing friends. He dies with his secrets, which are luckily survived by Horatio. Time wins again with Hamlet's indecision.

It follows that Hamlet should have confided in his friends, or his mother. Indeed, in Margaret Atwood's poem, "Gertrude Talks Back," Hamlet does hold a conversation with his mother. And if this conversation did take place in the novel, the tragedy would be prevented. In Gertrude's own words, "[she] could have put [Hamlet] straight in no time flat" (Atwood) with the knowledge. Sometimes it's as simple as asking, and the imaginary conversation quickly and effectively exposes grave truths simply by means of communicating.

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*Case 3: people in times of trained crisis have an optimal compromise of independent thinking and environmental stimuli to generate truths.*

Human acclimation to stressful situations is normal. At every stage in life, people become more hardy, from the time of their infancy to senescence. Teenagers have it especially rough,

learning to independently and responsibly conduct themselves in a quickly-advancing global workforce. Human perception is that no crisis lasts forever: eventually a person gets used to difficult situations, becomes well-trained to handle the hardship. And it turns out that this process of acclimation is especially useful for meditative, productive truth generation.

Even highly-stressful situations, if properly prepared for or thought out, can be suitable environments for finding truth alone. Sports are a common example, highly-performant and highly-stressful situations, but usually not associated with existential crisis or other distress. Another reason that O'Brien is able to stay mostly sane throughout *The Things They Carried* is because war is an act; it is predictable, the soldiers are trained, and there are clear, military objectives. This is especially true before he gets drafted into the military and is forced to face the decision on his own in the chapter, "On the Rainy River." The shock fades and O'Brien matures immensely as he gets used to the idea of participating in the war. He realizes that "Canada had become a pitiful fantasy" (O'Brien 55) – his sense of bravery and fear are totally redefined. This is illustrated too in "Constantly Risking Absurdity" by Lawrence Ferlinghetti, in which the poet (the "acrobat") performs a set of risky, well-practiced, and beautiful procedures in his art. Like a poet, who is trained and calm, a person who does not have to face a situation in crisis has much more mental freedom to perform well and think freely. And the poet slowly approaches "that still higher perch \ where Beauty stands and waits" (Ferlinghetti 24-25).

Here, the risk is no longer crisis, and can be treated as though it were everyday living (i.e., case 1).

The benefit of treating trained-crisis situations as non-crisis situations is that a person has much more mental freedom, while also overcoming more hardships that are ripe for discovery. Albert Camus analyzes the role of personal enlightenment in the case of the Sisyphus, a person is "superior to his fate" at the "hour of consciousness" (Camus). This consciousness lies at the height of enlightenment (at the beginning of Sisyphus's descent) between the toil of overcoming the crisis (pushing the rock up the hill) and tedium (walking down the hill). Sisyphus is doomed to a life of hardship, but he also has an infinite number of these moments. It's the perfect middle ground between the doldrums of everyday living and the overwhelming sense of despair or pain in crisis.

The best part about this is its inevitability, much like the inevitability of the periods of crisis and tedium in life. It necessarily follows the toughest hardships. It can be Sisyphus as he realizes his accomplishment, or Hamlet as he discovers his honor and success and mortality and failures right before his death, or Grendel as he is struck by the painful wonder-disgust of Wealtheow and the Shaper. Interestingly, Camus realizes that “this myth is tragic ... because its hero is conscious” -- tragedy necessitates this moment at the top of the descent. But it creates beauty in non-tragic ways, too.

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It’s difficult to force a recluse into seeking help. Hamlet thought that he should keep his motive secret and his loved ones out of the entire ordeal. Unfortunately, his failure is great and afflicts everyone around him with sadness at his insanity. And Eveline thought it would be less hurtful for her family not to know she was thinking about leaving, but that only tore herself up.

By the same token, given the opportunity to socialize in worry-free free time is rather enjoyable, but a person should not get carried away in the practice. It doesn’t allow for new truths to form.

The amount a person can learn is directly proportional to the difficulties they face. Little to nothing in leisure time, a larger amount during a crisis (moderated so as to keep a healthy mind), and the most productive moments in times of trained crisis, or the initial part of the descent.

Truth is about learning, and the truth of truth itself can too be learned. Like an exercise, methodical and deliberate, people can elect not to be a Grendel, an Eveline, a Kugelmas, or a Hamlet, falling to their fiery and tragic ends; all it takes is a small conscious effort to decide what help is really needed. Vigilance is key here.

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## Grendel Chapter 2 and “Things” and Research

### Grendel Chapter 2 Notes

- Second time mentioning words as “skin” or “web” and as a “spell” (p. 15, also seen in Chapter 1)
- Actually a thousand years old? Language actually spoken by no one else?
- Lives in a magical world separated from the ordinary world (connected by a body of water)
- **Dark, mysterious tone**— talk of mysterious magic and “darkness [he] displaced” (17), darkness of a cavern, “large old shapes with smouldering eyes” (16), wickedness, “every dark corner of the cave and the woods above” (17)
- Much of a change of tone between older (Chapter 1) and younger Grendel (Chapter 2)— younger self was innocent, helpless, crying out for help and curious
- “Humpbacked shapes in the cave” (21)— potentially more of Grendel’s family?
- Grendel (before meeting Man) speaks the language of Man and has fire, but it is a little different
- Grendel’s mother loves him but can’t express it verbally— Grendel tries to capture it in words (29)

History of Astrology. Why study astrology during the time when Beowulf was written?

- Beowulf written ~700-1000AD
- Zodiac’s 12 signs still relatively new (from ~500B.C. from the Egyptians and Babylonians, perhaps just introduced to the Anglo-Saxons)
- Perhaps switch to Christianity / Anglo-Saxon culture prompted surge of interest in astrology?

Source: [https://en.wikipedia.org/wiki/Zodiac#Twelve\\_signs](https://en.wikipedia.org/wiki/Zodiac#Twelve_signs)

Story Summary of Beowulf, Information about “Author”

- Beowulf is the story of a hero named Beowulf named Beowulf that helped kingdoms by killing monsters (Grendel, Grendel’s mother, a dragon) and becomes king in the process
- Beowulf is the longest surviving Anglo-Saxon poem
- Book was written shortly after England’s conversion to Christianity (700s AD) because it had references both to Christian and pagan religious beliefs
- Author probably lived in England but had Scandinavian events (because Anglo-Saxons and their culture originated from mainland Europe, such as Scandinavia)

Sources:

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<https://en.wikipedia.org/wiki/Beowulf>

“Things” by Liesel Mueller

- Attributing human-like qualities to inanimate objects for a human-like comfort; only a philosophy; no actual additional action/safety except peace of mind
- We feel safety with our own and a bore/coldness/danger in non-human things
- Similar to how Grendel groups with his mother (and kin?) and people group with themselves, even though they speak the same language, both use fire, and both have similar bodily structures

Nihilism and Solipsism

- “I understood that the world was nothing: a mechanical chaos of casual, brute enmity on which we stupidly impose our hopes and fears ... I alone exist. All the rest, is merely what pushes me, or what I push against, blindly ... I create the whole universe, blink by blink. — An ugly god pitifully dying in a tree!” (Gardner 22)
- Usually causes despair when viewed from an existential viewpoint; also implies lack of morals
- “I think, therefore I exist” → Descartes’ solipsistic philosophy
- “The problem with human knowledge and certainty is that it is derived from our experience of the world which is internally derived from our admittedly fallible senses” (“The Matrix and Solipsism”) — how can anyone know any better or farther than their own existence? Existence is only based on what we perceive (back to a possible definition of truth with the correspondence theory: what if our senses and/or words can’t capture all information we come across, and thus can our “truth” truly correspond to the real world?)

Sources:

<https://en.wikipedia.org/wiki/Nihilism>  
<https://en.wikipedia.org/wiki/Solipsism>  
<https://incinemascopic.wordpress.com/2013/03/19/the-matrix-and-solipsism/>

## Evil to the Point of Good: Grendel Dragon Encounter Chapters 4-6 Analysis

Grendel goes to the dragon because he feels purposeless and confused. All of his well-intentioned previous interactions with humans always had left him feeling desolate, frustrated, as if he were the aggressor and not the humans. Furthermore, he is devastated by the fact that he will always be seen as “the dark side ... the terrible race God cursed” (Gardner 51) to humans, so that he can never be accepted into the beauty of the humans and blissful illusion of the Shaper’s songs.

The dragon has a solution, treasure worth more to Grendel than gold or silver, that could not be obtained elsewhere: perspective. An answer to his futile struggles with the humans, a life purpose.

The moment Grendel enters the dragon’s lair, the dragon is characterized by its eyes, “not firey but cold as the memory of family deaths” (57). Grendel had not previously met something so evil, “sly, hardly hiding his malice” (58)—the only encounters he had had with intelligent animals were with his mother and with the self-righteous humans. He had never encountered a being as evil as he saw himself, never “kn[e]w how *[the humans]* feel when *they* see [Grendel]” (59). At that point, Grendel realizes that how he viewed the humans was never mutual—no matter how intelligent or well-meaning he was, finishing their waste, trying to speak to them, they could never see him as an equal. The dragon is the human society’s mirror on Grendel: he sees unconditionally the monster in the dragon, old and obscene, that the humans see in him.

But the analogy doesn’t end with the humans’ view of Grendel: the dragon’s condescension on Grendel and his farsightedness also impress on Grendel, who acts the same toward the humans. The same way that Grendel feels old and wise watching the human civilizations evolve and predicting their patterns, the dragon “see[s] from the mountaintop: all time, all space” (63), implying that Grendel’s view is very limited. This causes Grendel not only to expand his thinking to accommodate the fright of the humans, but also to consider the larger scheme of the fight: to what ultimate end does his interaction with the humans have? What do his conflicts entail, from the present to the end of time?

From this the dragon’s advice to “seek out gold and sit on it” (74) makes sense. The dragon claims that continuing to steal from and kill the humans will “improve them ... stimulate them ... make them think and scheme ... drive them to poetry, science, religion, all that makes them what they are for as long as they last” (72-3). This is a clear purpose in life that Grendel can strive to achieve—create a reign of terror that results in the benefit of the humans! The dragon doesn’t care about the loss of any individual—which to him is just “a temporary gathering of bits, a few random dust specks” (70) that have little meaning—but rather the progress of the universe as a whole. Sitting on gold is just one simple, concrete way for Grendel to achieve this goal of universal progress, and it can symbolize any method of frustrating, prodding, motivating the humans to improve upon themselves. In Joseph Campbell’s words, “in [saving himself], [a person] saves the world ... The influence of a vital person vitalizes” (Campbell). Grendel is the vitality of the humans, the evil juxtaposition of mankind that *causes* themselves to be righteous. In other words, the people cannot exist as they are without monsters like Grendel. And that gives Grendel a worthwhile motive to plague humans to the point of change.

This solution also solves his discord with humans, claiming that his contribution to the betterment of the human race will make Grendel “mankind, or man’s condition” (Gardner 73)—that his place as the evil in the Shaper’s song is something to embrace rather than a shame. The dragon even declares that Grendel will “scare [humans] to glory!” (73) and sweep himself along in their glory. While glory is not one of Grendel’s motives, the pride of the humans in their song of their achievements was the only thing that brought Grendel to tears—confused but happy tears.

## Don't Be [In]different: Deign to be Human

With increasing rates of terrorist attacks since the rise of Islamist extremist groups in the 21st century, studying the origins of an amoral perspective become ever more relevant. From where does such an uncaring, insane behavior originate?

In her essay "Language and Thought," Susanne Langer makes one important distinction between animalistic beasts and humans: that humans are distinctively elevated because of their ability to interpret subjective "symbols" as well as objective "signs," while all other intelligent animals are separated by their ability to recognize and react solely to signs. Humans too follow this development, beginning by recognizing signs until symbols have meaning to them.

An exemplar in the growth of a criminal lies in that of a monster. John Gardner does this in his novel *Grendel* by examining the growth of Grendel, a monster with human intelligence that follows the evolution of signs to symbols that Langer delineates. As a child devoid of language, he learns to *categorize* and develop expression by himself. By that time, he has reached the level of intelligence of the humans he observes. At that point, his advanced understanding and pattern-analysis skills lead him to subscribe to *nihilism*—the belief that existence is without meaning, as view that is often attributed to modern-day sociopaths and criminals. Thus, Gardner's story provides evidence that the developmental gap between usage of signs and symbols almost certainly predicts the most likely avenue from human intelligence. In Grendel's case, his recurrent *contrasting* of himself to others in his formative stage—between the understanding of purely signs to symbols—causes him to become a nihilistic, spiteful monster.

The flashbacks in *Grendel* are characterized by a predictably judgment-free life. He describes this youthful lack of intense thought as a "spell" (Gardner 16): playful, carefree, "cautiously darting from tree to tree challenging the terrible forces of night on tiptoe" (Gardner 16). These are the signs, the ability to explore and react to surroundings and the "essence of rational behavior" (Langer 1) that Langer mentions. At this point, Grendel is at a stage of simply absorbing rational information about the new aboveground world around him, without taking any time to interpret or infer. At this developmental stage, Grendel's mind is composed almost completely of material images, without judgment or language; the basic human necessity of conception of symbolic ideas and expression do not yet exist. Little from this stage affects the outcome of Grendel's personality.

On the other point, Grendel's present voice is one that sounds remarkably similar to that of a human. He yells at animals and the sky, judges and hates animals and humans he encounters, expresses himself poetically, learns the art of deceit. He cries fake tears, smiles a "terrible, sycophantic smile" (Gardner 7), describes himself as a "disfigured son of lunatics" (Gardner 7). He even develops anthropocentrism when he gazes down on other organisms as "below complexity" (Gardner 7), a concept limited to human thought. He has already learned the importance of subtleties and gestures, symbolism for ideas. By this time, his attitude is strictly accusatory of the world, lacking in the youthful color of many years ago.

The difference between these two versions of Grendel is very apparent, as great as the difference between a human child and a full-grown adult. The transition is not so obvious.

By the time Grendel encounters the humans, he is already in a state of transition. He begins to form ideas for himself, so that he can understand the *presence* of the language that the humans use. However, while Grendel recognizes the humans' sounds as language, he could not express himself: "nothing would come out" (Gardner 26) when his mouth moved, or he would just howl and moan. However, in the lack of language, Grendel was already discovering how to *categorize* and *generalize* the humans' behavior. He discovered that they were "thinking creatures, pattern makers, the most dangerous things [he's] ever met" (Gardner 27) based on the fact that they had developed the expression of language and the use of fire. Even though Grendel too had the conveniences of language and fire, there was a different connotation about it: the humans' fire was "pungent, painful as thistles to the nose" (Gardner 23), and their language is as if "made by brittle sticks, dried spindles, flaking bits of shale" (Gardner 23). Or when the bull charges at him,

he learns that the bull “fought by instinct, blind mechanism ages old ... the same way against an earthquake or an eagle: I had nothing to fear from his wrath but that twisting horn” (21). In this case, he generalizes the motions of the bull into a pattern, as with other animals. However, what makes this action remarkable is Grendel’s emotional response of a bold “nothing to fear” about the bull, the ability to inject a subjective thought spurred on by a rational series of observations.

This is the same process described by Lisel Mueller in her poem “Things,” in which humans personify objects to give them life (clock, chairs, shoes) or to make them more human and less formidable (country, storm, cave). In essence, the ability to personify can be broken up into two simpler steps: classifying an object by its humanlike attributes and then generalizing that human attribute to all parts of that object. Giving “the storm an eye” (Mueller 18) is no different than Grendel stating that “the wars began, and the war songs, and the weapon making” (Gardner 34). People categorize other items by their likeness to humans so that they are more comfortable with the idea of those items; likewise, Grendel categorizes humans and nature by their differences to him in order to more easily comprehend them. Humans are wasteful, warring, and weaponized, which is easily distinguishable from Grendel, who steals their waste, watches their wars, and attacks without planning or weapons. And while nature is beautiful and unthinking, Grendel is unsightly and logical. Before developing more complex thoughts that include mixed connotations about an object, there is a period of decisive generalizations, of contrasting himself with others to find more meaning.

By the time Grendel reaches the twelfth year of his war on Hrothgar, he is very intelligent. The satirical manner in which he laughs at the peoples’ vain attempts to “replac[e] the door [to the meadhall] for ... the fiftieth or sixtieth time” (Gardner 14) indicates that he is perhaps *even smarter* than the humans, who are unable to stop him despite the regularity and repetitiveness of his intrusions.

In fact, this demeaning of human beings is regular enough to cause Grendel to become so irreparably separated from them that his life becomes an obsession with their demise. Even when the Shaper left Grendel’s mind “aswim in ringing phrases, magnificent, golden” (Gardner 43), Grendel cannot bear the sudden beauty of these human beings. What was so great in this poetry that could leave such a monster terrifying as Grendel “crawling, whimpering, streaming tears ... [like] a baffled, indifferent ewe” (Gardner 44)? What mystic force turned around his toughness in the face of man?

In the words of Christopher Nelson, Grendel is a *barnacle*, “stuck where [he was] years ago, who [has] lost the will and imagination required to seek happiness” (Nelson 1); he “begins the twelfth year of [his] idiotic war” (Gardner 1) against the humans with nothing less than scorn, sardonicism, and satire. And he doesn’t care. This manifestation of existential nihilism—the belief that nothing in life has any meaning—comes naturally to Grendel. Years of considering the actions of humans disgusting and pathetic have molded Grendel into a rigid cynicism that “cannot come to understand how much more is possible, how spacious and open life can be” (Nelson 1). Thus he cannot even begin to comprehend the Shaper’s words, cannot fathom the shape or color of the beauty within.

This manifests so naturally for Grendel because of his childhood habit of comparing himself *against* the humans, rather than *with* them. While human beings compare other items to themselves, Grendel often sees himself as a “disfigured son of lunatics” (Gardner 7) and a monster, so outcasted that he cannot compare himself even to the human beings he so bitterly criticizes. This aligns with Nelson’s claim that a positive liberal education requires “like-minded and generous companions with whom to study” (Nelson 2): instead of growing up in a supportive, similarly-minded community of intellectuals, Grendel constantly antithesizes himself against the humans and thus becomes stuck in a redundant, nihilistic, barnacle-like gloom.

Without a supporting circle of family and friends, Grendel becomes the indifferent beast he thinks he is. Contrast is a useful complement to comparison, but its excess leads to self-destructive carelessness. From differences, to envy, to apathy, to hatred.

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### Grendel's Crisis: Aesthetic Nihilism

Billboards, magazines, and social media always promote the smartest, richest, and most beautiful people in the world. The people living the dream of commoners. But can it be useful to create unrealistic standards—or beautiful illusions—for ordinary humans? In his novel *Grendel*, John Gardner explores the idea of illusion in society through Grendel's questioning of human society. Modern society is formed on illusion, and the ones to best protect or destroy society are the ones who best understand the nature of illusion, especially when it comes to beauty.

Grendel is the clear enemy of society, the monotony of his lonely days broken up only by the drama of faux-heroes such as Unferth or war between nation-states. Human civilization was younger than he is, and he often breaks into the meadhall and kills many men because he feels the obligation to do so. After meeting with the dragon, he realizes that his purpose is to “improve the humans] ... stimulate them! ... make them think and scheme” (Gardner 72). At which point Grendel realizes that there is an ultimate consequence, his motive behind the twelve years of the previously “idiotic war” (5) on the humans.

However, the complete destruction of Hrothgar’s men is opposed by two people, before the hero Beowulf. Ordinary people with no extraordinary skill in wielding swords, but instead the truth.

The greater of these two heroes is the Shaper. His songs “had changed the world, had torn up the past by its thick, gnarled roots and had transmuted it, and they, who knew the truth, remembered it his way—and so did [Grendel]” (Gardner 43)—he *dictates* that the people’s past was glorious, and that there is evil in the world that would plague the humans. “Grendel ... was the dark side, he said in effect. The terrible race God cursed” (51). While this is a pivotal moment in Grendel’s journey of becoming a monster, as he proceeds to meet with the dragon to find his own purpose, the Shaper impresses on Grendel as an impregnable defense for the humans. The Shaper’s poetry forces Grendel back to his cave, bawling, reflective on the humans’ view of himself.

Poetry is “a made thing,” according to the TED talk “Why people need poetry” by Stephen Burt. The expert poet is in fact an expert illusionist, capable of “introduc[ing] you to feelings, ways of being in the world, people, very much unlike you, maybe even people from long, long ago” (Burt). With a childhood devoid of human beings, Grendel’s only view into the emotions that people contain—those of pride, of love, of the joy of living—are through the Shaper’s words. The ability of poems to cause a person to believe for a moment that they are someone else—perhaps even a fictional character, the ultimate happy or sad person, however the poet wishes—pervades Grendel with such human contentment that he forgets the monster that he is.

Of course, the dragon dismisses the Shaper’s illusion as simply a method to keep them going. He believes that poetry is whimsical, that the Shaper “spins [an illusion of reality] all together with harp runs and hoots, and they think what they think is alive, think Heaven loves them” (Gardner 65). To the dragon, who is able to see indefinitely through time and space, poetry is simply a whimsical form of art. He doesn’t see the practical side of poetry that allows lesser beings to experience life more fully through the illusion of imagination.

At this point, the dragon’s theory is instilled upon Grendel and he discovers a loathing for poetry and all superficiality in mankind. The war on humans begins. The “charm” (75) of invulnerability Grendel discovers the dragon put on him is simply a metaphor for Grendel’s newfound realization: that, despite

all of the Shaper's glorifying words of a mighty human history that the men and Grendel had begun to believe under the influence of the poems, there is no truth. The poetry is a facade, and Grendel knows it—the ultimate skeptic of humankind.

Interestingly, Grendel's own words become poetic ("He stares strange-eyed at the mindless world and turns dry sticks to gold" (49)) and he realizes that all of his own thoughts are "spinning a web of words, pale walls of dreams" (8). While he consciously wages a war on the humans for the sense of artificiality that enrages him, he subconsciously puts to use poetry to express complex thoughts that regular language cannot contain. At this point, he reaches the level of human intelligence, according to its definition by Susanne Langer in her essay "Language and Thought," which states that human intelligence is distinguished from bestial intelligence by the ability to use symbolic language pragmatically. A hypocritical satirist.

The second commoner that completely revolutionizes Grendel's philosophy is Wealtheow, a symbol of beauty, innocence, and political formalities. Grendel believes that "any simpering, eyelash-batting female in her court, given the proper setup, the minimal setup" (Gardner 102), that her beauty is a despicable form of worth because there it is only a physical characteristic; but she is beautiful. Her image and innocence "tore [Grendel] apart as once the Shaper's song had done" (100). Grendel becomes so vexed about the meaning of her beauty that he takes the unusual opportunity to raid the meadhall in the winter to destroy Wealtheow, only to stop before killing her after once more realizing her innocence that reminds him of the "Baby Grendel that used to be" (110). Like the Shaper's song, her beauty truly means nothing—she is no different than if she were ugly—but it represents a greater idea. An idea with the power to influence people.

Beowulf is Grendel's final mentor on the idea of illusion. He begins to present the same nihilistic view as the dragon, but it changes. "*You make the world by whispers*" (171) whispers Beowulf to Grendel. In other words, everything is how a person makes it out to be—this is the opposite of the dragon's philosophy that fate is predetermined and fixed. The wall that Beowulf smashes Grendel's head against is only a figment of Grendel's imagination. Beowulf makes Grendel sing poetry about it to emphasize its illusory property. The dragon's charm is an illusion as well, believed true by Grendel; Beowulf is able to defeat Grendel in spite of it because he realizes the illusion that even Grendel cannot notice, he can see another level of illusion.

What gives Beowulf this ability is the difference in ideology between the dragon's and his own. While Grendel and the dragon believe that nihilism enables them to terrorize society, as every life and death is inconsequential, Beowulf rejects this outcome. He instead focuses on a different theory known as "optimistic nihilism"—that people should always take the opportunity to make constructive choices and eliminate evil whenever possible. Beowulf clearly juxtaposes the two philosophies with his diction—he tells Grendel's world of "murder," "burning," "dark nightmare-history, time-as-coffin," but also of an alternative nihilism, where "time is the mind, the hand that makes (fingers on harpstrings, hero-swords, the acts, the eyes of queens)" (170). In his eye, in the human eye, meaning is something to be constructed like poetry, a more fundamental force than that of destruction. Monsters will menace society, but good—the beautiful poetry and the innocent youth—will always prevail.

Thus Grendel's philosophy is flawed and he is destroyed.

In contrast to the heroes and monsters, the rest of society fails to notice the illusion, and this allows a civilization to continue. For example, Hrothgar's people see Grendel's attack on and Beowulf's

defense of the people as simply as that: the classic monster-and-hero story. If society were represented by Plato's Allegory of the Cave, the heroes and the monsters fight in front of the fire, casting their shadows on the walls. The rest of society are the prisoners in the cave, only able to judge the fight by the size of the shadows on the walls. They come up with the names "hero" and "monster" for the human shape and the larger, hairier, (presumably) more dangerous shape. Least of all do they realize that their shadows are not the reality. In actuality, the hero sees the monster as much more than simply a "monster" — it has a name, a personality, hateful qualities, even the occasional moment of goodwill. The monster has thoughts, has philosophies, is struggling with the idea of beauty and illusion, and the hero has his own respective beliefs.

Similarly, Unferth, the aspiring hero, makes the superficial divide very clear between himself and Grendel. He repeatedly tries to condescend on Grendel by emphasizing his bestiality, whether by calling him "monster" (Gardner 82) or "foul thing" (83) or "dread creature" (84) or "wretched shape" (84). Attempting to label Grendel as a monster and not the intelligent creature that he puts Unferth at a disadvantage in the fight, and therefore he loses the fight. He does not understand as Beowulf does that the fight is not of brawn but of ideological. Grendel notices that Unferth is almost mentally prepared to "fight with men instead of poor stupid animals" (83) on their first encounter, but rejects the idea and is thus unprepared to fight Grendel's cleverness. Grendel easily discovers that Unferth's hero qualities are false and easily defeats him with the dragon's charm, homologous with his own defeat by Beowulf.

There is an inherent tendency of humans to over-generalize that makes so many people "ordinary" (i.e., neither monsters nor heroes). Humans "gave the clock a face, \ the chair a back, \ the table four stout legs" (Mueller 3-5) to feel safer in a world of personified entities. Humans group "inert, static, motionless, fixed and immobile" (Collins 13) together in thesauruses in order to make composing literature easier. The reason why the Shaper's words and Wealtheow's beauty is so influential to the people is that people are conditioned to mistaken objects for the ideas they represent and forgetting how they actually exist. The mainstream education of poetic nursery rhymes and an implementation of a large, occasionally-redundant vocabulary causes these two misleading systems of generalization.

It follows then that the most influential members of society often have a non-conventional upbringing. This is simply said for Grendel, who is born in a cave, isolated from other intelligent beings. He observed the world as it was, not learning the whims of language and the discriminations of society—the education of morals. The original epic *Beowulf* states that Beowulf "was fostered out by [his] father, \ left in the charge of [his] people's lord" (*Beowulf*, 2428-2429), so he too was lacking in the moral education carried out by family.

By this logic, Hrothulf, nephew of the aging king Hrothgar, is raised by a common peasant to realize cold, hard, Machiavellian values on governance. He realizes that the formalities of government are merely "stinking fraud" (119), which shows his ability to see past the Shaper's illusion and gives him the potential to be the next major hero or monster in Hrothgar's kingdom. What will determine which path he will take is whether or not he masters the art of aesthetic illusion.

In a letter to Susie West, Gardner wrote that "It's better to be wrong, even foolish, than nihilistic." The statement embodies itself. Why live a life with no meaning but to destroy? It's inevitable that we all become specks of dust in a careless universe— but humans exist to make the best and most beautiful of it.

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## Responses

Hrothulf is described as having “the manners ... of a half-tamed wolf ... already a God-damned pretender” (112). The fact that he schemes with Red Horse in the woods, secretly, while putting on a respectful and taciturn facade in public represents the crumbling of society, foreshadowing some sort of sudden change or revolution in society. Hrothulf is the embodiment of Machiavellian philosophy, a strong, duplicitous leader.

The conversation between Red Horse and Hrothulf gives a truer idea of the thoughts of the common people on the government. While the focus on humans had previously been on the powerful royalty and lords, this interactions a new point of view, more similar to Grendel's. They expose problems with the structure of human society that the lords did not have the freedom to speak about. Gardner included the conversation in order to foreshadow sudden change, express the feeling of progression of a society. Red Horse is trying to indoctrinate Hrothulf with his ideas that are progressive for the time, questioning the current rule, and he is passing this down to the next generation in power.

Grendel's hesitation in killing Wealtheow symbolizes the balance between his monstrous and humane sides. While he was so resolute in killing Wealtheow at first, the idea of “balance” infiltrates his mind: one moment he decides to “kill her and teach them reality ... and nothing alive or dead could change my mind!” (110), while the next he thought that he would “kill himself, for love of the Baby Grendel that used to be” (110), before changing his mind once again. Gardner uses this to redefine the idea of a monster again: a being that knows how to appreciate youthful, innocent beauty but still choose to destroy it.

The inclusion of Ork emphasizes an agnostic, satirical view of religion. Ork looks up to superficial and potentially nonexistent gods that gives meaning to society. Grendel too gives humanity purpose by wrecking their property and making them more clever. The fact that both Grendel and the gods (who Grendel impersonates) have the ability to improve mankind further substantiates the nihilistic and non-religious perspective of Grendel. This relates back to the conversation of the dragon, who said earlier, “If [Grendel] withdraw[s], [he]’ll instantly be replaced. Brute exists ... are a dime a dozen” (73). The fact that Ork is blind is a metaphor for the fact that humanity is blind in who or what they put their faith in. Thus Grendel is disgusted, because he feels that religion is merely false worship and something to be made fun of (as he does when he playfully convinces the priest that he is the Destroyer, holding back laughter).

“Tedium is the worst pain” (138). 12 years. While it may seem that Grendel is a barnacle, stuck in the useless redundancy of eating people and slapping Unferth to the side, Grendel experiences many different changes of mind throughout his war (purposefully by Gardner to expose the reader to those many philosophies.) He is always bored with the latter, obsessed with finding purpose and sometimes even justice, where his nihilistic logic would allow it. If he were plainly evil, he could easily have eaten many more of Hrothgar’s men, perhaps taking down the entire kingdom, slowly— instead, he chooses to wage a war of targeted destruction, taking his time to follow the dragon’s offhand secondary advice of

improving them by challenging them. This in turn is why he finds humans and nature in general so beneath him. He kills a goat that keeps “climbing, mindless, mechanical, because it is the business of goats to climb” (139) because of the tedium of its actions. Grendel is repulsed and frustrated by the stagnancy of human beings, who are unable to hold off his redundant attacks. A theme of this is the bliss of the ignorant, or the monotony of the intelligent, an unfortunate phenomenon.

The death of the Shaper is the death of the ideas he embodied: an air of illusory greatness able to raise a kingdom to fame. Without the Shaper, the people are not protected and unified by his song, which was an important part of building the kingdom. The loss of beauty that left Grendel stunned—the only thing that could bring Grendel to tears and great self-disgust for being so evil—now left Grendel no reason not to attack the people. The Shaper’s loss represents the doom of the kingdom to either doom by violence or monotony, now that the people were not uplifted by beautiful poetry.

## Hamlet 1.2 Close Reading Analysis

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### King Claudius's Speech

#### Use of Royal "We"

King Claudius refers to his brother in the royal sense, talking about “our dear brother” (1.2.1) and “our late brother’s death” (1.2.19), as if the death of his brother were an everyday occurrence or something else of little importance. Similarly, the wedding appears to be similarly dispirited when he again uses the royal “we” in “our queen … have we … taken to wife” (1.2.8-14). Together, these suggest that his brother’s death is something that he is not really sad about, and the marriage is not something he is happy about, suggesting an ulterior motive to the entire event: the search for power (analyzed below in “Order of Ideas”).

Interestingly, Claudius only uses the personal “I” to refer to Hamlet: “my cousin Hamlet and my son” (1.2.66). He repeats the idea that Hamlet is part of his family: “And with no less nobility of live \ Than that which dearest father bears his son \ Do I impart toward you” (1.2.114-116). This suggests one of two possibilities: that he truly loves his nephew Hamlet and feels sorry for his loss, or that he wants to appeal to the better side of prince Hamlet, the rightful heir to the thrown, so as to avoid anger and a rightful overthrow. The latter option aligns with the business-like manner of the wedding event.

#### Antithesis

From a literal perspective, the antithesis is a metaphor for the happy and sad events taken place so close to one another, giving a mixed mood to the event.

I’m not exactly sure what the intended purpose of the antithesis was, but it only seems to cloud the happiness of the marriage and make King Hamlet’s death seem trivial. “A defeated joy” (1.2.10) seems to put a damper on the jubilance of a wedding, but the king asserts that “in equal scale weigh … delight and dole” (1.2.13)— that the happiness will balance out the sad. Perhaps he is trying to assure his people that his reign will be as happy as his brother’s was, that the recent sadness should only be turned over to delight at a glorious new reign.

While this seems to reassure the people, regarding the event “with mirth in funeral and with dirge in marriage” (1.2.12) seems very disrespectful to the late king. It doesn’t seem very sincere of him to talk so lightly about his brother’s death.

#### Word Choice

King Claudius says that it is “befitted \ To bear our hearts in grief” (1.2.2-3). But to be “befitted” means that it is *appropriate* that the people grieve for their lost king—a sort of formality, a shallow act. This goes along with his frequent usage of referring to his brother’s death with the royal “we,” as if his brother were just another political figure. “Wisest sorrow” (1.2.6) again distorts the normal human reaction of sorrow, injecting some sort of political correctness into it into it. If he were more sincere, he may have said something more mournful, ignoring any mention of wisdom or formality: simply that he is mourning his brother’s loss, and that it is very sad. His wording implies that it may be a good idea to appear sorrowful, but that is not the true emotion.

#### Order of Ideas

1. Acknowledge his brother's death
2. Talk about marriage to his brother's wife
3. Negotiate with Fortinbras to avoid an attack
4. Talk to Laertes about his future ambitions
5. Talk to Hamlet about his future ambitions

This order of events seems a very clear power play, a quick and utter usurpation of prince Hamlet. First, he addresses the issue of his dead brother, without very sincere sadness, indicating the lack of a person in power. Next, he establishes his right to power to fill in the absence left by his brother by marrying his brother's wife. The next events (dealing with Fortinbras, Laertes, and Hamlet) consolidate his power by closing his grip against the three young men most likely to take power over the kingdom: subduing Fortinbras (who has the potential to attack the kingdom), asking about Laertes (who is the son of powerful royalty), and asking about Hamlet (who was the presumed heir to the throne). In one "business meeting," Claudius quickly and effectively seizes and establishes his rule over the kingdom.

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### **Hamlet's Soliloquy**

#### Paraphrasing (ten sentences)

[1] I want to commit suicide but cannot because my religion dictates against it. [2] I feel that the world has fallen into disarray, with no restrictions placed against corrupt, foul things. [3] It hasn't even been two months since my father died. [4] He was so great, so loving to my mother— how could the world have come to this? [5] She used to love him so much too. [6] Why do women have to be so weak? [7] My mother cried for a short time, but changed loyalties so quickly, without logical thought, a stupid move. [8] The current king is no uncle to me, and definitely not a father. [9] The relationship between my uncle and my mother is disgusting and is even almost incest— it cannot end well by its nature. [10] I should probably keep my thoughts on this matter quiet.

#### Notes on Style

The tone is clearly one of disgust and hopelessness. Prince Hamlet discusses the marriage with clear repulsion ("unrighteous" (1.2.159), "wicked speed" (1.2.161), "incestuous sheets" (1.2.162)), criticizes his mother of being weak ("a beast that wants discourse of reason \ Would have mourned longer!" (1.2.154-155), "frailty, thy name is woman!" (1.2.150)), his uncle for being so unlike his father (*antithesis*: "hyperion to a satyr" (1.2.144), "my father's brother, but no more like my father \ Than I to Hercules" (1.2.156)), and he even is disappointed at himself for not being able to commit "self-slaughter" (1.2.136). He laments the rise of his uncle to power and his wife to her lowly state (both of whom he compares against his loving, strong-willed father), and none of his words have hope for a positive change in fortune— very hopeless.

#### Similar Character?

Prince Hamlet is a little like Grendel in that they are both pessimistic about the current state of affairs due to skepticism, and they both question the strength of women. Grendel, for example, hates that Wealtheow could so easily turn herself over to Hrothgar and sacrifice her love to her kingdom simply for a political affair, similar to how Queen Gertrude is so easily swayed to marry the new king. Both of these characters are compelled to commit suicide shortly afterwards, but neither follows through with it.

### Care to share a truth?

"It is as easy as lying." *Hamlet* 3.2.387.

In a world that values sincerity as a trait above almost any other, lies—treachery, conspiracy, rumors, and even white lies—run abundant. Honesty is a virtue run amok, and it always seems that the most virtuous die the most untimely deaths. The people who can understand their own truth and communicate it with others live the most fulfilling lives. Those that are convinced of a faulty truth, or those that can know the truth but cannot tell it to others (an *inner* truth), often result in tragedy.

In the historical Battle of Balaclava that serves as the subject of the poem "The Charge of the Light Brigade" by Alfred Lord Tennyson, the soldiers in the light brigade were unaware of the misdirection. Their truth was that of the officer's command: it was "Theirs not to reason why \ Theirs but to do and die" (Tennyson 14-15). The heroism lies in the soldiers' firm belief and dutiful actions carried out for their commander, even if they knew it meant certain death. They carried out their truth—but their truth was a miscommunicated blunder.

It's not difficult to see how an absolute faith in a defective idea, or putting absolute trust into someone or into a philosophy, contributes to an inability to find one's own truth. Because no person has the same understanding as others, this means the ideas are already thought out and there is no need to challenge them. Blind faith in a religion is a common example—taking every idea from scripture literally without any interpretation or skepticism is a recipe for catastrophe. The path has already been trodden, but it may be paved to disaster. In contrast, the "pathway of finding truth ... was thickly grown with weeds ... [where] each weed \ Was a singular knife" (Crane 1-9). This is a path that is often neglected out of convenience; or, in the case of the soldiers at Balaclava, not an option.

But for those willing to take the overgrown path, other tragic pitfalls await.

Hamlet is deeply saddened as he observes his uncle's marriage to his mother and ascension to the throne only a month after his father's death, to the point that he contemplates death in the first soliloquy. After the ghost of his father tells him of the regicide, Hamlet knows the truth and is determined to stay alive to carry out his uncle's demise under the cover of apparent madness and absolute secrecy. He *knows* "[the marriage] cannot come to good. \ But ... I must hold my tongue" (Shakespeare 1.2.164). The discrepancy between what he *knows* and what he *expresses* causes his demise.

Rosencrantz, Guildenstern, Polonius, Laertes, Ophelia, and the Queen—people dear to Hamlet at some point—are all without knowledge of the true cause of the King's death. They are all less disgruntled by the King's death and the hasty remarriage of the Queen. While this may only be because they lack the atomic-family relationship that Hamlet shares with his father, Hamlet perceives it as a test of faith, a disloyalty to the royalty. While Hamlet puts on his "antic disposition" (Shakespeare, 1.5.192) in an attempt to keep his friends uninvolved with the revenge plot—a noble cause—they each are slowly driven insane by his lack of transparency. Ophelia is driven to mental illness and eventual death, and Hamlet "hast cleft [his mother's] heart in twain" (Shakespeare, 3.4.177).

The tragedy in Hamlet's contained virtuosity can be explained in light of Kugelmass's downward spiral in "The Kugelmass Episode" by Woody Allen. In an attempt to escape the mediocrity and tedium of everyday life, Kugelmass uses the service of a sketchy self-employed magician to live his dream life. The difference between the two characters is that Kugelmass is doomed from the beginning—after all, throughout the whole story he "see[s] ruin and alimony; jail. For adultery with Madame Bovary, my wife

will reduce me to beggary" (Allen 4) and therefore he is not honest to himself—but Hamlet only sees his flaws as his plot progresses in an increasingly violent manner. But both are compulsive liars—they share the ability to lie through their teeth. Kugelmass is willing to lie to everyone except Persky, his accomplice and confidant, in order to fulfill his goal. While Hamlet's intentions are sound at first, the goal is warped by his means as he gets further entangled in his convoluted plot, and he only is able to confide in his best friend Horatio. Both Kugelmass and Hamlet isolate themselves in the realms of their own minds, so disparate from the real world that they cannot help their friends or their friends them.

In his loneliness, Hamlet is infected with the seed of revenge, honorable but corrupting. The results of his apparent madness are the degradation of his public image, the loss of his dearest friendships, and a greater motive for the King to assassinate him. Only after Horatio is instructed to "report [Hamlet] and [Hamlet's] cause aright \ To the unsatisfied" (Shakespeare 5.2.370-371) is Hamlet finally the people's hero, but this effort is too little and too late.

It's all too true that history is written by the victors. Usually the victors have the pride to express themselves and record their achievements. But a character such as Hamlet, so invested in keeping the plot secretive, will, sadly, go down in history as the mad prince who kills the King for reasons unknown. While Hamlet does watch the downfall of the King unfurl in his dying moments, it is too late—Hamlet is ensnared by his own lack of truthtelling. Had Laertes not opened up the truth at last ("The King, the King's to blame" (5.2.351)), the truth of King Claudius's guilt would never have been exposed. The secret would die with Hamlet. He would die a villain, not a hero.

Similar sets of attitudes appear in the medieval epic *Beowulf* and John Gardner's *Grendel*. The monster Grendel is no stupid creature; in fact, he is older than any living human, having watched the rise of human civilization. But his insights are all rendered naught when he is killed and his death celebrated by the people of the kingdom. From his experiences with nature and with man, Grendel discovers many philosophies throughout his lifetime, from solipsism and nihilism to Machiavellianism. These philosophies are his truth, but not impressed upon anyone or anything else. His effort to communicate (peacefully) with the humans is never enough; he knows the truth but cannot spread it. The dragon has a little bit more power, telling his truth to Grendel, but he too is killed by Beowulf, and civilization sees its death as a triumph. So much knowledge, gone.

Tragic loss. "A terribly pity—loss of a remarkable form of life. ... Meaningless, however" (Gardner 70), instructs the dragon to Grendel.

Many parallels run between Beowulf and the dragon, between Grendel and the dragon, and therefore between Beowulf and Grendel. Beowulf, for example, calmly states that Unferth will "prowl the stalagmites of hell for [murdering his brothers]" (Gardner 162), able to dictate how his fights were heroic without jest; Grendel cannot. Grendel instead plays with Unferth, abusing the only human besides Beowulf capable of understanding Grendel's speech; he laughs as he heartlessly covers Unferth in apples, reducing him to "a poor miserable virgin" (Gardner 85) rather than the hero the people saw in him. Unferth is the only human that can help the people glimpse Grendel's truth. To state and debate one's position is the foundation of society, but Grendel never does the latter.

Eveline has a similar problem in James Joyce's short story "Eveline." She spends too much time arguing, not with her father or her fiancé, but between her different selves. Rather than be dragged to one side or the other by her family's or her friends' words, she is dragged apart by her own. Her personal opinion is stifled because "the voices around [her] \ kept shouting \ their bad advice" (Oliver 3-5), and she

never goes far enough that “there was a new voice \ which [she] slowly \ recognized as [her] own” (Oliver 27-29). In other words, Eveline is able to understand the opinions of both her family (who would benefit from her stay) and her love (who would benefit from her leave), but not at the same time. Her ambivalence cripples her ability to hold an opinion and communicate it with others, so that she couldn’t escape her difficult situation. Here, she can understand multiple truths, but without the communication with others, she cannot synthesize a satisfying solution.

An external honesty remedies the problems with simply being moral internally. Horatio and the guards outside of Hamlet’s palace have the good loyalty and honesty to tell the prince all that they had seen, revealing the truth to others. King Hrothgar and the Shaper are able to sustain a kingdom for so long together because they both share the glorious image of the kingdom as they see it (the humans’ truth) to the people, rather than keeping it to themselves. Even the young king Hygmod is able to resist disaster by Hrothgar’s troops by presenting his sister as a gift— bringing to mind the human truth of beauty and love. All of these characters, able to transmit some value of themselves to their respective communities, live not only past the tragedy of their introverted friends, but also to fame and remembrance. While King Hrothgar is not as physically powerful or philosophically advanced as Grendel, and while Horatio not as intelligent as Hamlet, they are able to impose their beliefs on other people.

Communication is key.

“Tell the truth but tell it slant—” Dickinson 1

Human society is built upon the idea of the forum: conversation, discussion, debate. While the truth may be dangerously “Too bright for our infirm Delight” (Dickinson 3), it is certainly better to reveal some truth (a “slant” truth) than none at all. Because if one holds ideas to himself, with sole intentions but no cooperation or other real action, what happens at his death? What is he to the world who keeps his secrets and tells not one bit of the truth?

Tragic is the loss of great ideas, not communicated or communicated through loss.

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## Making Decisions as a Lonely Sisyphus

Hamlet and Eveline are both presented with problems that have clearly-defined but difficult options to choose from. For Hamlet, the issue is the revenge of his father's death by killing his murderous uncle, and for Eveline the chance to run away with her love to escape the harsh life under her almost-abusive father.

Neither of the two characters can make their decisions conclusively. Hamlet resolves to take revenge on Claudius after he is informed by the ghost of his father of the details of the murder, but he does not resolve to kill the king right away, taking his time to resolve any doubt of Claudius's guilt. After the guilt is confirmed, Hamlet reasons that he should kill Claudius only when sinning. After seizing letters written by the king directed to kill Hamlet, the prince returns to Denmark and yet again misses his chance to kill the clearly-guilty king. In Eveline's case, her thoughts go between thinking about "her promise to keep the home together as long as she could" (2) and her love for her fiancé, between the fact that "[her father] could be very nice" (2) sometimes to the madness of his aging.

While Hamlet and Eveline come from very different social backgrounds, their second thoughts are both caused by the similar social pressures. The apparent courses of action (that they do not readily realize) are the result of self-oriented motives. The benefits are not equally shared upon the public.

Hamlet's revenge for his father would, in his father's words, "let not the royal bed of Denmark be \ A couch for luxury and damnèd incest" (1.5.89-90), but it involves bloody combat and has the ability to throw the nation in a state of kingless anarchy or confusion, as well as the strife of his mother and the king's comrades. It satisfies a personal hunch and the restoration of the royalty's honor but has the ability to destabilize a nation.

Similarly, Eveline's pursuit of personal fulfillment would benefit her husband-to-be and herself, but hurt her close family and perhaps the town around her. To dissuade some of the guilt for the latter, she tells herself that "Miss Gavan would be glad" (1) and that they would "say she was a fool" (1) — that perhaps they will be happy she had left. But the fact that she yearns for the return of the good days of her youth, in that same hometown with the people before they left, implies that she probably has the same impact on the remaining people in the city. Her leave will hurt those friends who have the same happy memory of her as she had of her friends.

Thus the epiphany in both of these stories is in the realization of the broader social effect, a subconscious restraint on egocentric passion. This is embodied by the ominous words that Eveline remembers her mother saying: "Derevaun Seraun!" (3) which means "At the end of pleasure this is pain" ("Derevaun Seraun - Eveline"). An ostensibly simple success of either of the two's decisions could be the harbinger of many nasty greater repercussions, and it is therefore unwise not to act right away. These epiphanies provide necessary restraint against rash action.

But while Hamlet's and Eveline's actions are properly checked, they also lack timeliness. And the key to that—an unfortunate trait both characters have—is the fear of mutual trust.

Hamlet trusts nobody except Horatio and the guards, who already knew about the existence of the ghost before he did. In an effort to contain his revenge plot to a personal matter, he maintains an air of secrecy and an "antic disposition" (1.5.182). While he successfully hides the problem from his old friends Rosencrantz and Guildenstern and even his loved one Ophelia, his extended play of insanity drive

them all to their demises. He kept a secret, but all too well—nobody around him knew of his plot and could give him good counsel. Hamlet tested the unconditional loyalties of his old friends Rosencrantz and Guildenstern, of Ophelia and his mother, all while acting mad; naturally, they all responded poorly, and Hamlet took this to mean that they were untrustworthy. He doesn't understand the idea of mutual trust—perhaps if he had confided in Ophelia in a normal manner, his mind would be clearer and she would not be driven to her own mental illness and death, egged on by his insulting words: "Get thee to a nunnery" (3.1.131). Similarly, Eveline does not tell of her plans to run away to her brothers or friends, so she only has the her own aforementioned selfish and societal views to guide her, and nothing else. She believed she "had nobody to protect her" (2), thinking only to her brothers (one dead and one often far away) and dead mother, but never to her fellow friends. Of course if Hamlet had told the King (whom he sought to murder) his plan, or if Eveline had told her father her plans, there would have been consequences. But the similar tragedy, and the ensuing madness, is caused by a ubiquitous and constant suspicion that inhibits their ability to lend trust (without proof of absolute loyalty).

Without someone else to help, both Eveline and Hamlet get stuck in a deadly pattern of ambivalence, working up their passion almost to a sense of achievement before dashing their own hopes with some contrasting epiphany. This is the "hemiplegia or paralysis" that Joyce sees in Dublin's characters such as Eveline. They push Sisyphus's rock up his hill and dropping it on themselves, over and over. A true friend breaks the tedium by convincing the friend to leave the rock alone or by pushing it over the hill's crest.

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## The Thing He Carried

Jonathan Lam carried his backpack and all of his supplies throughout the school day. He had pretty standard equipment: a Swiss Army backpack, a digital watch by Swatch, a Pilot G-2 pen, and an orange notebook crammed with school papers in between the pages that had not been ripped out.

He carried a box made by Cross built for one pen, filled to the brim with a neat array of three narrow-diameter black pens, three push-top mechanical pencils (Japanese: Pentel and LOGO), a flash-drive, a flash-drive pen, mechanical-pencil lead refills, an eraser, and two colored pens. To every object inside was taped a handmade label with the letters "JLAM" clearly inscribed in black ink. Even the box itself was labeled. The stationary inside was interlaced just tightly enough that none of it could slide around, but just loosely enough so that the container could slide out of its case with ease.

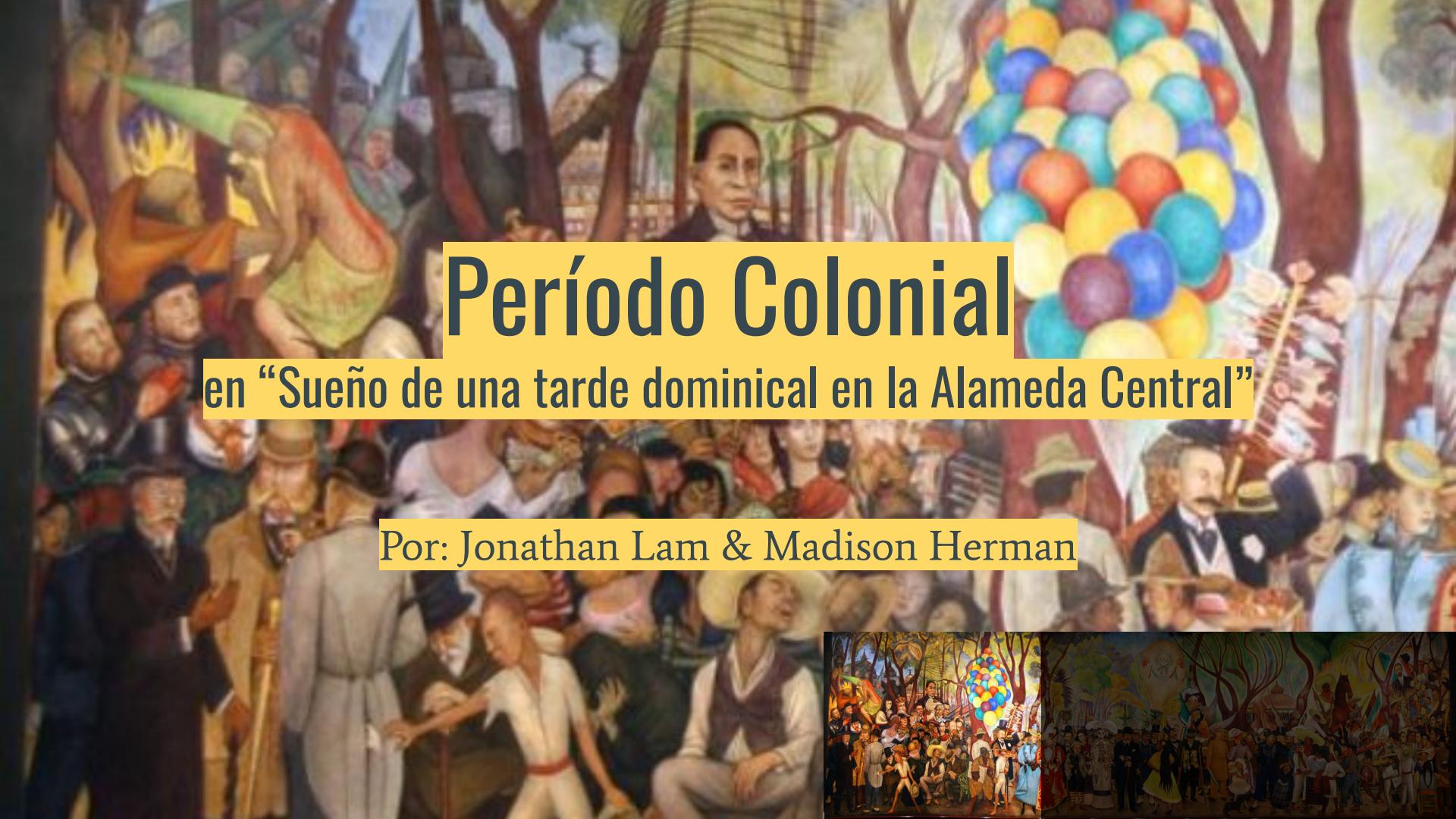
It was mostly a vainglorious piece of engineering. He had made a point to improve his handwriting this school year and not to lose a single piece of his stationary at the beginning of the school year, but these goals had faded. There were more exciting and more important initiatives that crossed his path: hackathons, college admissions, Rubik's cubing. The labeling system worked and he did manage to keep all of his writing utensils, but that was of little importance in his mind.

He carried the high expectations of an immigrant. His father had emigrated from China when he was in high school, and he was always working. He had worked in a restaurant then, taken a bargain by going to medical school, and was a busy doctor now. His mother had also immigrated to the U.S. when she was young, but at least she knew some English coming from English-ruled Hong Kong. His father had nothing when he came over. Jon would recite stories that his father would tell, of his father not knowing the difference between "interaction" and "intercourse" for a school essay; of the initial embarrassment and the subsequent, religious study of the English dictionary; of the ceaseless toil and fear that life wouldn't improve from the level of an uncared-for, unwanted migrant worker.

He certainly wasn't the only one: David Gandhi and Mohammed Ahsan and Park Jung-suk carried the same weight. They all carried the knowledge that they had a heritage to live up to, a culture of thousands of years of persisting through hardships. They carried the shame, as their immigrant parents did, of classmates mocking them by stretching out the edges of their eyes with their fingers, or asking the latest news about the last terrorist attack. Of course, there were some good-natured inquiries—for example, when Billy Condosa wanted to know what his girlfriend's Chinese tattoo really meant or when Joel Bart asked for a Chinese restaurant recommendation. Jonathan Lam had grown used to all of these requests, whether they be for good- or mal-intent, and whenever a racially-insensitive joke was thrown around, if someone realized and hushed the others with a sharp glare and apologized to him, he would smile and say that he was used to taking worse insults from his siblings. Which was true to some extent and usually extracted him from a sticky racial situation. After all, he couldn't risk losing all his family had gone through for a single punch, a single detention, a single stab in the image of the Chinese race in the eyes of the other students. He learned that sometimes it was better just to carry the shame.

Like when he had to use the bathroom during the SAT. He carried the shame of a hyperactive bladder ever since the fifth grade. But because he was among the top students of his grade, this was something he couldn't talk about. It wasn't right nor convenient to talk about grades and then the numerous trips to the bathroom. His parents had worked so hard for him to get a free education in the American schooling system, finish at the top of his class, and earn a better life like they did. They didn't pay for him to program computers into the wee hours of the night or Rubik's cube between classes or have a bathroom problem.

But on the day of that standardized test, it was all too much. The stress, the two hours before relief. He relieved himself during the test. The initial warmth turned to a clammy damp. He wanted to scream or storm out of the room, but that was not something a second-generation Asian was permitted to do. There was no one to help him. He had nothing better to do than to simply continue the test.



# Período Colonial

en “Sueño de una tarde dominical en la Alameda Central”

Por: Jonathan Lam & Madison Herman



# Información Preliminar

La era colonial de México, desde el descubrimiento de Cortés hasta el Porfiriato, fue muy complicado.

Había muchos conflictos militares, especialmente intervenciones exteriores en México. También había el conflicto entre los conservativos y liberales.

# Eventos / Personas Importantes

# Descubrimiento Español de México (1500s)

- Hernán Cortés, conquistador español de México
  - Tomando control de Tenochtitlán en 1519
- Los españoles fueron muy brutales



# Inquisición Mexicana (1571-1821)

- Un evento religioso de los españolas
- Continua hasta la independencia de México
- 50 personas son ejecutados, incluyendo 24 judíos



# Independencia de México (1821)

- Inspirado por las revoluciones democráticas americano y francesa y la Era de Iluminación
- Agustín de Iturbide fue un general mexicano importante durante la guerra



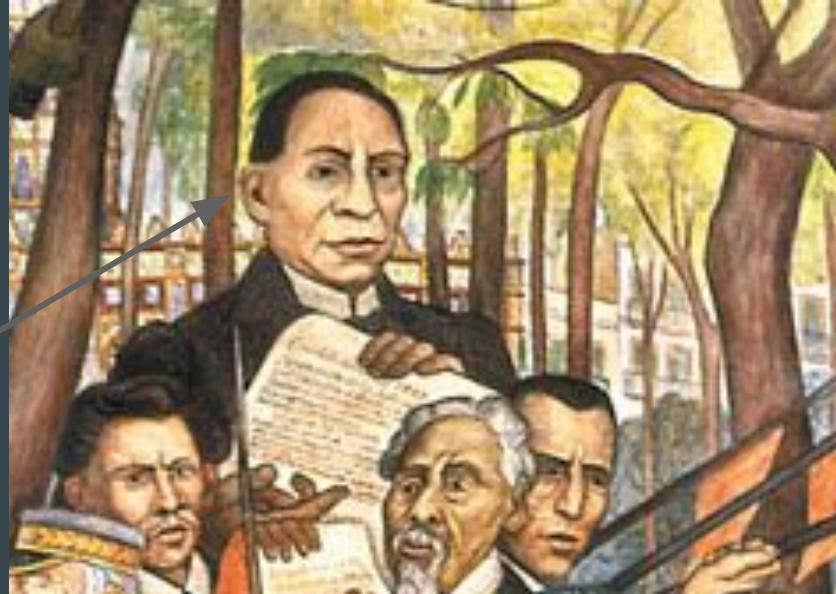
# Intervención estadounidense (Guerra de EEUU-México) (1846-1848)

- Luchado por conflictos de fronteras, y porque los EEUU quería conseguir más tierra
- La general mexicana durante la guerra, Antonio López de Santa Anna, fue un militar y político muy ineficaz y perdió la guerra
- México perdió **más que 50%** de su tierra a los EEUU en el Tratado de Guadalupe Hidalgo al termino de la guerra



# Guerra de Reforma (1857-1860)

- Una guerra entre los liberales y conservativos de México
- Los liberales tomaron control del país con la Plan de Ayutla, una plan liberal que quiere expulsar Santa Anna de su posición
- Don Benito Juárez fue líder del bando liberal, y ellos ganaron la guerra



# Intervención Francesa (1862-1867)

- En respuesta a unos políticos ofendidos, Francia invadieron México y instalaron una emperador de México, Maximiliano de Habsburgo
- Conservativos son enojados (la Guerra de Reforma), apoyaron los franceses
- Los liberales (con Don Benito Juárez) insistieron que sus mismos son los líderes de México, y ganaron con una guerra de guerrillas
- Juárez fue héroe de por muchos americanos latinos



# Temas

# La religión

- Mostrando con los iglesias y la inquisición
- Uno de las metas más importantes de conquerer nueva tierra para España fue para propagar la religión cristiana



# La guerra y la violencia

La época fue muy violenta. Había 4 guerras importantes hasta 1821 a 1867:

1. Guerra de Independencia de México
2. La Intervención Estadounidense
3. La Guerra de Reforma
4. La Intervención Francesa

Es una tema importante de toda de la mural



# Las personas indígenas

- Están en el parte anterior de este mural
- Representa que los mexicanos ordinarios duraron todas estas conflictos, muchos sufrimientos



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# **Fotoperiodismo de La Revolución Mexicana de 1910-1920**

Por Jonathan Lam

# Foto 1

- soldados estadounidenses
- gran influencia americana en la guerra
- interés comercial del porfiriato



Temas importantes: influencia de EEUU

# Foto 2

- la democracia y justicia social
- La Decena Trágica (Francisco Madero → Victoriano Huerta)



Temas importantes: influencia de EEUU, golpe de estado

# Foto 3

- utilización de trenes en la guerra
- efecto de trenes en la gente antes de la guerra



Temas importantes: influencia de EEUU, golpe de estado, indignación de las masas

## Foto 4

- causa de una emigración grande (a los EEUU)
  - 50.000 - 100.000 migrantes/año



Temas importantes: influencia de EEUU, golpe de estado, indignación de las masas, desplazamiento

# Foto 5

- facción constitutionalista de Carranza
- ideas del Partido Liberal de México (PLM)
- reforma social
- victoria liberal



Temas importantes: influencia de EEUU, golpe de estado, indignación de las masas, desplazamiento, triunfo liberal



# Resumen

La Revolución Mexicana fue un conflicto muy complicado, especialmente por la intervención estadounidense, que resultó en la victoria de la gente contra las régimen totalitarias.

# iGracias por Mirar!

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-

*Guernica* de Pablo Picasso  
y  
Las Protestas de Plaza de Tíannamén

• • •

Por Jonathan Lam

# *Guernica*



# Las Protestas de Plaza de Tiananmén

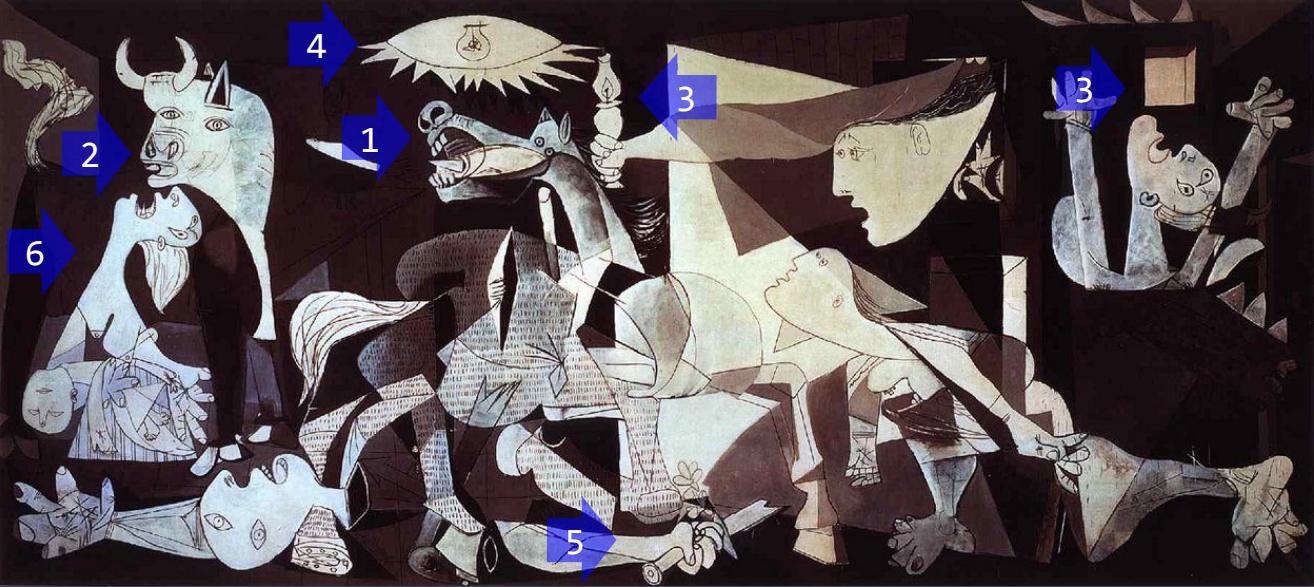
- Millones de estudiantes de universidad protestaron contra la injusticia económica.
- El gobierno tuvo miedo que las protestas destruyen el país.
- El gobierno usó el ejército en 3 junio, 1989.
- Hay miles de muertos y heridos.



# Conexiones a *Guernica* (la mural)

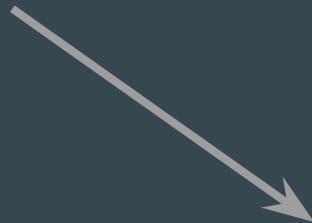
## Símbolos en común:

- |                                |                               |
|--------------------------------|-------------------------------|
| 1. el caballo                  | = la democracia y la libertad |
| 2. el toro                     | = el gobierno comunista       |
| 3. la vela, la ventana pequeña | = protesta pacífica           |
| 4. la luz                      | = los tanques y armas         |
| 5. la espada rota              | = matando de estudiantes      |
| 6. la mujer y su bebé          | = los estudiantes             |



# Otras Conexiones al Bombardeo de Guernica

- Agresores oscurecieron los detalles
  - Número de fallecidos es inseguro
- Una imagen es tan famosa como el evento



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# El Son Cubano

## Introducción Visual al Caribe

por Jonathan Lam

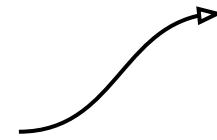
# El Son Cubano

- Estilo de música afrocubano
- Raíz Bantú
- Ritmo y canción únicos
- Son ➔ salsa



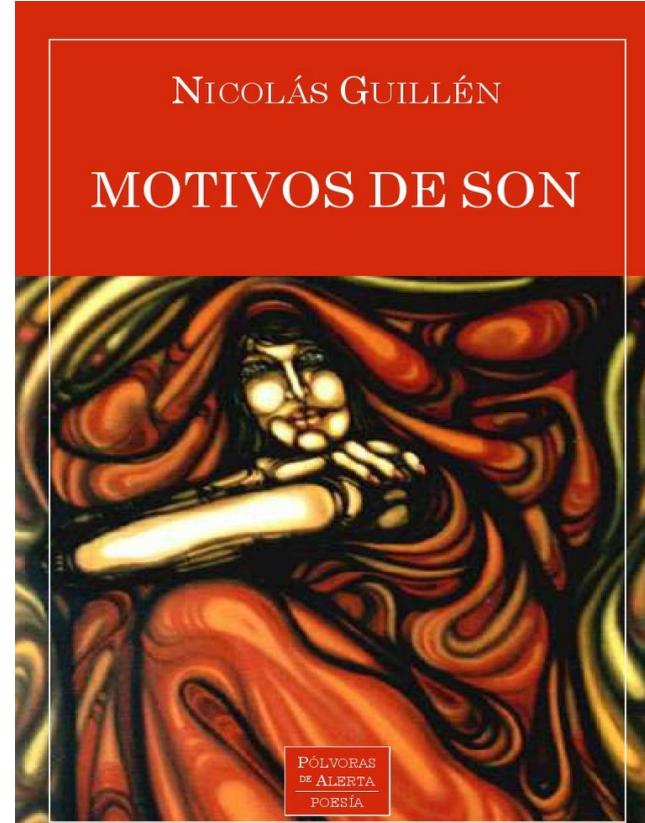
# Los Bongós

- Instrumento afrocubana
- Primero en la zona oriental de Cuba
- Estilos: nengón, changüí, son cubano



# *Motivos de Son*, Nicolás Guillén, 1930

- Nicolás Guillén
  - Premio Nacional de Literatura de Cuba
  - Padres mulatos
  - Luchó en España (republicano)
  - Comunista, exilado de Cuba
- Colección de poemas por Guillén
  - Temas de conflictos de género, raza



# “Búcate Plata,” *Motivos de Son*

Búcate plata,  
búcate plata,  
poqque no doy un paso má  
etoy a arró con galleta  
na má.  
Yo bien sé cómo etá to,  
pero biejo, hay que comer:  
búcate plata,  
búcate plata,  
poqque me boy a corré.

Depué dirán que soy mala,  
y no me quedrán tratar,  
pero amó con hambre, biejo,  
¡qué ba!  
Con tanto sapato nuebo,  
¡qué ba!  
Con tanto reló, compadre,  
¡qué ba!  
Con tanto lujo, mi negro,  
¡qué ba!

Búcate plata  
búcate plata,  
porque no doy un paso más  
estoy a arróz con galleta  
no más.  
Yo bien sé cómo está todo,  
pero viejo, hay que comer:  
búscate plata,  
búscate plata,  
porque me voy a correr.

Después dirán que soy mala,  
y no me quedrán tratar,  
pero amó con hambre, viejo,  
¡qué ya!  
Con tanto zapato nuevo,  
¡qué ya!  
Con tanto reló, compadre,  
¡qué ya!  
Con tanto lujo, mi negro,  
¡qué ya!



- Usa estilo fonético
- Conflicto de género

[Video](#)

## Bibliografía

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¡Gracias por mirar!

# La Industria en la Guerra Civil Española

Por Jonathan Lam

Carlos Fontseré



# “La industria, l’agricultura tot per al front”

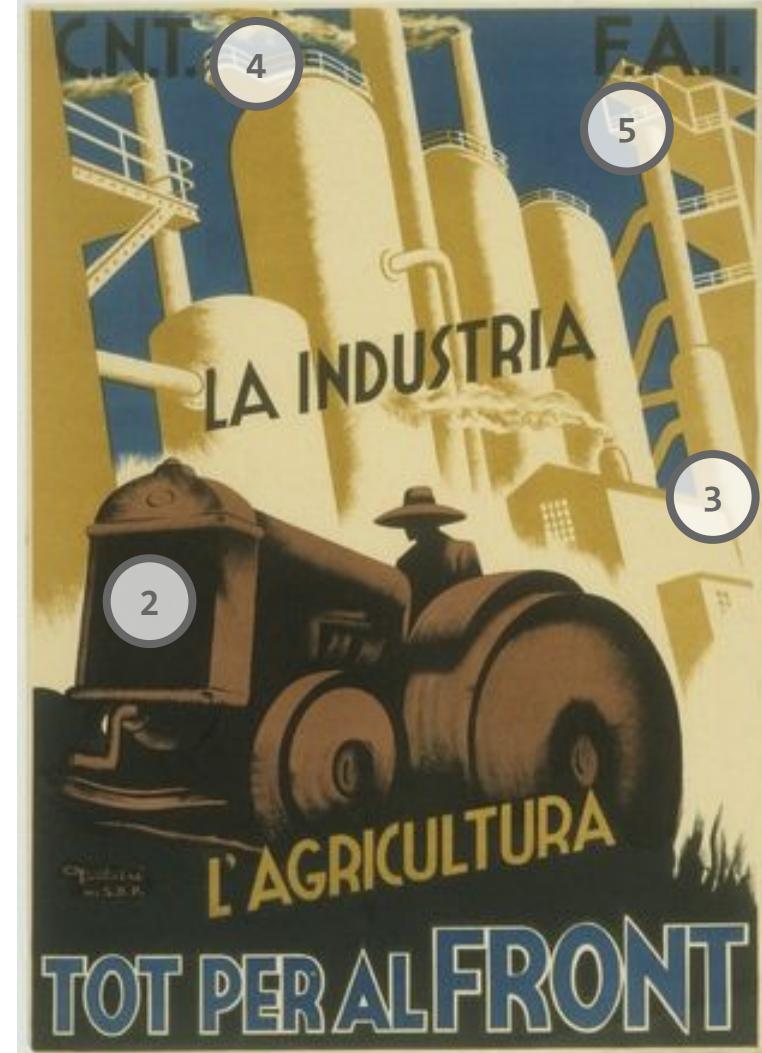
1. (de Catalán) *La  
industria, la agricultura,  
todo por el frente*

2. tractor → granjeros, agricultura

3. fábrica → industria

4. CNT → Confederación Nacional de Trabajo

5. FAI → Federación Anarquista Ibérica



# Colectivización



- **Movilización de la economía a la guerra**
- **Forma del socialismo**
- Funciona en partes republicanos (e.g., Cataluña)

# Bibliografía

“Background of the Spanish Civil War.”

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# La Perspectiva del Bando Nacional en la Guerra Civil Española

Por Jonathan Lam



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## Gráfico 1

- El comunismo → el problema
- Francisco Franco luchó contra al comunismo



---

## Gráfico 2

- Franco protegió España de las ideas comunistas

El bando nacional consiste de:

- CEDA (Confederación Española de Derechas Autónomas)
- Monárquicos carlistas y alfonisinos
- Países totalitarios (Portugal, Italia, Alemania)



---

## Gráfico 3

- El bando republicano consiste de:
  - **Bolchevismo**
  - **La injusticia social**
  - **Los politicastros**
  - **El francmasonería**
  - **La FAI (Federación Anarquista Ibérica)**
  - **El separatismo de Catalonia**



---

## Otra información sobre Franco y los nacionalistas

- 1936: Franco participó en un golpe de estado que empezó la guerra civil
- 1939: Franco ganó la Guerra Civil Española, era el dictador hasta 1975
- Los países fascistas (Italia y Alemania) que apoyan Franco lucharon por fascismo en la Segunda Guerra Mundial





# Bibliografía (otras fuentes de información)

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“Guerra Civil Española.” <[https://es.wikipedia.org/wiki/Guerra\\_Civil\\_Española](https://es.wikipedia.org/wiki/Guerra_Civil_Española)>.

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# LAS DOS FRIDAS

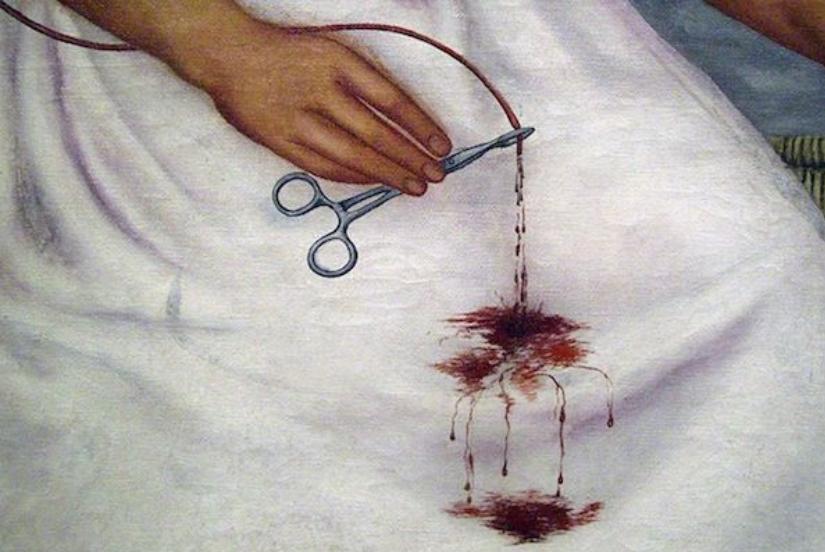
UNA AUTORRETRATA DE FRIDA KAHLO



por Jonathan Lam

- Nubes tormentosas
- Corazones descubiertas
- La sangre goteando
- Una vena conectado, se toman de sus manos
- Traje tradicional (a la izquierda) y moderna (al derecho)





Fórceps

# LA SANGRE

Retrato de Diego Rivera



# TEMAS

- el conflicto entre prácticas nuevas y tradicionales
- partes de cuerpo gráficos y descubiertos ⇔ sus heridas
- el tumulto en general
  - su divorcio (el mismo año) y su amor
  - la Revolución Mexicana

(nubes ominosas)



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<<https://www.1st-art-gallery.com/Frida-Kahlo/The-Two-Fridas.html>>.

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<<https://www.fridakahlo.org/the-two-fridas.jsp>>.

# “Sensemayá” y las Garífunas



por Jonathan Lam

# (Sín)tesis

---

El sufrimiento (especialmente el conflicto social) fue el factor importante para preservar la identidad cultural (la cultura afrohispana).

# Temas de “Sensemayá”

ritmo: mayombe

naturaleza: culebra

religión: sensemayá

¡Mayombe—bombe—mayombé!

¡Mayombe—bombe—mayombé!

¡Mayombe—bombe—mayombé!

La **culebra** tiene los ojos de vidrio;  
la culebra viene y se enreda en un **palo**;  
con sus ojos de vidrio, en un palo,  
con sus ojos de vidrio.

La culebra camina sin **patas**;  
la culebra se esconde en la **yerba**;  
caminando se esconde en la yerba,  
caminando sin patas.

...

Sensemaya, la culebra,  
Sensemayá.  
Sensemayá, con sus ojos,  
Sensemayá.  
Sensemayá, con su lengua,  
Sensemayá.  
Sensemayá, con su boca,  
Sensemayá.

...

---

“el negro Caribe o Garífuna, es un producto híbrido”

“una guerra intermitente” (y derrota)

# “Conociendo a la gente Garífuna”



viaje a Honduras

# Conflictos sociales

---

- Tecnología es peor → afecta economía
- Tierra comunal está tomando por gobierno
- Las idiomas español y inglés son más útiles

# La música y ritmo (y cuentos)

---

“Las canciones son siempre el goce y el dolor del hombre”

“... importantísimas para el bienestar del espíritu”

(El Limo del Almendares, Balada de Mis Dos Abuelos)

# La música y ritmo (y cuentos)

---

“... era el medio para comunicar toda clase de mensajes: planes de escape, lugares de escape, lugares para juntarse, las cosas necesarias a traer”

“música mantiene al cuerpo libre y la fatiga a un nivel mínimo”

(BVSC)

# Música Garífuna frente Son Cubano

---

Similar:

- Ritmo prominente
- Temas de sufrimiento

Diferente

- Son es más divertido (cambios en sociedad)

# La medicina

---

Curanderos “nunca rehus[an] ayudarlos”

Lo que “no pueden sanar con los tradicionales procedimientos médicos”



(el brujo de “El Limo del Almendares”)

# Resumen

---

Conflictos social / político

Felicidad / sufrimiento

Oppresión

Falta de tecnología / reclusión



Unidad / identidad cultural

La música

Necesidad de expresar (música)

Curandero

**¡Gracias por mirar!**

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# “Candela” por Faustino Oramas

## Proyecto BVSC

— Por Jonathan Lam —

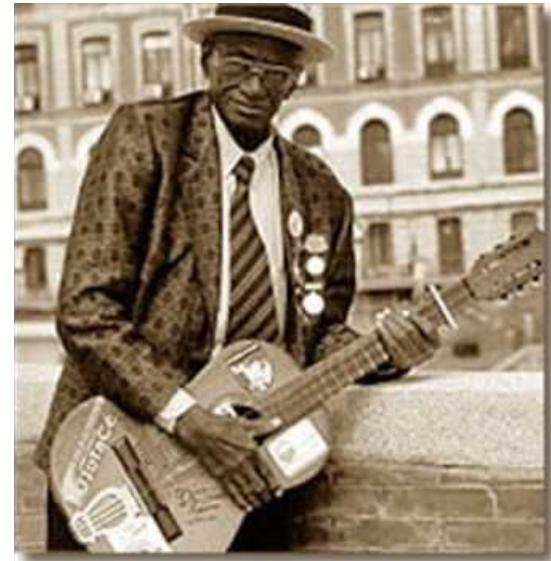
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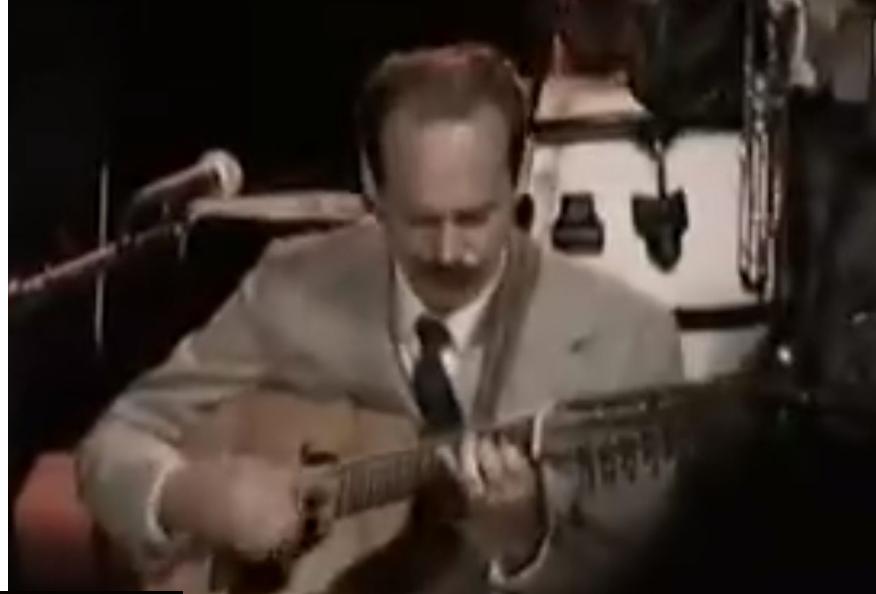
# Composer: Faustino Oramas

- Campesino, música original→ dinero
- “El guayabero,” “el juglar mayor de Cuba,” “el rey de doble sentido”
- Trovador, tresero, compositor
- > 50 canciones
- Improvisación
- Uno de últimos trovadores



# Instrumentos

- Sonero (la voz) — improvisación
- La trompeta
- Los timbales
- La tres



# Temas

- El amor "candela"
- La música
  - Los tambores "timbal"
  - El baile "danzón," "guaracha"
  - La diversión "quiero que seguir gozando"
- La lengua "aé"

# “Candela” y Son Cubano

- *Descarga* (sesión improvisada)
- Instrumentos típicos (tres, timbales, trompeta, voz)
- Vivaz, divertido, y informal (conversación)
- Lengua informal (aé)

# Bibliografía

¡Gracias por mirar!

“Buena Vista Social Club - Candela.”

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Candela lyrics © Universal Music Publishing Group, Music Sales Corporation

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# PROYECTO DE COMUNIDAD: VOLUNTARIO EN THOMAS HOOKER

Jonathan Lam

# MI PROYECTO

Mi proyecto es ser voluntario al Programa Lighthouse en Thomas Hooker.

- Tutor por tarea
- Voluntario general



# INFORMACIÓN SOBRE LIGHTHOUSE

Lighthouse es un programa después de escuela para cuidar los niños con padres que están trabajando.

Cada día consiste de:

- Una hora por trabajo (tarea)
- Una hora por actividades
  - Rugby
  - Tenis
  - Puzzles
  - Mucho más

# LAS METAS

- Aprender las diferencias en perspectivas académicas (STEM)
- Hablar con más fluidez en Español
  - Aprender vocabulario de matemáticas
- Aprender sobre la cultura español-americano por niños estadounidenses

# ¿QUÉ HICE?

- 17 visitas (34 horas)
- Ayuda con tarea
- Ayuda con facilitar actividades
- Tomar fotos y hacer entrevistas

# VOCABULARIO

Cociente, dividendo, divisor, divisor, división larga	Quotient, dividend, divisor, long division	Bola	ball	mascota	pet
ajedrez	chess	Fracciones mixtas, fracciones impropias	Mixed fractions, improper fractions	El soccer	soccer
Segundos nombres	Middle names	Pato	duck	Parque infantil	playground
lapicero	pen	Disculpe	Excuse me	Alubia	beans
gringo	White foreigner (derogatory)	Cinco y tres de cuatro	5 $\frac{3}{4}$	pilla-pilla	Tag (the game)
coreografia	choreographed	Darse bien	To be good at [something]	Helado italiano	Italian ice
Fracción, denominador, numerador	Fraction, denominator, numerator	rugby	rugby	Volúmenes de prismas	Volumes of prisms
terapeuda	therapist	La simulacro de incendio	Fire drill		

# LOS ESTUDIANTES



# LOS ESTUDIANTES

- Clase de 12 quinto grados
- Cinco estudiantes hispanos: Alex, Ariana, Kayla, Ángel, Gabriel
- Enfoque en Kayla, Ángel, y Gabriel



# ÁNGEL

- Dominicano (nació en los EEUU)
- Primo de Gabriel

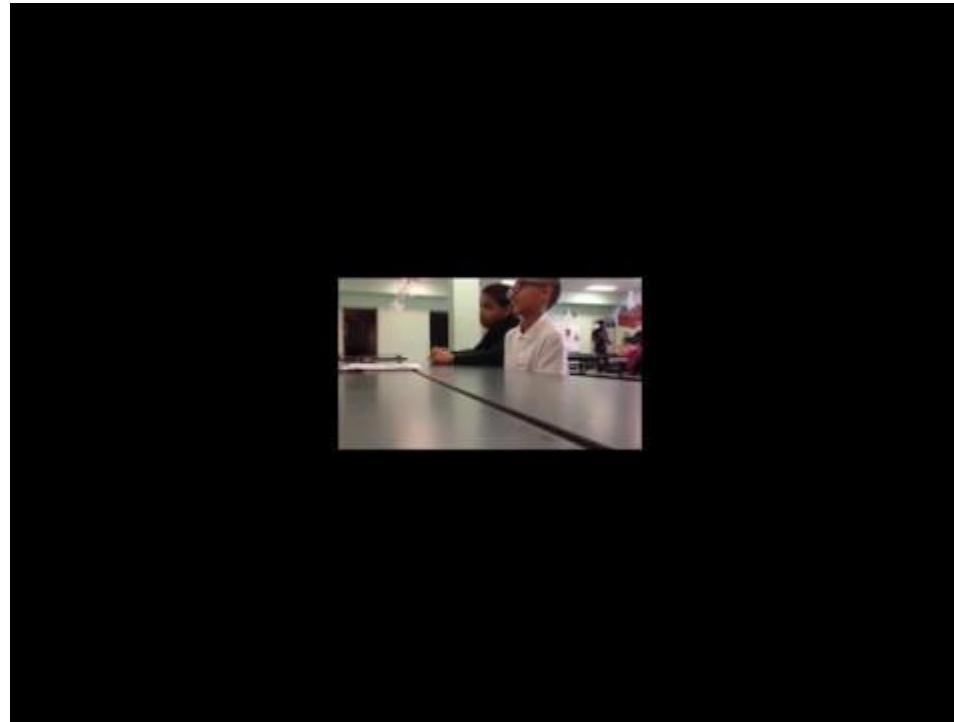


# GABRIEL

- Dominicano (nació en los EEUU)
- Primo de Ángel



# LA ENTREVISTA (ÁNGEL Y GABRIEL)

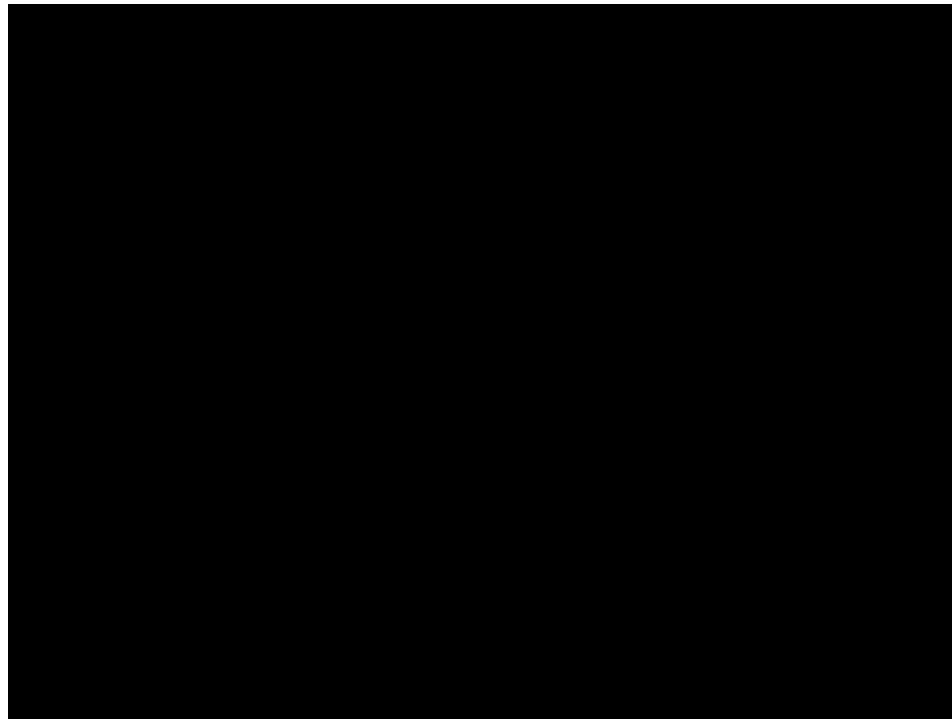


# KAYLA

- Hondureno (nació en Honduras)
- Siempre quiere hablar la verdad, es más serio



# LA ENTREVISTA (KAYLA)



# ENTREVISTAS (RESUMEN)

Nombre	Ángel	Gabriel	Kayla
Años	11	11	11
Clase favorita	matemáticas	“math”	arte???
Clase menos favorita	inglés	historia	matemáticas
¿Hablar español en casa?	la mayoría	no mucho	casi siempre
¿Hablar inglés en casa?	un poco	la mayoría	poco
¿Qué quiere ser?	doctor	policía	terapueta
Intereses	videojuegos, deportes	videojuegos, deportes	arte

# CONCLUSIONES

# CONCLUSIONES

Meta 1: Aprender las diferencias en perspectivas académicas (STEM)

- mucho énfasis en matemáticas
- poco énfasis en ciencias
- a los chicos les gustan las matemáticas
- a las chicas les gusta el arte

# CONCLUSIONES

Meta 2: Hablar con más fluidez en Español

- aprender vocabulario de matemáticas
- “Spanglish” y Español menos formal
  - depende en la nivel en casa
- todos bilingües
- soy gringo

# CONCLUSIONES

Meta 3: Aprender sobre la cultura español-americano por niños estadounidenses

- padres hispanos son estrictos sobre notas
- necesita ser resistente para sobrevivir

# CONCLUSIONES

En general: aprendí cómo trabajar con niños y ser un voluntario responsable.

- primera vez ser voluntario por mucho tiempo
- primera vez trabajar con niños

# ACTIVIDAD

Math

www.CoreStandards.com

8

100 90 80 70 60 50 40 30 20 10 0

Take this problem.

Addie is Substituting Babysitter.

1) How does a line that was  $3 \frac{1}{2}$  inches long change if it is cut into two pieces? One piece is  $1 \frac{1}{2}$  inches long. How long is the second piece?

2) At the beach, Roger finds a piece of driftwood that is  $2 \frac{1}{2}$  times as long as his stick. If his stick is  $1 \frac{1}{2}$  inches long, how long is the piece of driftwood?

3) On Saturday, a boy rode his bicycle for  $2 \frac{1}{2}$  hours. He stopped for a break after  $1 \frac{1}{2}$  hours. How many more hours of sleep did they use during the day?

4) A boy drew a line that was  $4 \frac{3}{4}$  inches long. If he drew a second line that was  $2 \frac{3}{4}$  inches long, what is the difference between the lengths of the two lines?

5) For Halloween, Bailey received  $7 \frac{1}{2}$  pounds of candy. After a week her family had eaten  $2 \frac{1}{2}$  pounds. How many pounds of candy does she have left?

6) Over the weekend Carol spent  $3 \frac{3}{4}$  hours total studying. If she spent  $2 \frac{2}{3}$  hours studying on Saturday, how long did she study on Sunday?

Answers

1. 1  
2. 4  
3. 1  
4. 4  
5. 1  
6. 1  
7. 1  
8. 1  
9. 1  
10. 1

# ACTIVIDAD

1. Emparejar las expresiones de Inglés al Español.
2. Emparejar las expresiones de Español a sus soluciones.

# ACTIVIDAD

1. Emparejar las expresiones de Inglés al Español.
2. Emparejar las expresiones de Español a sus soluciones.

Durante mi proyecto, siempre estuve aprendiendo sobre vocabulario relevante a la tarea simple, en la hoja de actividad.



¡Gracias por mirar!

# PERSONAS PARA DAR GRACIAS

- Sr. Poulos
- Sra. Días, coordinador de voluntarios por Lighthouse
- Sra. Perez, coordinador de sitio de THS
- Otros voluntarios/trabajadores en THS
- Los estudiantes españoles de grado cinco
- Otros estudiantes

A black and white close-up photograph of the famous war photographer Robert Capa. He is shown from the chest up, looking directly at the camera with a serious expression. His left hand is propped under his chin, supporting his head. He has dark hair and is wearing a light-colored, collared shirt.

# Robert Capa: Fotoperiodismo en la Guerra Civil Española

Por Jonathan Lam

# Información Preliminar

# Fotografía y la Guerra Civil Española

- Gran innovación con la fotografía (35mm film)
  - No necesitan trípodes, fue más móvil
  - Leica (la primer cámara con 35mm film) fue muy anunciado en 1934
- Invento de los periódicos con imágenes (1930s)
  - Demanda por fotógrafos
- La Guerra Civil Española fue la guerra primera que fue casi totalmente fotografiada



Leica III



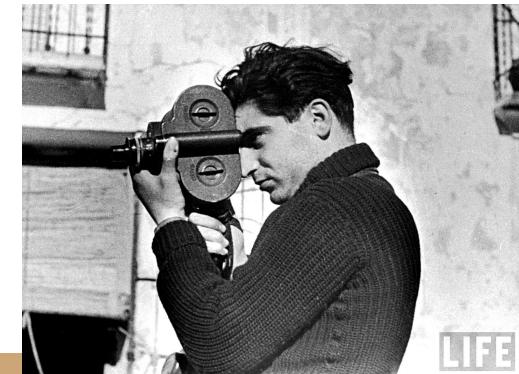
Contax II

las cámaras preferidas de Capa



# Robert Capa (nació André Friedmann)

- Nació en Budapest, Hungría, en 1913, con el nombre André Friedmann
  - Cambió al nombre más americano en París
- Se influyó mucho por el nazismo (Alemania) y opresión política (Hungría)
- Fue fotografía por cinco guerras:
  - La Guerra Civil Española
  - La Segunda Guerra Sino-Japonesa
  - La Segunda Guerra Mundial (especialmente con la batalla de Normandía)
  - La Guerra Árabe-Israelí
  - La Guerra Indochina
- “El mejor fotógrafo de guerra en el mundo”  
(Picture Post)



# Influencia Mundial de Capa

- Viajó con y influyó a Ernest Hemingway (escritor)
- Quiso **re-personalizar la guerra**
  - Especialmente para generar simpatía por el bando republicano
- Fundó Magnum Photos, el primer cooperativa fotográfica
- Recibió la Medalla de la Libertad de Presidente Eisenhower



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# Galería

# Para cada foto:

## 1-2 minutos (en parejas):

1. ¿Qué ves en la foto? Descríbelo.
2. Adivina el contexto (el evento) y título del foto.
3. Identifica una tema en común o una conexión a otro texto.
  - (Guernica, La Lengua de las Mariposas, Pecado de Omisión)

## 1-2 minutos (con la clase):

1. Voy a descubrir la situación actual de las fotos.
2. Vamos a discutir las temas y conexiones.

# Foto 1



# Foto 2



<https://shop.magnusphotos.com/collections/robert-capas-fine-prints/products/the-falling-soldier-spain-september-1936-robert-cap>

# Foto 3



<https://shop.magnumphotos.com/collections/robert-capas-fine-prints/products/the-falling-soldier-spain-september-1936-robert-cap>

# Foto 4



<https://shop.magnumphotos.com/collections/robert-capas-fine-prints/products/the-falling-soldier-spain-september-1936-robert-cap>

# Prueba de Coincidencia

¡Gracias por Mirar!

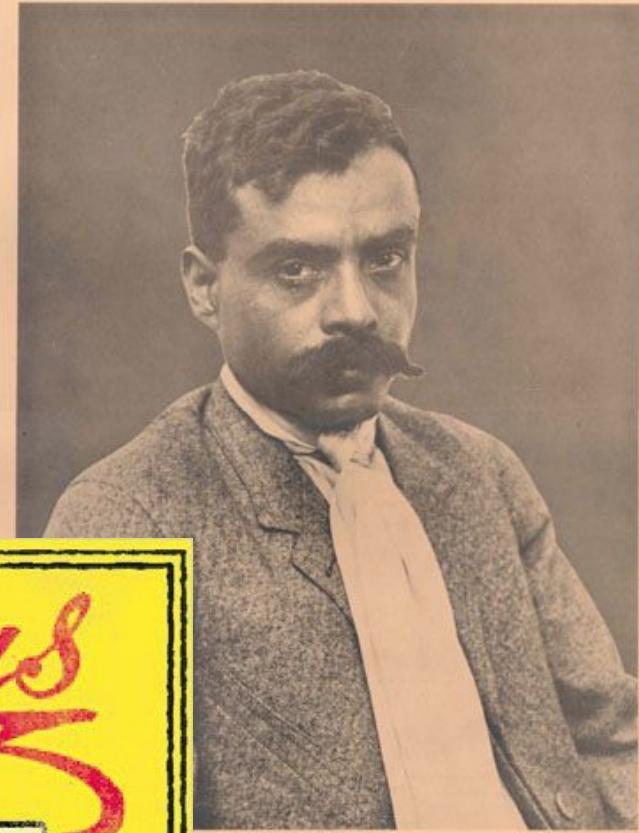
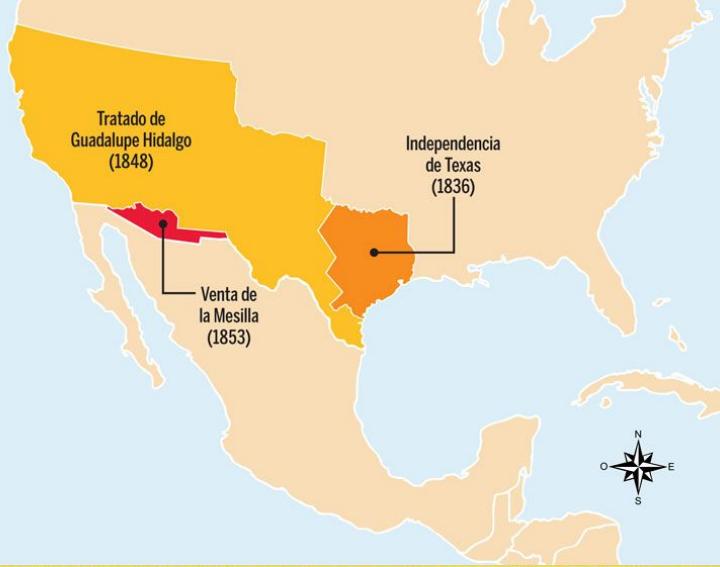


# **La Conexión Entre los Campesinos y la Tierra**

---

**por Jonathan Lam**

# Contexto



N DE AYALA  
1911

LOPEZ GONZALEZ

# Tesis

campesinos ↔ tierra, naturaleza

ricos ↔ industrialización

amenazas a la naturaleza → conflicto

intervención de fuera es mala

# Conexiones a la historia

# La Intervención Estadounidense en México

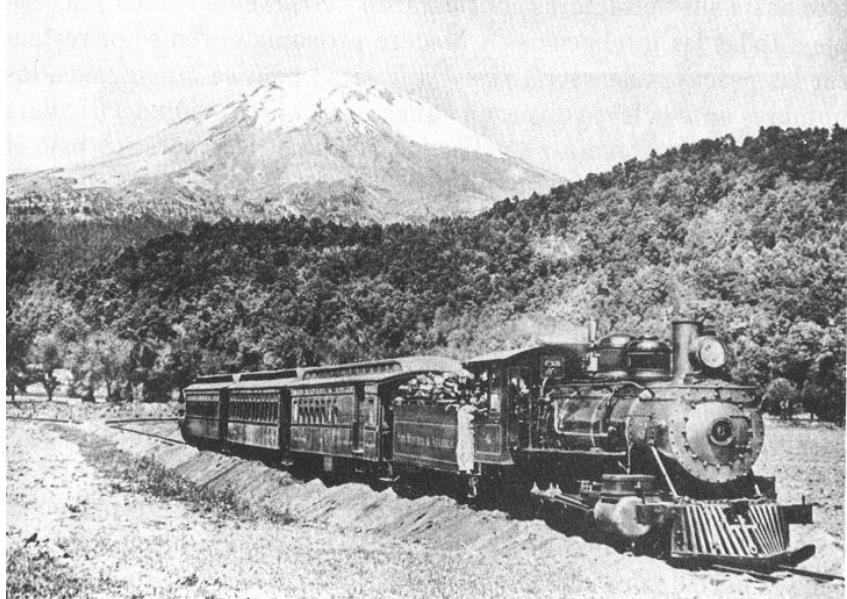
(1946-1948)

- México perdió > 50% de tierra
- Tierra → raro



# El Porfiriato

- Construcción de vías férreas por compañías estadounidenses
- Tierra → más rara
- Campesinos → más pobres



## PLAN DE AYALA.

Plan elaborado por los hijos del Estado de Morelos, affidado al Ejército Insurgente que defiende el cumplimiento del Plan de S. Luis, de las reformas que ha creido conveniente aumentar en beneficio de la Patria Mexicana.

Los que suscribimos, constituidos en Junta Revolucionaria, para sostener y llevar a cabo las promesas que hizo la Revolución de 20 de noviembre de 1910, próximo pasado, declararon solemnemente ante la faz del mundo civilizado que nos juzga, y ante la Nación a que pertenecemos y amamos, los propósitos que hemos formulado para acabar con la tiranía que nos opprime y redimir a la Patria de las dictaduras que se nos imponen, las cuales quedan determinadas en el siguiente Plan.

1.º Temiendo en consideración que el pueblo mexicano acusillado por don Francisco I. Madero fue a derramar su sangre para conquistar sus libertades y reivindicar sus derechos conciencidos, y no para que un hombre se asechare del Poder violando los sagrados principios que juro defender bajo el lema de "Sufriremos, Efectivo," "No Reclamaremos," ultrajando la fe, la causa, la justicia y las libertades del pueblo, convencidos de que tales son las bases sobre las que nos

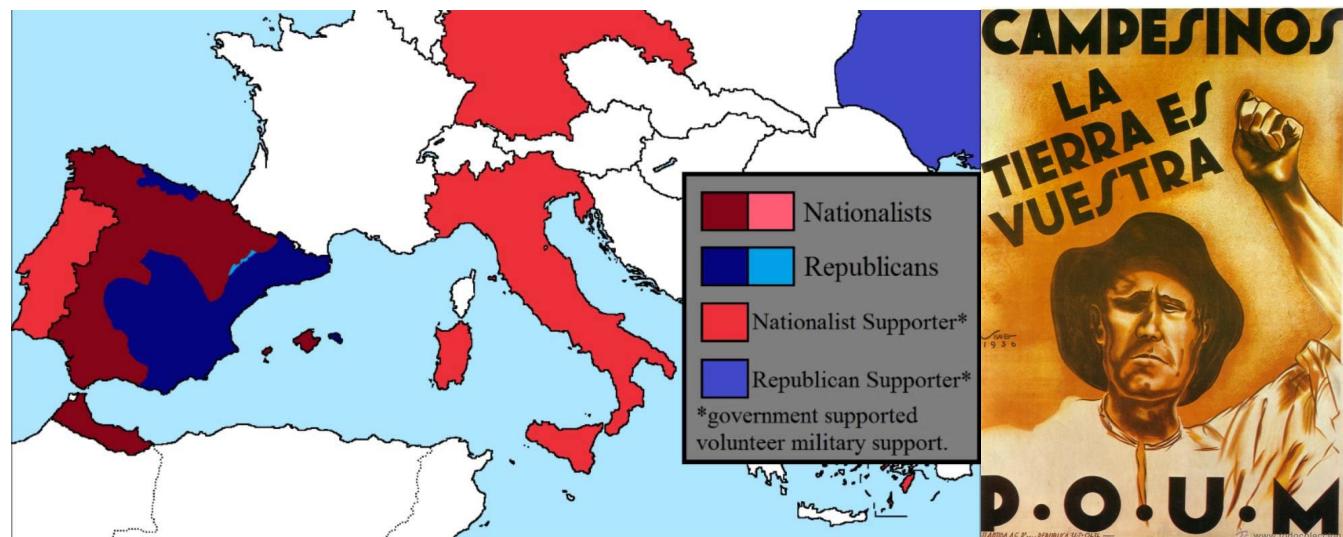
promesas y numerosas intrigas a la Nación; teniendo en consideración que el tantas veces repetido Sr. Francisco I. Madero ha tratado de ocultar con la fuerza bruta de las bayonetas y de ahogar, en sangre a los pueblos que lo pidan, solicitan o exigen el cumplimiento de sus promesas a la Revolución, llamando los bandidos y rebeldes, condonándoles a una guerra de exterminio, sin conceder ni otorgar ninguna de las garantías que prescriben la razón, la justicia y la ley; teniendo en consideración que el Presidente de la República, señor don Francisco I. Madero, ha hecho del Sufrimiento efectivo una sangrienta burla al pueblo, ya imponiendo contra la voluntad del mismo pueblo en la Vicepresidencia de la República al Lic. José María Pino Suárez, o ya a los Gobernadores de los Estados designados por él, como el llamado General Ambrosio Figueras, verdugo y tirano del pueblo de Morelos; ya entrando un contubernio escandaloso con el resultado científico: loscondados feudales

# La Revolución Mexicana (1910-1920)

- Plan de Ayala por la reforma agraria
- Constitución de 1917

# La Guerra Civil Española (1936-1939)

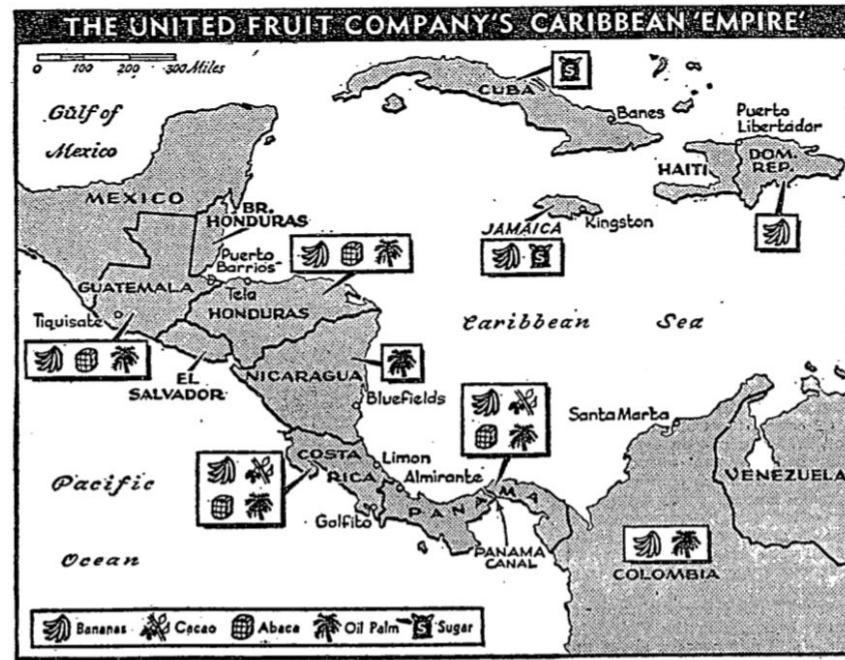
- La Segunda República → reforma agraria
- Opresión de Franco, Italia, Alemania



# La Compañía United Fruit en Guatemala

(1950s)

- Jacobo Árbenz → reforma agraria
  - UFC tiene 550,000 acres, 85% no usado
  - Golpe de estado por la CIA → 30 años de guerra



**United Fruit has principal divisions at the cities and towns named on the map.**

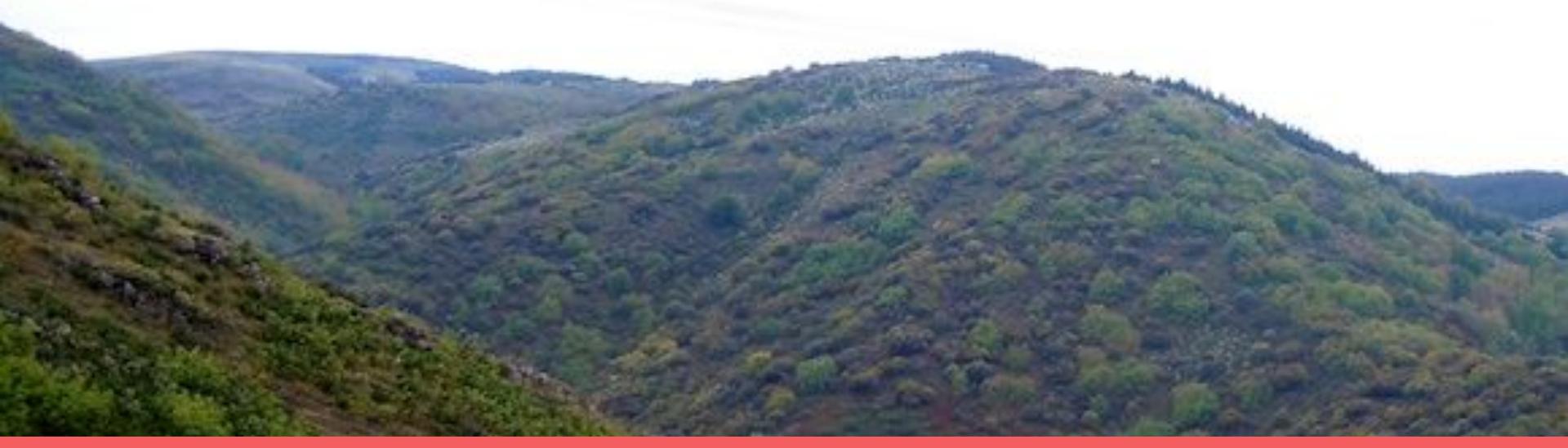
# Conexiones a la arte

# “Pecado de Omisión,” Ana María Matute

Ana María Matute

la naturaleza

Lope está celoso de otras personas



# *El Norte*



Frida Kahlo



# Ahora en España

- Mucho modernización en todas los países
- Desempleo juvenil ~ 50%
- Proporción de tierra agraria segundo más grande de UE
  - Pero muchas jóvenes tienen educación profesional





¡Gracias por  
mirar!

## Fuentes

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*El Norte.*

*Frida.*

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Proyecto de Comunidad

**VOLUNTARIO EN EL PROGRAMA  
LIGHTHOUSE A LA ESCUELA  
THOMAS HOOKER**

Jonathan Lam

## Community Outreach Project Proposal

### CONTACTS

- A) I will be volunteering as a STEM tutor for elementary-level students of Hispanic ethnicity at the Thomas Hooker School in Bridgeport for the Lighthouse Program. The school's general information is below:

Lighthouse Program: Thomas Hooker Elementary School

Website: <http://bridgeport.ct.schoolwebpages.com/education/school/school.php?sectionid=343>

Address: 138 Roger Williams Rd, Bridgeport, CT 06610

Main Office: (203) 576-7185

Kindergarten through 8th grade

- B) I have met with and conversed with Michele Dias, the Lighthouse Program representative, to set up the location and hours of the volunteering. I will meet in person with the site administrators at Thomas Hooker Elementary School (the project coordinators) Sonya Reed and Kim Febriello on February 2nd, the first day of the volunteering. Their contact information is below:

Lighthouse Program representative: Michele Dias: (203) 576-7252.

Project coordinators: Sylvia Perez [sperez@bridgeportedu.net](mailto:sperez@bridgeportedu.net)

### PROPOSAL

- C) The targeted audience that I propose to work with are children of both genders (up through the 6th grade, or about 11 years of age) that are ethnically Hispanic (at least one close progenitor is from a Spanish-speaking country) attending the Lighthouse Program at Thomas Hooker Elementary School. These will be students seeking tutoring in mathematics and/or science coursework. It is part of the Bridgeport school system and has a large proportion of Hispanic students. I aim mostly to work at the older kids (grades 4-6) with fundamental mathematics skills.
- D) The schedule that I will volunteer are Mondays and Fridays through February and March for 2.5 hour sessions, beginning at 3:10p.m. Days on which the Lighthouse Program does not meet have been accounted for. The schedule may be subject to changes due to snow days and other unexpected cancellations. The schedule below consists of 14 weeks and consists of 35 hours, which fulfills the 30 hour minimum. If more than two days are cancelled, then I will extend this schedule into April, continuing the same general agenda. Here is an outline of the days I will volunteer and what I hope to accomplish on those days:

2/2:	Meet site coordinators
2/5, 2/9, 2/12, 2/23, 2/26:	Meet students, get acquainted with Lighthouse Program, begin tutoring
3/2, 3/5, 3/9:	Continue tutoring, conduct staff interviews

3/12, 3/16, 3/19, 3/23:	Continue tutoring, conduct student interviews
3/26:	Continue tutoring, provide students further resources for help in STEM homework, say goodbye

E) Some of the questions I would like to address are:

- a) What are the differences in education between Spanish and English teaching at the primary and secondary school level?
- b) What is the attitude (in general) that children of hispanic backgrounds have about STEM education, and potential careers?
- c) How does familial life (life at home, with family) and family history affect how students learn (both for STEM fields and otherwise)?
- d) How do the teaching methods and attitudes differ between that of a Caucasian and Hispanic-majority school? How does this affect the students' learning?

I hope to answering these questions by directly interacting with students of Hispanic descent in the Lighthouse Program by tutoring them in math and science. This will involve me not only in purely mathematical or scientific discussion, but hopefully also be able to ask meaningful, relevant questions about their lives, so that I can make connections between familial life and STEM interest. I will also conduct interviews (described below) that can be used to more directly answer these questions.

F) My ultimate goal is understand the cultural perspectives about STEM education and research between that of a generally-Caucasian population (e.g., the population of one of the Easton and Redding middle schools) and that of a generally-Hispanic population. Hopefully I can gain some insight into how cultural values differ in terms of these fields of education. My vocational interest is in engineering, so I hope that I can gain some real-world, first-hand perspective on the field. A secondary goal of mine would be to improve my Spanish skills, especially the use of colloquial phrases, quickly and accurately conjugating verbs, and an authentic pronunciation. Having very little interaction with native Spanish speakers in all of these years of Spanish class, I think that it would be a good idea to take advantage of the children's Spanish speaking skills.

Specifically, I will participate in the tutoring of middle-school children in STEM-related homework. This includes any degree of helping review to teaching mathematical concepts. I will incorporate technology by bringing a tablet or laptop to look up information and record the log of help I have completed.

I will recreate my daily activities by keeping a log of the students I helped, the subjects I helped them with, the Spanish vocabulary that I learned, and their overall attitude towards the problem. The latter will include any notes about the kids' personal or familial experiences with

solving math problems, classroom attitudes, general demeanor towards the subject matter, or anything else that I think might be helpful to answering the questions for this project.

Lastly, I hope to conduct several interviews in Spanish, both of students and of science and math teachers. This will allow me to capture more vividly how exactly the members of the school feel about the subjects that I want to study, in a directed, simple manner. I will present clips of these in class to aid the conclusions I draw from this experience.

- G) I will demonstrate that I have used Spanish consistently by recording the number of times I interacted with students, other volunteers, and staff and how I interacted. I will also record new vocabulary and any new Spanish I learn, along with the context in which it was used. I will present this in an orderly fashion based on what was most crucial to learn in my experience. I will also present the aforementioned student and staff interviews with the class to demonstrate that I have conversed with others about a relevant matter in Spanish.

If the people at the school that I will go to do not speak Spanish to me, I will talk to Mrs. Dias about my school assignment. She has helped me choose which school to volunteer at, and she remains open to helping me change locations if the school does not have an adequately-high amount of Spanish immersion. However, I don't think this will be a problem. If a student speaks only English but wants tutoring help, I will not turn them away, but I will ask that students who speak Spanish speak to me in Spanish.

- H) My backup plan, given that I am somehow unable to tutor students in mathematics and science, is to tutor students in music (piano or trumpet), or perform more general volunteer work at the Lighthouse Program (e.g., watch over kids, clean up after kids, administer activities, etc.). I know that they are very open to volunteer help, therefore I believe I can reliably volunteer in their program in some form.

If the specific school (Thomas Hooker) has problems with scheduling or other technicalities, then I know that Mrs. Dias can help link me up with other schools in the program, such as John Winthrop Elementary School.

- I) Signature

Student: \_\_\_\_\_ Date: \_\_\_\_\_

Teacher: \_\_\_\_\_ Date: \_\_\_\_\_

## Spanish Community Outreach Program Time Log Sheet

Every volunteer session was from 3:30-5:30p.m. (2 hours; total 34 hours).

Session	Date	Description of Activity
1	2 / 5 / 18	Explained project to kids, learned structure of program, learned some names, began tutoring
2	2 / 9 / 18	Begin homework tutoring (math)
3	2 / 12 / 18	Homework help (history, math)
4	2 / 23 / 18	Homework help (math, spelling)
5	3 / 5 / 18	Homework help
6	3 / 12 / 18	Homework help
7	3 / 16 / 18	Homework help
8	3 / 19 / 18	Homework help
9	3 / 23 / 18	Homework help, began taking some photos of kids doing activities
10	3 / 26 / 18	Homework help
11	4 / 6 / 18	Homework help, begin writing interview questions
12	4 / 16 / 18	Homework help, interview Kayla
13	4 / 20 / 18	Homework help
14	4 / 23 / 18	Homework help, interview Ángel y Gabriel
15	4 / 27 / 18	Homework help, continue take some photos
16	5 / 4 / 18	Help supervise trip to ice cream place, take some photos
17	5 / 7 / 18	Homework help, record video of me helping with homework

Lista de palabras nuevas

Palabra(s)	Traducción	Contexto
Cociente, dividendo, divisor, división larga	Quotient, dividend, divisor, long division	Los estudiantes están haciendo la división larga
ajedrez	chess	Enseña a una estudiante cómo jugar ajedrez
Segundos nombres	Middle names	Hablamos sobre los segundos nombres de los estudiantes
lapicero	pen	Dije que me gusta usar los bolígrafos, pero los estudiantes dijeron que la palabra es "lapicero"
gringo	White foreigner (derogatory)	Kayla me describe (y le describe a Gabriel) hablar como un gringo
coreografia	choreographed	Los niños hicieron el baile coreografiado.
Fracción, denominador, numerador	Fraction, denominator, numerator	Los niños estuvieron aprendiendo cómo hacer operaciones con fracciones.
Volúmenes de prismas	Volumes of prisms	Los niños estuvieron multiplicando tres números para obtener los volúmenes de prismas rectangulares
Bola	ball	Cuando jugamos el baloncesto, Kayla dijo que se refiere simplemente "la bola."
Fracciones mixtas, fracciones impropias	Mixed fractions, improper fractions	Los niños estuvieron aprendiendo operaciones con diferentes tipos de fracciones y convertir entre los dos.
Pato	duck	Hablamos sobre el término de invierno y el regreso de los aves.
Disculpe	Excuse me	
Cinco y tres de cuatro	5 $\frac{3}{4}$	Enseñar fracciones
Darse bien	To be good at [something]	Hablamos sobre la habilidad de los chicos jugando Fortnite
rugby	rugby	Juegan rugby algunas veces
La simulacro de	Fire drill	Busqué por internet para hablarlo con los chicos

incendio		
terapeuda	therapist	Kayla quiere ser terapeuda cuando se creció
mascota	pet	Hacer preguntas para la entrevista
El soccer	soccer	Chicos dicen “soccer,” no “fútbol”; es un ejemplo de “spanglish,” como “bola”
Parque infantil	playground	Busqué por internet para describir “playground”
Alubia	beans	A Gabriel le preguntó que te gusta comer
pilla-pilla	Tag (the game)	Busqué por internet para describir el juego “tag”
Helado italiano	Italian ice	La comida que compran los chicos en Rita's

Otras apuntes del lenguaje:

- “Yo” es más como “Jyo”
- Una fracción como “5 ¾” se lee “cinco y tres de cuatro”

## Diarios

### Diario 1: 2 / 5 / 18

Voy al Programa Lighthouse por la primera vez. Al comienzo, necesité explicar mi proyecto a los estudiantes que me asignó Sra. Perez, porque no sabían quién soy y por qué estoy allí. Usé un poco de inglés para explicar, pero traté de hablar en español por el resto de la sesión.

Fui asignado a dos estudiantes que hablan español, Angel y Gabriel. Durante la primera hora del Programa Lighthouse, de 3:30 a 4:30, hay tiempo silencioso para hacer la tarea. Los chicos separan y sólo se permiten hacer tarea o leer silenciosamente. En la próxima hora, de 4:30 a 5:30, hay tiempo para actividades. Este tiempo, los estudiantes pueden jugar los juegos de mesa juntos. Angel y Gabriel jugaron con Jenga con algunos amigos, y yo participé también.

Durante el tiempo para la tarea, traté de ayudar cuando ellos quieren, pero no quería molestarles. Les pregunté qué libros están leyendo, y ayudé a Gabriel un poco con algunos problemas de palabras con la división larga. Fue muy complicado y incómodo porque no sé muchos de las palabras necesarios para explicar. Por ejemplo, no sé las palabras “cociente,” “dividendo,” “divisor,” “división larga,” y otras palabras específicas a la tarea (sólo lo busco ahora en WordReference). Entonces, aprender las palabras necesarios para explicar y entender las matemáticas y las ciencias (y otra tarea en general) será mi tarea principal para el proyecto.

Sin embargo, los chicos están leyendo por la mayoría del tiempo de tarea, y no hablé con ellos por mucho de la hora. Trabajaron muy duros, terminaron toda la tarea, y leen los libros muy silenciosos después. Se portan muy bien.

Hablé mucho más con ellos durante el tiempo de actividades. Aprendé que en la familia de Angel, sus padres no saben bien inglés, por eso generalmente hablan con él en español. Es el opuesto en la familia de Gabriel, en que hablan la mayoría en inglés. Además, a Gabriel no le gusta participar en el Programa Lighthouse, porque ha estado en programas después de escuela casi toda su vida. Empezó el Programa Lighthouse cuando se mudó aquí hace dos años, y dice que no quería estar aquí, sino jugar los videojuegos nuevos en su casa.

Casi toda no me sorprende. Es normal que a los chicos jóvenes no les gustan las clases y enfocar en tarea, que ellos están bilingües, y que hay muchos estudiantes en un programa después de clase en Bridgeport (en que muchos padres trabajaron tardes presuntamente). Pero me sorprende mucho el nivel de disciplina que los estudiantes (de grado uno a ocho) tienen cuando se instruye ser silencioso y hacer tarea. Están estudiantes mucho mejores que los estudiantes aquí en Easton cuando fuimos en la educación primaria.

No hablé mucho sobre los intereses académicos, especialmente en las materias de STEM, pero voy a enfocar en este sujeto en el futuro.

Además, empecé hablar con otro estudiante hispano que se llama Alex. Espero que pueda interactuar con más de los estudiantes hispanos en el futuro. Ahora sólo estoy asignado a dos estudiantes, pero no pienso que voy a aprender suficiente sin más estudiantes.

### Diario 2: 2 / 9 / 18

Este visite fue un poco incómodo como la primera vez, porque no fue bien introducido y no sé las nombres de los estudiantes. Sólo interactúa con los mismos estudiantes, Gabriel y Angel.

Durante el período de tarea, fuimos a una aula de música, y los estudiantes hicieron la tarea como el lunes. Algunas veces hablaron con sus mismos, pero el supervisor (Sr. Staten) les pidieron silenciar.

Por la mayoría de la hora, Angel está leyendo un libro de historia estadounidense (de la época colonial), y Gabriel (y muchas de sus amigos en el grado ocho) están leyendo un libro de la clase inglés, "Life of Holly Woods." Pregunté Angel cómo fue la historia. Contestó que es más o menos bien.

Por la hora de actividad, inicialmente vamos a jugar el tenis en el gimnasio, pero habrá una ceremonia en el gimnasio con muchos sillones, por eso no jugamos. Regresamos al aula de música y juegan un videojuego de paintball en un Wii de la escuela. Por una parte del tiempo de actividad, una chica me preguntó enseñar cómo jugar ajedrez (chess). No habló español, entonces hablé un poco inglés consigo.

Aprendí alguno sobre las vidas de Angel y Gabriel cuando les preguntó sobre sus vidas (es parte del sentido incómodo — no sé otro método o sujeto hacer conversaciones con ellos en español). Ellos son primos, pero no me parecen muy similar (físicamente). Ambos tienen hermanos (chicos y chicas). Por razones que no entiendo, a Gabriel le gusta muchísimo las bananas, y tan Angel y las chicas de la clase le burlan sobre las bananas. (Por otro lado, las chicas tenían una obsesión con los "boogers," y los chicos les burlan también.) Aprendí sus segundos nombres (middle names), pero no los apunté y no los reconocé.

Les preguntó al termino si les gustan Lighthouse. Gabriel, como la primera vez, dice que no le gusta. Pregunté qué parte, y contestó "todo." Entiendo que todavía está un chico jóven y no apreciaba que Lighthouse apoya hábitos importantes como el enfoque para la tarea, el silencio, y el respeto a los maestros. Muchas veces me parece muy feliz durante la actividad (y algunas veces durante el tiempo de tarea). Pienso que es verdad que le gusta Lighthouse por las interacciones con sus amigos. Comenzé entender las perspectivas de los hijos sobre sus clases, una meta de mi proyecto.

También aprendí que hay otra estudiante de la clase de Angel y Gabriel que se llama Ariana que habla español. Es puertorriqueño. Finalmente, conocé a otra estudiante de clase que se llama Kimberly, y es vietnamita. Quiero introducirme más formalmente el siguiente visite para interactuar con otros estudiantes.

### **Diario 3: 2/12/18**

Hoy fue mucho más interesante que los primeros dos días. Al comienzo, me introducí a la clase un poco más formalmente. Dije que quiero ayudarles con la tarea en español, o hablar en español en general. Cuando dije que los estudiantes pueden ayudarme aprender español, fueron muchos más entusiasmados hablar conmigo. Me alegra de que ellos son orgullosos sobre su lengua.

No hablamos mucho sobre la tarea, sino español en general. Tratamos de hablar en español básico, pero es más difícil que pensaba. Por ejemplo, aprendí que ellos no entienden "bolígrafo," que aprendí significa "pen." Sin embargo, ellos no saben otra palabra mejor para se llama el objeto, entonces ellos simplemente lo llaman un "lápiz" también. Y aprendí que un lápiz con grafito rellenable se llama un "lapicero."

Para la mayoría del tiempo, hablé con una chica guatemalteca, que se llama Kayla. Nació en Guatemala. Su padre camina a Nueva York de Guatemala en pie, dice. (Creo que es muy interesante porque

acabamos de ver la película *El Norte*.) Muchas veces no me entendió, y dice es porque mi español (castellano) es muy diferente del español que sabe— el español de España es más “religiosa.” Por ejemplo, mientras que pensaba por muchos años que “baloncesto” es una palabra bien conocido, pero ella no conoce. Ella dice que jugar el baloncesto es simplemente jugar “el bola” (me parece es similar cuando una persona dice “let’s play ball” en inglés— es una manera más informal). Cuando estoy hablar consigo, y con Angel y Gabriel, realizé más qué terrible es mi acento.

Otra cosa interesante que aprendí de Kayla es la palabra “gringo.” Es como una palabra derogado para un americano que no sabe español. Es una palabra que no quieres referirte. Oí en *El Norte*, pero no sé la connotación que tenía la palabra.

En la hora de tarea, los niños todos pasen mucho tiempo en las matemáticas hoy. Gabriel terminó primero. Él dice que le gusta las matemáticas, y le interesa cuando dice que voy a participar en una competición nacional de matemáticas esta semana. Por otro lado, Kayla se dice que no le gusta las matemáticas, y no tiene notas altas en la clase.

Para la actividad, primero había una sesión de baile coreografiado. Hay una tema de mover como zombis. Una maestra muy entusiasmada les instruye. Después, jugaron el baloncesto (la bola), y hablé un poco con Kayla otra vez.

Durante el programa en general, también ayudar con el programa en general: por ejemplo, supervisé cuando los niños van al baño, y traigue un walkie-talkie a otra voluntario.

Hoy avancé mucho en el objeto para aprender español. No hablé mucho con los chicos sobre las materias STEM, pero aprendí mucho sobre el español coloquial. Espero que todas las oportunidades en el futuro serán similares.

#### **Diario 4: 2/23/18**

Hoy tenía menos interacción con los hijos que los otros días. Todavía siento que soy extremadamente tímido porque no conocí bien todos los chicos. Entonces, no me avancé tanto a mis metas que las otras veces.

Hoy, el foco de muchas de los estudiantes fue la ortografía. Tienen ejercicios de una manual de vocabulario nuevo. Corregí algunos de sus repuestas, pero la mayoría fue correcto. El vocabulario es del inglés, entonces no es muy importante para mi proyecto. Dicen que es bastante fácil. Sin embargo, cuando encontraron el parte de su tarea incorporar el vocabulario nuevo en una cuenta corta, ellos se frustraron. La opinión de todos los estudiantes que me hablaron (Kimberly, Alex, Kayla, Angel, Gabriel) dicen que inglés fue el sujeto más difícil. (Y Ángel y Gabriel dice otra vez que las matemáticas son mucha más fácil y que es su sujeto favorito de la escuela.) Alguien dice que la lengua no es muy importante. Dije que estoy de acuerdo que las clases de literatura y del lenguaje son difíciles, pero son muy importantes para la carrera. No sé si este clase de estudiantes de grado cinco es una buena representación de otros chicos similares, pero me parece que hay una tendencia general de no gustarles la clase de inglés y de gustarles la clase de matemáticas. Es información útil por mi meta de aprender más de los intereses académicos de estudiantes hispanos. Quiero investigar más (en las entrevistas en el futuro) sobre la relación entre cuánto español hablan en casa y sus opiniones de la clase de inglés.

Durante el periodo de actividad, los chicos generalmente jugaron los videojuegos, y las chicas generalmente vieron videos de cuentos de horror en YouTube en la computadora. Todos están muy

ocupados, y no querría afectar su diversión. Entonces, otra meta para mí en este proyecto es ser más sociable y tímido (una meta general de mi vida) para que tener una experiencia más rica. Este también ayudaría mi meta de aprender cómo hablar español con más fluidez.

Este visitó, ayudé mucho más con el programa en general. Supervisé algunas viajes al baño, muevieron las televisiones por los videojuegos, y ayudé limpiar. Puesto que (me parece que) los otros voluntarios no hablan español, este parte de la experiencia está en inglés.

Al término, hablé con Sra. Perez para obtener permisión grabar videos de los chicos para el proyecto. Dice que los chicos necesitan completar impresos de permisión, y que puedo empezar grabar las entrevistas o otro video el próximo vez. También se inscribió a Edmodo.

#### **Diario 5: 3 / 18**

La mayoría del visita fue muy similar a los otros. Había la hora de estudiar y la hora de actividades.

Para la hora de estudiar, la mayoría de los chicos están haciendo las matemáticas. Específicamente, estaban haciendo la adición de fracciones de denominadores diferentes (¡aprendí estas palabras!). Necesitaban cambiar los denominadores ser igual, y los cambian de fracciones impropias a fracciones mixtas. Involucró algún división y multiplicación con que los ayudé. Trabajé con algunos de los estudiantes (como Alex y Kayla) y otros (como Kimberly) en inglés, porque no saben español.

No me parece que fue demasiado difícil por muchos de los estudiantes. Sólo Kimberly no terminó su tarea en la primer hora.

En la hora de actividades, los chicos Ángel y Gabriel van a jugar los videojuegos otra vez. Alex van a jugar con Legos, y Kayla jugó el hockey de aire.

Cuando Kayla terminó algunos partidos, le llamé para hablar un poco en español. Ella me enseñó un poco español más auténtico; por ejemplo, la pronunciación por la palabra “yo,” uno de las palabras más conocidos, es más como “jo” que “yo.” También, trató de enseñarme cómo tirar la lengua para pronunciar los “rr,” porque todavía no sé cómo hacerlo.

Como los otros visitas, ayudé con supervisar viajes al baño. Hoy estamos en la cafetería todo el tiempo, como la primera vez.

Hoy aprendí un poco más de mis observaciones por mi meta de aprender los intereses académicos de los estudiantes. Los estudiantes generalmente son proficientes con las matemáticas, y los hacen muy rápidamente. Y durante el período de actividades, a los chicos les gustan jugar los videojuegos o construir con Legos o Jenga, mientras que las chicas generalmente juegan juegos de mesa.

También aprendí alguno español más auténtica de Kayla, que me ayuda a la meta de aprender español.

Ya hablé con Kayla sobre una entrevista. Las próximas veces, voy a tener las entrevistas con algunos estudiantes hispanos sobre sus familias y intereses en general.

#### **Diario 6: 3/12/18 y 3/16/18**

Decidí combinar las dos visitas en una entrada de jornal, porque no puedo tener la entrevista (todavía no tengo la permisión de grabar videos) y las visitas pasaron como los otras. Imprimí las formas de permisión hoy y probablemente empezaré grabar las entrevistas este viernes. Estoy pensando en preguntas apropiadas ahora. Pienso que quiero aprender sobre las vidas de los estudiantes en casa, la

influencia de estar políglota, y que piensan sobre la escuela (especialmente las clase de matemáticas) y sobre la programa Lighthouse.

La primera visita (3/12/18):

Muchos de los chicos estudian las matemáticas como la visita previa. Algunos todavía están haciendo la adición de fracciones, y algunos están haciendo los volúmenes de prismas rectangulares. Verifiqué que Gabriel hizo su tarea correctamente (él hizo) y ayudé Alex con la adición de algunas fracciones.

Ángel trabajó en la tarea de inglés, analizando y comparando dos textos.

Cuando terminaron Ángel y Gabriel, hablamos de manera informal. Ellos hablaron que hay un video muy cómico de Jackie Chu en SNL, y hablaron mucho sobre los videojuegos. Ellos jugaron juegos como Fortnite y Black Ops y GTA5. Dije que ellos no están tan maduros, pero ellos piensen que están.

También les muestre mi Rubik's Cube, que se fascinaron mucho. Quieren jugarlo mucho. No sé nada del vocabulario de Rubik's cube en Español, pero si me triagaría otra vez a Lighthouse, voy a aprender.

La segunda visita (3/16/18):

Los estudiantes hicieron su tarea de matemáticas otra vez (y están haciendo las operaciones con fracciones). Hoy, están haciendo algún con los volúmenes de las prisms, y también las operaciones con fracciones (multiplicar y dividir). Para Gabriel y Ángel, fue muy fácil y terminaron muy rápido. Me dijeron que es bastante repetitivo y fácil. Sin embargo, ayudé otros estudiantes con su tarea de matemáticas un poco.

Para la actividad, los chicos jugaron el tenis. Ayudé poner las redes y limpiar al termino. No pude hablar mucho con los estudiantes durante este tiempo, porque están muy móviles. Yo ayudé sacar los bolas durante el tiempo y formar parejas con los chicos cuando no tuvieron.

De estas dos visitas, no aprendí mucha Español autentica. Pero, hablar mucho con los estudiantes (especialmente Angel y Gabriel) sobre su tarea (de matemáticas, que muchas veces fue muy fácil), y de sus intereses (los videojuegos). No es muy diferente que los otras visitas; necesito planar preguntar sobre otras cosas, por ejemplo sus familias, en la conversación casual. Espero que puedo entrevistarlos pronto también.

#### **Diario 7: 3 / 19 / 18**

Vamos a una aula nueva por el tiempo de tarea hoy. Los chicos de grado cinco están haciendo más con las fracciones dividirlos y hacer problemas de palabras y imágenes. Sienté con Ángel y Gabriel otra vez, y verifiqué sus respuestas. No tienen nadas respuestas incorrectas.

Me sorprendió que un no yo sepa leer los números con fracciones. Angel dice que un número como “ $5 \frac{3}{4}$ ” se lee “cinco de tres cuatro.” Me parece un poco extraño, y cuando busqué en la red, otras personas dicen que es como yo imaginó: “cinco y tres cuartos.” Es posible oí incorrectamente, o es una manera más casual de decir.

Otras estudiantes generalmente no tienen problemas con las matemáticas, pero había mucha tarea de ciencias sociales que no terminaron. Además, Angel y Gabriel me muestren una prueba de ortografía, y los hicieron bien.

Para la actividad, Angel, Gabriel, Alex, y una chica (no sé su nombre) tuvieron una competición de construir cosas de Jengas y Legos (la creación más creativo ganó). Al termino, cuando salieron la mayoría de los estudiantes, juegué con los Rubik's cubes y lo les enseña un poco a algunos chicos.

Para mi meta de aprender español, practiqué cuando observé la tarea de matemáticas, y aprendió algo sobre los números en español. Para la otra meta de aprender los intereses, observé más o menos el mismos sobre las matemáticas. Estoy dando cuenta de que los chicos jugaron con los videojuegos en el período de actividad no más que las chicas, quien hoy están jugando "Just Dance" en el Wii cuando los chicos están construyendo de Legos y Jenga.

Aquí está las preguntas para la entrevista (tentativo). Anticipo una conversación de aproximadamente cinco minutos.

¿Cómo te llamas? ¿Cuántos años tienes? (introducir a nuestra clase)

¿Qué es tu clase favorita? ¿Por qué? (y preguntar más sobre sus respuestas, especialmente de matemáticas o ciencias)

¿Qué etnicidad es tu familia? ¿Quién en tu familia hablan español?

¿Hablas español mucho en casa? ¿En la escuela? ¿Con tus amigos?

¿Qué crees del Lighthouse Program?

¿Cuál es tu actividad favorita en Lighthouse?

¿Cómo es mi acento de español?

#### **Diario 8: 3/23/18 y 3/26/18 (visitas 9 y 10)**

Combiné estas visitas porque no avanzé tanto como las primeras visitas hasta mis metas. Lo siento que esta entrada de jornal es tarde— estaría muy ocupado esta semana.

3/23/18 (viernes)

La tarea fue operaciones con las fracciones mixtas (adición, sustracción, multiplicación, división, y problemas de palabras). Confirmé con Ángel que un fracción como  $\frac{4}{5}$  se lee "cuatro de cinco," y una fracción mixta como "3  $\frac{1}{4}$ " se lee como "tres y cuatro de cinco." No fue fácil comunicar la idea de multiplicar la denominador y numerador por el mismo número para obtener el una denominador en común para añadir o sustraer. Traté de explicar que siempre se necesita sustraer el número menor del número mayor, y que algunos palabras (como "total," "combinar," "más") indica adición y otros (como "diferencia," "cuanto queda") indica sustracción.

Los chicos jugaron el tenis por la actividad. Me encargué uno de los grupos, y botamos los bolos en la pared. No puedo hablar en español porque algunos de los estudiantes no hablan español. Observé que casi todos de los niños son muy activos y están en forma.

3/26/18 (lunes)

Hablé un poco con Kayla al empiezo casualmente, y aprendió algunas palabras. Por ejemplo, hablamos sobre el termino del invierno y la nieve recién, y aprendió la palabra "pato" (duck) cuando hablamos de los aves regresiendo.

La tarea de matemáticas fue más o menos el mismo que el viernes. Los estudiantes en la clase de Ángel tienen mucha tarea de matemáticas (dos paquetes). Gabriel terminó su tarea de matemáticas pronto y tiene desafío con la tarea de la clase de inglés (analizar un texto).

Para la actividad, Gabriel y Kayla jugaron Uno, Ángel continuó hacer su tarea de matemáticas, y Alex jugó con Legos. Algunos de las chicas jugaron "Just Dance" en el Wii.

Cuando traté de enseñar las matemáticas y cuando hablar casualmente, aprendí mucha vocabulario de español; contribuyó a mi meta de aprender más español y ganar más fluidez. Y, como siempre, observé los intereses de los niños de sus actividades y el entusiasmo en que hicieron tarea diferente.

Por los hechos de que los niños están en forma, están muy estudiados durante el tiempo de tarea, y no juegan o usar los móviles (o cualquier aparatos electrónicos) durante el programa Lighthouse, concluir otra vez que están niños educados muy bien.

Pregunté Sra. Perez otra vez sobre las entrevistas, y probablemente puedo empezar el próximo vez (4/2/18, el mismo día del "midpoint check"). Sin embargo, me dio permiso tomar algunos fotos durante la actividad, que están adjunto. Voy a continuar tomar más fotos y videos cuando puedo.

#### **Diario 9: 4 / 6 / 18**

¡Lo siento! Olvidé poner esto diario en Edmodo por las vacaciones. No es muy largo, porque los chicos también tienen las vacaciones y tienen una clase de rugby para la actividad.

Hoy los niños no tienen mucha tarea, como nosotros, porque tienen las vacaciones al mismo tiempo. Gabriel sólo tiene un proyecto calcular el volumen de una prisma rectangular, y Ángel sólo tiene un poca tarea de vocabulario.

Entonces, hablamos de otras cosas. Hablamos otra vez sobre los videojuegos, y aprendí que la frase "to be good at [something]" traduce a "darse bien [jugar Fortnite]."(Ellos dicen que les dan bien Fortnite, por supuesto.)

También hablamos un poco sobre las vacaciones y la semana pasada (porque no les he visto por una semana y media debido al día de nieve y Viernes Santo). En Pascua, ellos tienen una "búsqueda de los huevos de Pascua." En el día de nieve en lunes, Gabriel estaría sorprendido y feliz porque puede jugar más Fortnite. Gabriel irá a Chicago para jugar en un parque acuático durante las vacaciones.

Los niños jugaron rugby hoy, entonces no había una oportunidad buena para entrevistarlos.

No avancé en mis metas de grabar evidencia ni aprender mucha sobre la tarea de STEM, pero hablar mucho, en una manera mucho más cómodo que en el comienzo.

En la entrevista, voy a poner más preguntas sobre las vacaciones de abril, los videojuegos (por Gabriel: ¿por qué le gusta tanto?), y los deportes de actividad del programa lighthouse (e.g., el tenis, el baloncesto, y el rugby).

#### **Diario 10: 4 / 16 / 18**

Hoy fue más interesante. Hablé con Ángel, Gabriel, y Kayla todo el tiempo, como siempre. Hemos hablado sobre la nieve, la lluvia (y la simulacro de incendio\* en nuestra escuela).

Ángel tiene alguna tarea de la clase de inglés, y Gabriel tiene alguna tarea de matemáticas (calcular área y volúmen de formas). No terminaron en el período de tarea. Tuvieron buenas vacaciones: Ángel dice que se fue a un campamento de recreo por las vacaciones, y Gabriel

Revisé las preguntas de entrevista un poco con Kayla antes de la entrevista. Ella me ayudo con algunas preguntas, y generamos más preguntas.

Angel y Gabriel salieron más temprano, pero todavía tuve la oportunidad entrevistar a Kayla. No quería que grabé un video, entonces grabé una grabación de audio.

Me interesé algunas cosas. No sé que otras familias hispanos comieron el arroz diario como mi familia (creí que es una cosa asiática\*). También aprendí que ella quiere ser un terapeuta en el futuro, porque ella tiene una terapueta (porque tiene conflictos con su madre), y que sus padres son de República Dominicana y Honduras. Y no sé que no le gusta a matemáticas lo más, porque me parece que se da bastante bien su tarea de matemáticas.

Además, aprendí un poco español cuando Kayla me ayuda formar algunos preguntas para la entrevista.

Necesito obtener más información de las otras entrevistas para hacer conexiones, pero esta información sólo de Kayla es muy interesante.

(desde ahora, voy a indicar nuevos palabras que buscaré en el internet con un \*)

#### **Diario 11: 4 / 20 / 18 y 4 / 23 / 18 (visitas 13 y 14)**

La visita de 4/20, los chicos (Ángel y Gabriel) no necesitan mucha ayuda con tarea. Sólo había un problema en que ambos no leyeron los problemas de palabras correctamente y tienen el orden correcto de sus operaciones matemáticas. Ellos no tienen mucha tarea, y terminaron. La visita de 4/23, Gabriel tiene algunos desafíos con su tarea de inglés, que es una actividad de usar sinónimos mejores para descubrir cosas, y Ángel pasó mucho tiempo con su tarea de historia.

Debido al tiempo mejor ahora, los chicos tienen actividades más activos, y muchas veces fuera de escuela (en el campo). Entonces, no puedo entrevistarlos la visita de 4/20, porque los jugadores de rugby los están enseñando rugby otra vez. La segunda vez, están jugando sin instrucción, y puedo entrevistar a Ángel y Gabriel. Los entrevisté juntos, porque se lo quiere y ocupar menos tiempo (para que ellos vayan a jugar más pronto).

Les pregunté muchas de las mismas preguntas que me pregunté a Kayla. Desafortunadamente, mi móvil se quedó sin\* memoria, y no grabó toda la entrevista. Sin embargo, yo escribí apuntes sobre sus respuestas inmediatamente después y no perdí mucha información. El volumen de sus voces en la grabación no fue muy bien, entonces voy a transcribir\* pronto.

Aprendí mucho: que sus padres son de la República Dominicana, y que hay varios niveles de hablar español en casa (es más en la casa de Ángel como Kayla, pero menos con Gabriel). Como Kayla, ellos también dicen que no les gusta al programa Lighthouse, pero entiendo que es lógico decir por un chico que tiene diez años. A diferencia de Kayla, ellos tienen clases favoritas más claro (matemáticas), y les gustan las actividades físicas de Lighthouse (el baloncesto por Gabriel, y el soccer (él se dice esto — no fútbol) por Ángel). Ambos tienen familias muy pequeños como Kayla (sólo cuatro personas en casa) y no mascotas. La comida que dicen que comer a menudo es arroz con alubia\* (no se la palabra que dicen,

pero ellos dicen que significa “beans”). Y, finalmente, ellos me dijeron que mi español es comprensible, pero no muy bien.

Ambos están tímidos durante la entrevista. Puedo oír una diferencia entre sus acentos, y pienso es porque hablan español en niveles diferentes en casa.

Después de la entrevista, los hijos pueden jugar cualquier en el campo y el parque infantil\*. Yo juego un poco baloncesto con ellos, pero no mucho en español.

Otra vez, avance hasta mis dos metas: ser más cómodo hablar español, y aprender sobre las intereses de los hijos. Es interesante que estos jornales también sean más fáciles ahora. Me da cuenta de que no voy a hacer muchas visitas más. Tengo dos entrevistas (de tres personas), con algunos datos interesantes.

#### **Diario 12: 4 / 27 / 18**

La tarea de Ángel y Gabriel se trata de los volúmenes de prismas, y calcular las longitudes\* de la prisma usando la división. También habrá una competición de ortografía por los estudiantes del grado cinco, entonces les ayudo con las palabras. (Las palabras son en inglés, y no fue fácil explicarlos en español, por eso uso inglés). Ángel y yo pasábamos el tiempo de tarea entero practicando el vocabulario, y Gabriel hizo su tarea de ciencias sociales después de su tarea de matemáticas.

Durante el hora de actividad, los chicos fueron afuera para jugar. Ellos jugaron pilla-pilla\* (“tag”), fútbol, y otro juego en que guarden el balón de otros, y yo participé un poco.

Ángel y Gabriel se fue temprano. Hablé por mucho tiempo con Kayla. Ella describe algunos aspectos malas de la escuela. Dice que otro estudiante no es muy simpático y que ella le dio un puñetazo\*. (Ángel también dice que uno de sus primos le dio un puñetazo a él.) Me dijó que no es posible ser demasiado simpático, o como alternativa otros chicos te acosaran. También dice que sus padres es muy estricto sobre sus notas de clases, y que es el estereotipo de padres hispanos. Y, finalmente, me dijó que le gusta cocinar y comer los pelotas de masa\* (“dumplings”), que son un tipo hispana. Es un hecho interesante.

Como siempre, ayudé con el equipamiento (balones) cuando los chicos fueron afuera, y supervisé los viajes al baño.

No aprendí demasiado hoy, pero hay algunos hechos interesantes en la conversación de Kayla. Aprendí sus pensamientos sobre la escuela y su familia que no he considerado. Y practique mi español con Ángel y Gabriel y su tarea.

#### **Diario 13 (y final): 5/4/18 y 5/7/18**

Hoy y viernes fueron mis visitas finales por el proyecto. El viernes, los hijos no hicieron mucho productivo. Van a la tienda de helado (no recuerdo el nombre), un evento planeado por Lighthouse para divertirse y porque está muy calor. Caminamos a la tienda, y todos los chicos compran un helado italiano\*. Tomamos algunos fotos. Después van a jugar rugby, como cada viernes, y no quiero intervenir. No puedo hablar mucho en español con los chicos, porque está hablando con sus mismos en inglés y se divirtieron.

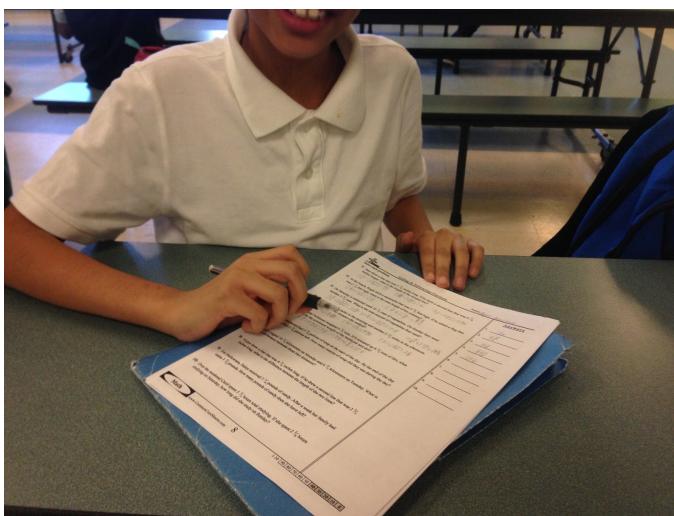
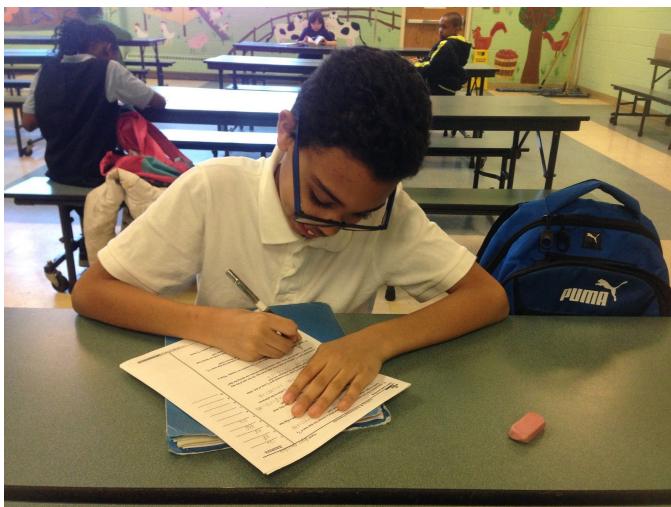
Hoy (lunes), ayudé a Ángel y Gabriel con su tarea de matemáticas (pero no necesitan mucha ayuda). Gabriel está practicando la orden de operaciones, y Ángel está practicando volúmenes con multiplicación y división. Además, ambos hicieron la tarea de ortografía, en preparación para un competición de

ortografía. Hablamos un poco sobre Fortnite después, porque a Gabriel le gusta mucho el juego. Después, los niños van al gimnasio y afuera para jugar. Juegan el fútbol conmigo.

No fue muy triste. Creo que aprendí mucho desde el comienzo del proyecto en marzo, y soy más confidente con mi español en general. Aprendí sobre sus intereses y los sujetos que no les gustan, y de la cultura hispana. No es específicamente sobre las matemáticas y clases de STEM, como querría. También fue mi oportunidad primera ser voluntario por mucho tiempo, y el primer tiempo trabajando con niños, entonces me enseña mucha la experiencia. Voy a explicar más en esta aspecto por mi proyecto de clase de salud (el proyecto es este proyecto).

Todavía necesito subir toda la evidencia por el proyecto, y voy a hacer pronto tras de organizarlos. Tal vez voy a continuar con una reflexión más detallado a esa hora.

## Imágenes del proyecto





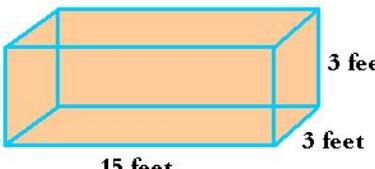
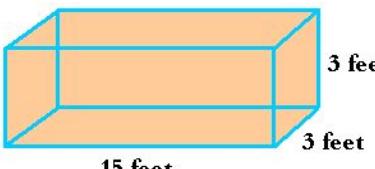






**Actividad: Problemas básicos de matemáticas en Español**  
 (por Jonathan Lam)

**Instrucciones:** Emparejar las expresiones matemáticas con la representación en Español, y calcular las respuestas.

Expresión (Inglés)	Español	Solución
$132 + 122$	cinco y tres de cuatro menos diecisiete y dos de cuatro	ciento noventa y ocho
$5\frac{3}{4} - 17\frac{2}{4}$	setenta de tres dividido por cinco de siete	ciento quince de noventa y seis
volume of the prism 	siete y dos de tres dividido por cinco y siete de cinco	ciento treinta y cinco pies cúbicos
$378 \times \frac{2}{3}$	tres multiplicado por tres; más tres multiplicado por quince; más tres multiplicado por quince; todo multiplicado por dos	negativo once y tres de cuatro
Jane has $53\frac{3}{8}$ watermelons. Steven has 42 oranges. Gerald has -2.5 pizzas. Together, how many fruit do they have?	trescientos setenta y ocho multiplicado por dos de tres	treinta y tres y un quinto
$\frac{72}{3} \div \frac{5}{7}$	ciento treinta y dos más ciento veintidós	doscientos cincuenta y dos
$7\frac{2}{3} \div 5\frac{7}{5}$	cincuenta y tres de ocho más cuarenta y dos	doscientos cincuenta y cuatro
surface area of the prism 	tres multiplicado por tres multiplicado por quince	noventa y cinco y tres de ocho

## Reflexión final

¡Qué rápido fue el tiempo! He sido voluntario por el Programa Lighthouse por treinta y cuatro horas, diecisiete visitas, y tres meses. En total, incluyendo la planificación, fue más que cinco meses, y he contacté cinco personas administrativos (Sr. Poulos, Sra. Días, Sra. Perez, y dos otras coordinadores de sitios) para que el proyecto funciona. También interactúa con cuatro estudiantes hispanos, colecta la evidencia necesario, escribí trece diarios, y hacer dos entrevistas.

Cuando empecé el proyecto, iba muy diferente que ahora. Tenía mucho miedo hablar con otras personas en español fuera de clase, porque es muy incómodo y difícil, y no hay muchas (o nadas) oportunidades hablar con personas sólamente hispanohablante, porque aquí no hay una población de personas que no hablan inglés. Ahora, mientras que todavía no soy totalmente fluido en español, he aprendido mucho y soy un poco más confiente.

Mi primera meta es este cosa, aprender un poco español y tener la capacidad hablar con otras personas que hablan español nativamente. En la clase en que trabajé, había Alex, Ariana, Ángel, Gabriel, y Kayla que hablaron español. Muchas veces sólo hablé con los últimos tres, pero a veces hablé con las primeras dos. Al comienzo, no fue muy cómodo. Necesité explicar mi proyecto, y fue como un extranjero por algún tiempo — los dos o tres primeras visitas. Pero, cuando explique mi proyecto otra vez, en español, dije que estoy aquí para aprender español en una manera menos convencional, los chicos son muchos más emocionado. Esta también contribuye a mi educación generalmente, una cosa que discutiré después: aprender cómo hablar con niños, una habilidad que no he practicando antes de ahora.

Fue emparejado con Ángel y Gabriel la mayoría de las visitas, y algunas veces también con Kayla. Durante la hora de hacer tarea, casi siempre tiene la tarea de matemáticas, y algunas veces con ortografía (y otras cosas de la clase inglés), y la historia. Curiosamente, no he recordando tarea de otras sujetos. Durante el tiempo que estuve allí, los estudiantes aprendieron (en la clase de matemáticas) cómo usar fracciones (con las operaciones de adición, sustracción, multiplicación, y división), convertir entre las fracciones impropias y mixtas, hacer los problemas de párrafo con fracciones, calcular la superficie de formas geométricos, calcular los volúmenes de algunos prismas, y calcular superficies y volúmenes con fracciones. Puesto que no había muchos sujetos, había mucha repetición con las horas de tarea, y también los chicos muchas veces no necesitaron ayuda con la tarea. Sólo verifique sus respuestas, y clarifique pocos preguntas de matemáticas.

La tarea de matemáticas fue muy importante para mi proyecto, porque la segunda meta de mi proyecto es estudiar las diferencias entre la educación de los sujetos STEM en una comunidad hispano en los Estados Unidos. Sé que los quinto grados de THS no necesariamente son una representación buena de la población joven hispano-americana, pero es lo mejor que tengo. De la hora de tarea, observé que hay un énfasis en la tarea de matemáticas, más que todas las otras clases, pero no hay mucha énfasis en otras partes de STEM: las ciencias, tecnología, e ingeniería. Quizás, por los niños jóvenes, no es esperado saber mucho sobre tecnología e ingeniería, pero esperé ver más tarea de ciencias.

Además, de las entrevistas, yo tengo algunas perspectivas diferentes en los intereses de los estudiantes. A Gabriel y Ángel les gustan muchas las matemáticas. Gabriel quiere ser policía, y Ángel quiere ser un doctor. Por otro lado, a Kayla no le gusta las matemáticas (le gusta el arte), y quiere ser terapista cuando se creció. La diferencia es interesante porque seguir de cerca los estereotipos de género. No he entrevistado más de los estudiantes, pero me parece que es más o menos los mismo: los chicos prefieren las matemáticas y los trabajos más masculinos, y las chicas otras sujetos y trabajos más cuidando. Es lo mismo con las actividades: a los chicos les gustan los videojuegos y los deportes, y las chicas menos. Pero ambos géneros son muy activos y todos participaron en todas las actividades, aún cuando no le gusta.

Y aprendió mucha sobre la cultura también. A Ángel y Gabriel les gustan mucho los videojuegos, especialmente Clash of Clans y Fortnite, y cuando terminaron su tarea, siempre están hablando sobre los juegos. Y Kayla me digo mucho sobre la vida hispana y su vida: explicó las desafíos sociales y personales que se enfrentó. Dice que los padres hispanos son muy estrictos con las notas. Su madre fue abusivo, entonces su padre se divorció y Kayla obtenga una terapueta. Dice que hay muchas fuentes de presión social en la escuela, y que necesito ser resistente para sobrevivir en su comunidad — ya había problemas con drogas con personas en su grado. Pienso que hay un poco exageración, pero no sé que es la situación cuando están en el colegio. Sólo vi un poco luchó cordial, pero tal vez es porque los trabajadores son muy estrictos.

Entonces, logré mis metas. En general, yo aprendió como ser responsable con niños jóvenes y ser voluntario. No he tenido una posición como esto; entonces, estoy agradecido que puedo lograr todo que quiero hacer, y también tener un tiempo divertido y hacer algunos amigos nuevos.



## PROYECTO DE COMUNIDAD: VOLUNTARIO EN THOMAS HOOKER

Jónathan Lam

### MI PROYECTO

Mi proyecto es ser voluntario al Programa Lighthouse en Thomas Hooker.

- Tutor por tarea
- Voluntario general



### LAS METAS

- Aprender las diferencias en perspectivas académicas (STEM)
- Hablar con más fluidez en Español
  - Aprender vocabulario de matemáticas
- Aprender sobre la cultura español-americano por niños estadounidenses

### ¿QUÉ HICE?

- 17 visitas (34 horas)
- Ayuda con tarea
- Ayuda con facilitar actividades
- Tomar fotos y hacer entrevistas

### INFORMACIÓN SOBRE LIGHTHOUSE

Lighthouse es un programa después de escuela para cuidar los niños con padres que están trabajando.

Cada día consiste de:

- Una hora por trabajo (tarea)
- Una hora por actividades
  - Rugby
  - Tenis
  - Puzzles
  - Mucho más



### LOS ESTUDIANTES

### LOS ESTUDIANTES

- Clase de 12 quinto grados
- Cinco estudiantes hispanos: Alex, Ariana, Kayla, Ángel, Gabriel
- Enfoque en Kayla, Ángel, y Gabriel



### ÁNGEL

- Dominicano (nació en los EEUU)
- Primo de Gabriel
- Le gusta Clash of Clans



### VOCABULARIO

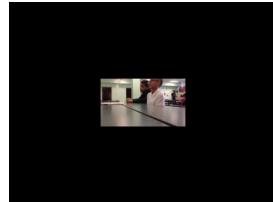
Cociente, dividendo, divisor, división larga	Quotient, dividend, divisor, long division	Bola	ball	mascota	pet
ajedrez	chess	Fracciones mixtas, fracciones impropias	Mixed fractions, improper fractions	El soccer	soccer
Segundos nombres	Middle names	Pato	duck	Parque infantil	playground
lapeño	pen	Disculpe	Excuse me	Alubia	beans
gringo	White foreigner (despectivo)	Cinco y tres de cuatro	5 ¾	pilla-pilla	Tag (the game)
coreografía	choreographed	Darse bien	To be good at (something)	Helado italiano	Italian ice
FracCIÓN, denominador, numerador	Fraction, denominator, numerator	rugby	rugby	Volumenes de prismas	Volumes of prisms
terapeuda	therapist	La simulacro de incendio	Fire drill		

### GABRIEL

- Dominicano (nació en los EEUU)
- Primo de Ángel
- Le gusta Fortnite



### LA ENTREVISTA (ÁNGEL Y GABRIEL)

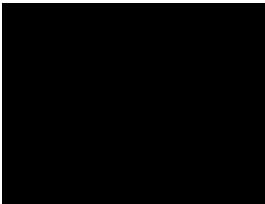


### KAYLA

- Hondureno (nació en Honduras)
- Siempre quiere hablar la verdad, es muy serio
- Su familia



### LA ENTREVISTA (KAYLA)



### ENTREVISTAS (RESUMEN)

Nombre	Ángel	Gabriel	Kayla
Años	11	11	11
Clase favorita	matemáticas	"math"	arte???
Clase menos favorita	inglés	historia	matemáticas
¿Hablar español en casa?	la mayoría	no mucho	casi siempre
¿Hablar inglés en casa?	un poco	la mayoría	poco
¿Qué quiere ser?	doctor	policía	terapueta
Intereses	videojuegos, deportes	videojuegos, deportes	arte

### CONCLUSIONES

### CONCLUSIONES

Meta 1: Aprender las diferencias en perspectivas académicas (STEM)

- mucho énfasis en matemáticas
- poco énfasis en ciencias
- a los chicos les gustan las matemáticas
- a las chicas les gusta el arte

### CONCLUSIONES

Meta 2: Hablar con más fluidez en Español

- aprender vocabulario de matemáticas
- "Spanglish" y Español menos formal
  - depende en la nivel en casa
- todos bilingües
- soy gringo

### CONCLUSIONES

Meta 3: Aprender sobre la cultura español-americano por niños estadounidenses

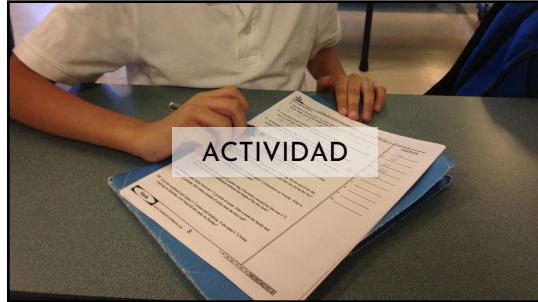
- padres hispanos son estrictos sobre notas
- necesita ser resistente para sobrevivir



## CONCLUSIONES

En general: aprendí cómo trabajar con niños y ser un voluntario responsable.

- primera vez ser voluntario por mucho tiempo
- primera vez trabajar con niños



## ACTIVIDAD

## ACTIVIDAD

1. Emparejar las expresiones de Inglés al Español.
2. Emparejar las expresiones de Español a sus soluciones.

Durante mi proyecto, siempre estuve aprendiendo sobre vocabulario relevante a la tarea simple, en la hoja de actividad.



¡Gracias por mirar!

## ACTIVIDAD

1. Emparejar las expresiones de Inglés al Español.
2. Emparejar las expresiones de Español a sus soluciones.

## PERSONAS PARA DAR GRACIAS

- Sr. Poulos
- Sra. Díaz, coordinador de voluntarios por Lighthouse
- Sra. Pérez, coordinador de sitio de THS
- Otros voluntarios/trabajadores en THS
- Los estudiantes españoles de grado cinco
- Otros estudiantes

## Memoir: A Working Definition

Memoir. It's a mirror. It's a self-portrait. It's a story. It's the past.

It's a story about the death of a mother. The pulling of a tooth, or the condemnation to eternal chubbiness. And it could be for the entertainment of others: it might be comical to hear what a teething child learns about the tooth fairy for the first time, or heartening to know that even the more despicable people in life are, after all, just people trying to make a living as a speech therapist.

But more than anything, it's about and for the memoirist and nobody else. The funny moments, the tears, and the joy are all a part of the writer. It's *not* a conscious effort to inform or entertain others. If that is the case, then the story becomes fiction.

Fiction is what Tim O'Brien calls "happening-truth," but not necessarily true to the author; true and particularly appealing to the audience. This is more appealing to a reader because of its sensible, plain conveyal of information. (On the other hand, his book *The Things They Carried*, while almost completely fabricated, can be considered a memoir, a "story-truth" truer than reality. The characters and plot details may not have occurred, but they were very real to him in the stories they told and the necessary relationships they shared.)

But memoirs are something more honest, and perhaps very uncomfortable. It's definitely not as straightforward as fiction: it probably seems that the anger in Strayed's statement, "Duluth was a freezing hick town where doctors who didn't know what the hell they were talking about told forty-five-year-old vegetarian-ish, garlic-eating, natural-remedy-using nonsmokers that they had late-stage lung cancer" (Strayed 10) has no place in the story of a mother's death. Nor the green pantsuit or the names of the apartment complexes outside of Minneapolis where Strayed used to live. In fact, the entire story can be told in a few words, as it often is, much more simply:

I began a journey to find myself. I realized only later that it had begun with the tragic death of my mother, who had been a great part of my life.

After all, every part of this is true. It can be used as the introduction to a story about a journey—people would understand. People could fill in the blanks with close deaths from their own lives, relive their own horrors or joys. It doesn't *feel* very genuine like a memoir, however, because that's not how the person remembers it best. In short, **a memoir is an attempt to capture a core memory as closely as possible to what a person remembers feeling at the time, encapsulating it with then thoughts and emotions**. That little Augusten Burroughs remembered that the beautiful flight attendant called him "precious," and that he liked it so much because it reminded him of gemstones. He remembered that the "impossibly exotic South," with his grandparents' "Technicolor peacocks" and "yet more sunshine," as a part of his memory. These are not simply superficial details to add to the reality of the situation: they are in fact crucial pieces to the story, true or not (considering that memory is easily warped, according to Mary Karr in "The Art of Memoir"). Missing little pieces, like Strayed's impulse to "take pleasure from [the male nurse]" (Strayed 21) in the sudden irrational mind that it would somehow help her situation, can't be glossed over. Little moments like this define a person: Burrough's good-natured naïvete and Strayed's desperation. These moments can't be told in any other way.

I began writing in tenth grade to try to improve my grade in English class. I began a blog, writing random snapshots of my life: mostly little events that set me off (e.g., excessive hype for the wasteful and socially-cemented prom) or enlighten me (e.g., discovering a brilliant reduction method for

a complex logic puzzle on my own). And many of these probably would fall into the memoir genre. Most of the time I write to remember, whether it be the strong loathing I have for the wasteful, socially-cemented prom, or the joy of discovering a mathematical reduction method on my own. Most often, the blog posts are associated with specific events, but that's not what it's about. You can't recall what you don't remember, and writing memoirs is my solution to the fear of forgetting.

Kaling's "Chubby for Life" and Strayed's "The Ten Thousand Things" focus on a broader theme, with supporting stories and the complete, random details that come to mind. Burrough's "Pest Control," Sedaris's "Go Carolina," and Walls's "The Glass Castle" are focused on their younger, less judgmental selves and the actions and impressions of the time.

Throughout all of these memoirs (including mine), there's the common theme of the variation in content and style. I often use multimedia in my blog, as does Kaling in her memoir, because pictures can carry heavier connotations with words. Strayed uses motifs, such as "religion" and female independence. All of these little details are "triggers," designed so that the memory, in all of its emotional glory, can be relived.

That's it.

Some definitions of memoir are to achieve some intelligent, greater-society purpose: to educate oneself or society from past mistakes, to portray a past event with brutal honesty, or to paint an all-encompassing portrait of a person. But these are just side effects, born of the power of wanting to remember. The little details, the impromptu realizations and naïve assumptions, may seem funny to an outside audience, but they are just meant to preserve a chunk of the life of the memoirist in pristine condition. From this "chunk of life" we can learn many things, whether we mean to or not.

(Sorry this is longer than a page. I got carried away.)



# worry about the future

pseudo-memoir by jonathan lam



To my grandma,  
陈玉金.  
for being is the strongest, most caring,  
and awesomest person I know.

Thanks for raising your three sons well,  
picking *ma-churn* with us,  
and ripping out that girl's hair.

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## Forgotten

“A bird is safe in its nest - but that is not what its wings are made for.”

Amit Ray

When I enter the bathroom uncle John comes in after me and says that he would stay with me, which is very nice. He is my favorite uncle. I don't have a phone or anything to contact anyone. So I am always afraid of getting lost.

I poop and leave the bathroom but when I go back outside he is  
Gone!

We're at Lake Compounce water park and I'm  
stuck  
outside the bathroom.

I'm too short to see any the rides at the park or over the crowd.

I venture out a little further, into the bright sunlight. The sun is dazzling. People are walking all around me, so that I can't see too far in any direction. It is mid-afternoon, probably around three o'clock, so it is really busy. The bathrooms are in front of a large, open space where many of the paths meet.

The only “ride” I can see is the water playground in front of me. It's like a much larger version of the playground at Beaches Pool near our house, where the water cones balance on a rod in the middle and fill up with water and flip scarily when the water is too heavy. I used to stand under them, counting and guessing when and which way they would flip so that the heavy water dumped on my head would make me scared that I would drown. But I stopped when it stopped becoming scary, or maybe because my sisters started copying me. But this playground was a lot bigger and had a lot more children to play with. It was pirate ship-themed, so it had a huge bucket at the top that poured down on the children.

Will it be better if I stayed or went? I pout, anxious.

I waited.

Should I ask someone to use their phone? I only know two phone numbers (three, if you include 911): my mom's and my dad's.

I started to walk.

But strangers might not let me use their phones, or they might kidnap me if they see me alone, just a little kid, as my parents always tell me. Or what if the strangers think I'm a trick? My parents also keep showing us videos from their friends in China of people doing horrible things to each other, like using

kids as distractions for stealing. My friends say that doesn't happen in America, but I really don't want to be kidnapped.

But if I leave, then my parents might go looking for me and not find me where I should be. I will be forgotten.

I stop again.

Which way do I go?

I am surrounded by a wave of people  
scattered, talking happily with each other while I  
stand in the middle, not walking.  
I keep turning in circles,  
not sure which way I should go. I keep  
going back and forth, saying that going  
means that I will lose them but staying  
means they will lose me. And nobody tries to help me— they  
just walk in circles around me, giving me some space but never really  
looking. I am in my little bubble of being lost.

Waiting is very awkward. I stand out in the crowd because I'm not happy. I want someone to realize that. But nobody does, and I begin to grunt. They just keep walking by, smiling, and I know nobody else is lost. I want to cry.

Where is my family? Where could they have gone? They can't have walked too far. I was only in the bathroom for five minutes, I swear! Maybe they left me here on purpose?

I begin to count the times the big bucket flips.

Should I stay?

(Bucket flips.)

Should I go?

Should I leave? I look around again.

(Bucket flips.)

...

Out of the crowd, I see uncle John, who is very tall. I run over to where he waves me over at the bench at the edge of the water playground. He tells me that my cousins are on the water playground. He doesn't seem scared at all that I was missing. But I tell him how scared I was, and he laughs and says I'm with them now and they would never leave me, but that doesn't change my scaredness.

Because I could have been stolen by someone else, or I could have run off and they would have blamed me. I told uncle John and my parents about the reasons I was scared, but he laughed again and told me to go play with my sisters and cousins.

But I think my thinking saved my life. If I went to a stranger and asked for their phone, I could be in serious danger right now. I know my parents and uncle John couldn't see it, but I did.

I don't like theme parks anymore. (2018 self: I still don't.)

## Mileage

"Growing up is losing some illusions, in order to acquire others."

Virginia Woolf

I used to live next to a trail. For many years, it was just "the trail" to me. A dirt path, two-and-a-half miles long. Where we biked and our dad easily outran us. Our house was right next to the beginning, and our driveway was separated from the path by only a two-and-a-half foot gap of poison ivy. It ran parallel to our road, Tait Road, and, for the first few years, ended where we reached a road. But some years and a new bicycle later, we learned that there was a second part, about a mile-and-a-half long, extended past that trail, and it was very smoothly paved with asphalt and had a rickety bridge and ended at a park, Old Mine Park. And even then, just before we moved and after the paving of the first trail segment, we realized that the trail went even further, reaching to Wolf Park in Monroe, some five miles past that, and beyond. We stopped at Wolf Park every time, whining and turning back. And only this year, a decade later, did I hear that the trail goes in the other direction as well. What I had thought of at as a beginning at our house was only a tiny sliver of a greater system.

Now I mostly know the trail by name and bittersweet memories. Bitter because it's all gone now. Sweet because I remember the carefree happiness of a childhood the trail created for me. Its name is the Pequonnock River Trail (a name whose spelling I have never bothered to remember), a trail constructed in the tracks a long-gone railroad, and now Tait Road has a parking lot built for the bikers and runners. I've only been to the trail recently for cross country or track, and I don't see many little children like I used to. Just sweaty joggers.

But I can still walk through those first two-and-a-half miles a decade later with my eyes closed, in any season, at any time, remembering every bend and milestone. The furled American flag, the mile-stone (which was paved over), the quarter-mile markers, the trail Indian Ledge Park, the skipping-stones place, Lion King's den. I can still see my dad's slippery running pants flowing and my sisters taunting at me from their bikes, white and purple. And I can hear my dad trying to say "invisibility cloak," but failing because of his incomplete English. But we didn't care. We didn't know better either.

## The Great Invisible Clock

Long icicles hung from the rock walls of the second gorge. In the summer, daddy would ride up onto the top of the gorge on his bike while we stayed at the bottom, but he said it was too slippery now. Our bicycle tires weren't completely full of air, but daddy said that was okay because it was cold and the tires would fill back up in the springtime. The newly-melting ground was muddy and slimy and spread all over the white tires of Jessica's bicycle and made squishy noises as we biked. It got all over daddy's grey, shiny sweatpants and mommy would probably yell at him later for it.

The dirt path below us became pebbly, and we stopped. On our right, the path to Indian Ledge Park appeared. We stepped off the main trail and onto that path. A few steps in, after we descended some fifteen feet and around a short bend, we stopped. Juliet and Jessica gave their bikes to daddy, who leaned

them against a tree. He put an invisible clock over it and we continued down the small trail. I took my bike with me, because it was a mountain bike unlike Jessica's and Juliet's, but didn't ride it because the trail was very steep and there was still some slippery snow on the ground. We crossed the stream on the creaky wooden bridge, passed the huge tree stump that was uprooted and lay sideways with a patch of dark dirt underneath, and onto the other main path that led us straight to Indian Ledge Park. Then I got back on my bike and raced my sisters to the park.

I won, of course.

We played on the playground there. The slides were extra slippery because there was a small layer of snow on them, and the metal was very cold. Juliet fell off of one of the monkey bars because it was so slippery, and we had to go home early because she couldn't play anymore. There wasn't even time to play on the swings, the best part. Both Jessica and I could use the *real* swings, but Juliet had to use the buckets with foot holes.

We walked back to the trail, slower now because Juliet was riding on daddy's shoulders, piggy-back style. Daddy took off the invisible clock and we started biking back, Juliet still crying a little bit. There was only a bruise and no blood, so it couldn't have been that bad, Jessica and I told her, but she wouldn't stop crying.

When we got back to the place where the trail split to go down to the river, where I had rode my bike across and we had skipped stones and swung on the rope swing, we noticed that there was a bicycle there. The biker must have been around Jessica's age, but a boy. The bike was black and red, like my old bike, and had no snow on it. We didn't see anybody around.

"Why didn't they put an invisible clock over their bike?" asked Jessica to daddy. He stopped.

"They must have forgot." He went over, dragged an invisible clock out of his pocket, and threw it over the bike. "I'll do it for them because they forgot."

But we still saw it. That meant it would be invisible to them. Our bikes were invisible to everyone but ourselves because daddy did the magic trick over our bike.

Jessica saw it too. "Now they won't be able to find their bike," she whined.

Daddy said, "No, they can see it too."

"But I thought only we could see it if you put it on."

"It's works with magic, of course they can see it."

I wasn't totally sure that made sense, but once we started moving again, it was time to say the Pledge of Allegiance as fast as possible as the large American flag appeared as we went around the corner. With one hand on my heart and the other on the steering wheel (I had just learned the one-handed steering trick, and even Jessica couldn't do it) I raced Jessica with the pledge. She won this time.

But then, as we passed the first gorge and saw icicles again, I began to cry. I thought daddy was lying, and that by putting on the invisible clock, they wouldn't be able to see it and lose their bike. Daddy lied to us because he couldn't undo the magic. We made someone lose their bike.

### Bouncy Ball

My grandma was out on the hunt with us. She was picking at the *ma-churn* (or in english, the “smart grass”) from the sides of the trail for us to eat. She taught us how to pick it as well, and we did it too, every time we couldn’t see people on the trail. It smelled very good when we picked it, and we made sure we didn’t pull the roots out so that they would grow again. (But sometimes we were wrong and plucked normal grass by accident, which isn’t very tasty in soup.) And then there was the *chong-chong* (“scallion” or “scallop” or something like that). They were easier. They were round, not like the *ma-churn*.

She was holding a plastic bag from Stop and Shop that we poured our yummy treasure into. It filled up pretty quickly, because we had not picked the *ma-churn* or the *chong-chong* for a few weeks and they had all grown tall again. I don’t think anyone else picked them. I never saw anyone else picking them. But my grandma was cool, and we got free food from the trail. My dad always made fun of her for scavenging food, but he never cooked like she did.

We were in the middle of our sneaky veggie-picking when I noticed the blue ball. It was at the bottom of a ditch near a little stream that carried water under the trail in a large pipe. I liked it right away because it had a cool pattern, like the stone marble. Someone must have dropped it down there and not tried to pick it back up. It was very steep and far down. I pointed it out to my grandma, and she looked and started climbing down.

Jessica and Juliet and I all told her to stop. It was too dangerous. But she climbed down on hand and foot, picked up the ball, and climbed back up again. She was still holding the bag of veggies in her other hand. She brushed off the dirt, and we returned home, and we filled up the bouncy ball with air and played with it for another day and a half before we got bored.

It’s still a good bouncy ball, many decades later. The cats are afraid of it though.

I have an awesome grandma.

### Crash Bandicoot Spring

We picked up Ray from his house, so it was Juliet, Ray, my dad, and I in the car. We were on the way to the trail. The snow was melting, but the ground was still frozen. Nonetheless, it was a *warm* 40 degrees Fahrenheit, so we chose the day to take a run. The sun was high, there were few clouds, and there was almost no wind. It was the kind of day you would remember for being extraordinarily ordinary. In its weather, in the event. A typical Sunday-afternoon jog with a friend.

Ray was no ordinary athlete. He was the top sprinter at our school, almost at the point of breaking the school record in the 100 meter dash. And I was just some skinny Asian kid who somehow picked up running because my family did it. He was an amazing short sprinter. I endured through distance. He was well over six feet tall. I hadn't gone through most of my growth spurts yet. He swore a lot around friends. I never did. We were a good match, I think. Balanced.

We parked in one of the spots leading up to the trail.

Our old house's driveway and the beginning of the trail both are located on a steep incline. Actually, one of the reasons we decided to move away was because of that steepness—on very cold days, the driveway became an impassable sheet of black ice, uncontrollable on the way down and sometimes unable to go up in a car. (When it got this icy, my grandma headed out with us with a sharp garden tool we called the “icepick” and we chipped away at it). The trail has the same incline. When we first moved to the house, we couldn't make it to the top of either hill from a standstill. So if we were going into the trail we would first check if any cars were coming, then use some of the momentum from hurling down our driveway to go up onto the trail, or vice versa from the trail onto our driveway. Or we could cross the poison ivy path, at our own risk.



Our old house and the trail. The hill is steeper than it looks.

The poison ivy path didn't exist anymore. A hedge grows there now. I guess the current owners of our old house wanted some privacy from the influx of sweaty people. And the familiar sight of the 1999 Nissan Maxima was replaced by a red Hyundai Sonata.

Not much had changed about the trail. It was just a lot more active, with many older runners exercising. I didn't see any toddlers. The floor was still mostly speckled with the incoming sunlight from the trees.

My sister had not yet begun cross country, so she was very slow. My dad went with her. Ray and I went ahead.

The first thing I noticed was Crash Bandicoot Spring, which was near the beginning of the trail. A name I hadn't recalled in many years. My sisters and I thought it looked like something from the PlayStation 2 videogame, "Crash Bandicoot." I don't remember which part.

After that came the first gorge. The American flag. The skipping stones and rope swing. The paved-over mile-stone. The long hill. The short hill. The second gorge. Indian Ledge Park. The straightaway with the new fence. And then the yellow gates that marked the end of this segment of the trail. All in heavy breaths, so that we didn't really pay attention to the sounds or smells. It was so fresh and quiet that there wasn't really much to hear or smell. Just old landmarks, ancient memories, rushing by in blurs.

Two-and-a-half miles. It took us sixteen minutes. But to me, this was something that began over a decade ago. Nobody passed us.

Panting, sweating, we turned back.

## Dinnertime

“There’s a difference between thinking you can’t be wrong and having no regrets. Wrongness is what occurs prior to empiricism, in hindsight a counterpart of revelation, and revelation is nothing to regret.”

Criss Jami

We sat down to eat dinner. My dad sat to the left of me, my mom to the right of me, Juliet facing me, and Jessica in some dorm seventy miles away, probably at some irregular angle from my orientation.

We never changed where we sat at the table, except the slight redistribution of chair-space when Jessica left for college. We picked the spot we wanted when we moved into the house and bought the dining table, and a decade later, we haven’t moved.

It was the same with the cups: Juliet always drank from the red, plastic, wide cup, now beginning to splinter. Jessica drank from a simple, plastic, narrow, tan-colored cup. My dad drinks from one of the mugs he brought home from work, and my mom drinks from one of the set of white porcelain cups. I drink either from the tall, blue plastic cup that came with a (now long-lost) cap and straw, is dual-layered and says “Escape the Ordinary,” or the yellow mug with an image of a Chevrolet Camero and the words, “Burning the midnight oil” on its side. However, we generally share the same eatingware amongst ourselves, many of which are older than any of us children, from the restaurant my dad used to own. When someone drops and breaks one of those almost-ancient bowls, I actually feel quite distraught. That was a piece of history. It reminded me of an old Chinese TV series we watched as a family about a poor girl named “A’xing” that gotten a broken old bowl of sentimental value stapled back together, but I don’t think we would go so far.

My parents sat on both sides of me. Even when Jessica was home, she and Juliet sat next to each other, opposite me, so that one sister was always cushioned from the onslaught of two parents by the other sister. I never had that luxury.

I just told my family a joke.

My mom chimed in. “So it’s like Shannon and McKayla. Tris keeps posting images of them, and they’re always happy. And Shannon is winning all of the ...” she gestured with her arms “... rowing competitions.”

“What? That has nothing to do with what I was saying,” I said.

“I thought that’s what you meant,” she said, a little quieter. She looked at my dad, who immediately jutted in.

“Yeah. It makes sense. It’s a piece of wisdom, that the second person is actually smart.”

“No, it doesn’t! There’s no second person! It wasn’t supposed to be a piece of wisdom. It was supposed to be a joke! You didn’t get it.”

"You can't say that," he retorted, almost shouting. But he didn't continue to explain.

"You know you're not making any sense, right? You don't get it— just admit it!"

Juliet said, "Let's just forget about it. So... how were your days?" She imitated my dad's low, loud voice. It was a question my dad always asked when he got home from work, and he would always get angry if we didn't provide an explicit rundown of the day.

But I didn't stop. "I'll repeat it one more time. Only once more. You guys didn't get it at all." My parents gestured at me to continue. "The quote went, 'People who think they know everything are a great annoyance to those of us who do.' It's sarcasm, can't you see?"

"Oh— yeah, you could interpret it that way as well. I was thinking of it a different way." But he didn't finish his thought. There wasn't a thought. I saw him trying to make sense of the peculiarities of the English language, his secondary language, that made the quote funny, while he looked into my glowering eyes. I don't think he found anything. My mom had already given up by the first criticism.

There was a brief silence.

"Again, how did your days go?" Juliet repeated, louder. No one replied.

There was always some sort of debate going on at dinner. The next night, my mom asked me whether or not a new immigrant from China should move in with a man she had just met. They said it was hypothetical, a moral question, but I knew it was an issue with my uncle. I wasn't listening to the context of the problem, so I mumbled that I didn't have enough information to answer the question. Besides, my parents were always talking about the problems on my mom's side of the family, and I didn't want to get caught up in the drama. I always seemed to support the family members my parents complained were lazy, irresponsible, or naïve. They asked again. I said *I don't know*.

When they asked a third time, I didn't say anything. I finished my rice, not eating any more *poi*, shoved my seat out without setting it back under the table, put my bowl and chopsticks in the sink, and left downstairs to try to memorize and solve a Rubik's Cube blindfolded in the company of our cats, Sharon and Jane. But I fall asleep every time I've tried to memorize a Rubik's cube, and this time was no exception. I was asleep before I knew it, Sharon purring and comfortably kneading my chest with her claws extended.

About an hour later, I woke up as the cats scattered because my mom came downstairs to wash the laundry. She approached the sofa I was reclining on with frizzled hair that meant I had fallen asleep, and posed the question again. I repeated that I don't have a good answer. My dad followed, yells at me for several minutes. He said I should have said, "I don't know." That I should have some respect. I said I did say "I don't know" at dinner, but he ignored that. I then said "I don't know," again. Then he said that I have an attitude. That it was my place to understand these family issues, because they will affect me and because family matters. After a few minutes they both returned upstairs.

None of the argument registered in my mind. What bothered me more than the confusing accusation was the overwhelming-ness of the sound. My dad may not have really been shouting. It wasn't loud enough to hurt my ear, like the snare drums that perform right behind me in the brass section, but it was too much. I imagined every syllable intoned with the square- or sawtooth-shaped waves I've seen as illustrations for the sound of electric guitars.

I fell asleep again, because the cats returned and I had no freedom to move without lifting them, which I had not the heart to do.

An hour later, my dad returned and yelled at me again to get up. He turned off the lamp, grabbed my hand, and jerked me up the stairs. I looked to the cats for help, but being the skittish cats they are, they were nowhere to be seen in an instant.

## An American Dream

"But I can say that life is good to me. Has been and is good. So I think my task is to be good to it. So how do you be good to life? You live it."

Morgan Freeman

On September 16th, 1994, the staff of Brookdale Hospital saw a Chinese man in his mid-twenties, dressed in a clean white shirt, enter the emergency section. His right eye was swollen under his rounded spectacles. The attendees went up to him to assess the level of injury and decide if he needed urgent help, but he denied the help.

He tried to introduce himself as *lam-zheng-wong*, or Chunwang Lam. The nurses ignored his introduction, worrying instead about the injury. He said he was here to work, but they said they didn't know him. He repeated that it was his first day as a medical student, not a patient. It took a few minutes for the hospital workers to accept that he was, indeed, working for his first day as part of clerkship for his third year of medical school.

Over twenty years later, he would tell this story to his children, and laugh about it. "My face was banged up so bad it took them some time to figure out I wasn't actually a patient," he liked to say.

Wang was a twenty-four year-old medical student who worked in the family-owned Chinese restaurant on E. Gun Hill Rd. in the Bronx. His parents cooked, and he and his brothers John and Frank served food and cleaned up. The restaurant made marginal profit, but it supported the family of five in their cramped apartment, and paid off Wang and Frank's tuition to the City College of New York. What made it manageable was that they were all in it together: three young brothers, recently legal citizens, struggling in the English-dominated landscape, wanting to raise families in comfort and get out of the slums of New York City.

Sometimes, biking from house to house for deliveries, one of the orders would turn out to be a robbery at gunpoint. There was no choice but to relent if the person who ordered the meal had a gun, and to report the incident later. But the police often didn't care much for small thefts like this, because there was no way to prove anything and no physical harm was done. All that could be done is to lock all the large bills away after every trip to minimize the losses.

Other times, the guns or knives would flash in the restaurant when customers refused to pay for their meal, and the family had to quickly hide or get behind the bulletproof glass. To them, the small amounts of money (ten, twenty, thirty dollars) weren't worth harm.

Sometimes the fights weren't even over money. One time, Wang was jumped on a street corner by three African American kids on his way to the restaurant from school, just because he was an easy target: a skinny minority youngster. The cops were called afterwards, but the other kids couldn't be found.

A week later, another young Asian male was murdered on that same street corner, reportedly by African American kids as well. The suspects weren't caught, but Wang speculated that the same people were involved, and that if he had been there again, it likely would have been him.

A lot of the time, Wang ended up studying for high school and college behind the counter on slow times in the restaurant. For him, the restaurant was a temporary inconvenience—his parents paved the way to America because they wanted him and his brothers to get a better education than they could have in China, taking years to be able to pay for the move. There was no time to waste. So after school, beginning from the move to New York when he was fifteen to his twenties, work came after school, and didn't end until late in the night. No exceptions. He envied Frank, who often went on long excursions to other restaurants to fix broken refrigerators and other appliances and spent extra time flirting with the girls there, and he envied John, who was the smartest of the three and could get by without trouble in school.

In the end, John didn't attend college until he was fifty-two years old, at Kingsborough Community College. While he was the best suited for school, he was the oldest and it was his responsibility to take care of his brothers. So Frank and Wang went off to the City College while John worked even longer hours.

The day before he began working at the hospital for the clerkship, the Lam family was working at the restaurant in the late afternoon. A group of five teenagers were loitering outside, smoking cigarettes and chatting for a few hours. The problem was that they kept coming into the restaurant to use the bathroom and leaving it disorderly and unclean. Wang and his brothers had to clean the bathroom, so they told them not to keep coming in. While they agreed, they came back in again to use the bathroom in clear defiance, so Wang hit him. This started a brawl between the group of teenagers and the family, which ended until Wang's mom grabbed one of the girls by her hair and began dragging her out until a good chunk of her hair came out. Wang came out with some bruises on his face, but no serious injuries.

A few days later, walking down to the restaurant, Wang saw two of the teenagers again. He quickly turned onto another street, but not before one of them noticed him. The teenager shouted "wait!" and approached Wang. He said that his friends were just being stupid and didn't really want to do any harm. He said they wouldn't do it again.

Seven years later, shortly after the bombings of September 11th, 2001, Wang, his wife, and his young children (only one and two years old) moved to a larger apartment in Stamford, Connecticut, a large city, but much smaller than the Big Apple. Two years later, they would move again to their first house in Trumbull, a more suburban setting, next to the Pequonnock River Trail. Another five years would pass until they moved to rural Easton, to a larger house. In Easton, there was no such thing as street violence.

He would tell the stories of his younger life. He would say that the kids on the street corner, like the rowdy teenages, were simply bored and had nothing better to do with their lives—it wasn't their fault that they were raised so that they couldn't find a nonviolent output. His children would listen—partially in awe, partially in disbelief. And he would watch as they grew up in the quiet countryside, sixty miles away from the ghetto where he fought for his life, thousands of miles away from the fight that his parents fought when they moved to America.

End.

## Church of Prom

So I was at home that night, at my computer. If you don't know me, I love to code. I had a terminal on the screen and a notebook with a scribbled checklist.

My goal for the night was to imitate agar.io, an online multiplayer game. Preferably before 11:00p.m. I wanted to improve upon my model from freshman year and was armed with new technologies, some less than a year old. And it was wonderful. That night I learned to use powerful tools that gave rise to many more utility web applications, including more multiplayer games and most recently the Safe Rides web-app.

But it's not really important that I was coding. What *is* important was the date: May 12, 2017. And that I finished before 11:00p.m., and that I had such a satisfactory time learning during this little activity. I went off to sleep all bubbly, and I am glad even now that I had spent that little chunk of time plowing through the tough technical details.

Because you know what else finished at 11:00p.m. on May 12, 2017? Prom.

I know at least sixteen of you are more open than me to social experiences like prom. But I'm the kind of guy that loves coding and Rubik's cubing and math for the heck of it. I've committed to a small school of very dedicated math nerds, where there are no sports and no homecoming. I'm not afraid of social events like parties, but I'm tired of them. They tire me. I can hold up a conversation, but conversations for high school boys often center around sports, TV shows, videogames, and girls, and I don't watch sports or TV shows, play videogames, or date girls.

I'm sure it's not just me: high school is that awkward time between having to ask to use the bathroom and driving whoever, wherever, whenever. You learn to make a lot of decisions on your own.

One decision that I don't agree is asking people to prom, especially at the cost of time and money. A national survey by Visa Inc. in 2015 found that households with prom-going teenagers in the northeastern US spent \$1,169 on average for prom preparations ("Cost of High School "Promposals" Hits \$324."). Here's a quick analysis of alternatives:

- Scenario 1: you have a significant other. Going to prom is expensive, awkward, and prone to public humiliation if you make the wrong move. Go take him or her out to a movie or a fancy restaurant for a tenth the cost.
- Scenario 2: you don't have a significant other, but feel like you need one. Do you really want to spend four hours of the “most memorable night of high school” with this partner you don't really know? This is a non-option. It's social pressure.
- Scenario 3: you want to celebrate the end of the year with your friends. Go do something fun like a paintball game or a pool party. Hang out at a friend's house afterwards.
- Scenario 4: you're an introverted nerd. The choice is easy.

If prom weren't such an established institution in society, a simple assessment of practical options like this would deter most people. Which means that social evils like peer pressure and outdated tradition feed prom. And the truth is that the Internet and social media and crazy YouTubers teach teenagers things like FOMO: the fear of missing out.

Think of it as a school gathering, surrounded by people you've known. It doesn't have to be fancy or organized to be fun. You won't fool anyone about who you are by dressing up or picking up a date.

And then there are ridiculous parts of prom culture. I'm sure some of you are familiar with social media groups specifically for girls to “claim” prom dresses. Last year my friend had a situation when her lab partner had the same dress as her and asked my friend to return her dress, but luckily she didn't give in to that pressure. But situations like this can end badly. An article named “Prom, Promposals, Promsanity” by the mother of boys going through the 2018-prom experience shows her absolute dismay at this new culture. She says:

“The concept isn't actually that new, as some small town specialty boutiques have kept records of dress purchases before, noting to potential buyers that someone from the same school bought that dress already. But this new social media method of putting dibs on dresses? Well, as you can imagine it lends itself to some serious trolling and keyboard shaming, because of course it does – this is 2018” (Fenton).

The article centers around the excessive-ness of the ceremony of prom. She mentions that teenagers these days are using “singing telegrams, balloon bouquet deliveries, flash mobs, and even fireworks” to ask others to prom.

A proposal is only supposed to declare one’s affection towards another and *ask* them to prom. But the same survey from Visa says that households with prom-going teenagers spend over \$300 on average for promposals (“Cost of High School “Promposals” Hits \$324.”). This extra flair draws attention and locks the proposee into saying yes, turning the *ask* to prom into a *demand* to prom. Because how can you say no to the hard work of an admirer of yours who uses bouquets, fireworks, singing telegrams, flash mobs, the efforts of an entire athletic team, already-bought prom tickets, and half the school as a crowd?

You’d be the jerk. People would say you didn’t even give him or her the chance. They put in all the effort to put this all together, and you broke his or her heart. It’s hard to say that you simply don’t want to go with them or you simply don’t want to go to prom. It’s this 2018 world of being “politically correct” and not offending anyone, even if it is the truth.

And you all know about the drug and sex problems. The website of Edgar Snyder and Associates, a personal injury law firm, reports that 54% of high school students had at least four drinks on prom night in 2015 (“Underage Drinking and Prom Night.”), and a survey by Seventeen Magazine (in conjunction with the CDC) found that 14% of teen girls have sex on prom night (“Prom Night Statistics”). But this is for wellness class to teach you, so I won’t elaborate.

The problem is that it’s all a part of the culture. Actually, the number one answer I get when I ask people why they are going to prom is, “It’s prom!” Or, “It’s tradition!” Nothing really sensible. Our society *religiously* accepts this as the “high school experience” and turns a blind eye to its vices. But if you think about your journey from a middle-schooler to a university student, you see there’s a lot more to the high school experience. Lots of learning and growth. But not towards prom. Towards something greater. My programming plans for morp are only one example of this fruitful “celebration of knowledge,” but there are so many activities that are

more meaningful (and fun) than prom, depending on the person, and it becomes very evident once you realize that prom isn't the only option. You just have to ask yourself, why do you *really* want to go to prom?

I could be getting everything wrong. I haven't been to prom. Prom is different for everyone, and certainly is a positive experience for many people. But I'm also sure that I don't carry any of the guilt or embarrassment or debt that some of the people who went to prom do now.

I hope you make good decisions as to what you'll be doing this May 11th, prom or no prom. You don't have to be typing away at a screen like I will be. You just have to be smart about it.

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### The Story of “Rex Walls-Style”

My first impression of memoir writing, that memoirs are a sort of note to satisfy the need to remember for the author and only the author was a little restricted. Walls’s *The Glass Castle* is a striking counterexample of the objectivity and exclusivity that I had previously thought. The book has reached out to millions of readers who sympathize with her human struggles, the “same issues” that everyone encounters in some form or another, which leads to my new understanding that memoir is, while not meant for purposes of entertainment as fiction often is, a way to capture moments in life for the *collective* keeping of all its readers.

The first aspect of *The Glass Castle* that sets it apart from what we read earlier was that it was in the context of a novel. Most, if not all, of the stories we read were also from larger works, but we read them as a complete entity, including the first chapter of *The Glass Castle*. Even though there was adventure to the scene and its own little plot, “breath[ing] in the familiar smell of Vitalis, whiskey, and cigarette smoke” (Walls 14) or “check[ing] out, Rex Walls-style” (14) means little to the reader. It’s a happy childhood memory, much as David Sedaris’s “Go Carolina” or the tooth fairy story. There’s no real connotation behind the Blue Goose, or fire, or Lori and Brian and Rex and Rosemary, or “Rex Walls-style” — you need much more context than that. The reader has no idea from this opening scene how dysfunctional and disjoint the family could become, which I only began to realize as I read Part I of the novel. Particularly that latter detail, “Rex Walls-style,” gains so much meaning as the book progresses — it’s as if the entire book were dedicated to explaining that it meant escaping the “FBI agents” (19) after Rex, presenting his children with stars for Christmas, forcing respect for his mother, building and trashing the glass castle foundations, and moving to New York City to reunite the family.

It’s as if each story were an individual annotation, a figurative sticky-note, and you’re trying to understand the whole book. But the book is (for practical purposes) infinitely long, and reading the entire story wouldn’t be feasible.

This annotation metaphor also works because of a point brought up in class: that a person cannot change the past, but he or she can change his perception of it. A sticky note can simply mark an event, such as the burning of a Christmas tree, but the fact that “when Dad went crazy, we all had our own ways of shutting down and closing off, and that was what we did that night” (115) is not something that would register in the mind of a nine year-old. It’s what Jeannette *knew* at the time, but only was able to register more completely as an adult, writing the memoir.

This contrasts with my original view of memoir, which sought less interpretation and purer dialogue and actions to tell the story. Again, that was in the context of a single, encapsulated short story, not a thematic, longer storyline. In Jeannette’s case, this interpretation doesn’t skew the truth (it doesn’t change what happened nor what she thought), but it is simply an improved expression. This amount of hindsight is not only non-damaging to a memoir (annotations don’t alter the content of a story), but also very important for Jeannette to try to feel the emotion of a child as an adult. The best way is to put her thoughts into words, even if they are the words of the present.

A single short story may not be very relatable to everyone, but *The Glass Castle* is widely appraised as being extremely relatable, despite the extreme circumstances of the Walls family. For example, Rosemary is a mom with “a houseful of kids and a husband who soaks up booze like a sponge” (197), but also steals money for her sweet indulgence and keeps a million-dollar property while her children starve. The father is a brilliant alcoholic, and Maureen the ungrateful daughter of Rosemary. Sure, it’s an interesting story, but that’s not the point. It’s not

meant to make people laugh or cry, an emotional thriller of a roller coaster. Rather, it's as some of the many sticky notes from Jeannette's story could fit right into the stories of anybody else, perhaps with the details slightly different: the wife could be the alcoholic, the grandmother a miserly hoarder, the dog causing the trouble, the step-son getting into the fights. Each annotation, every episode is a key part not only of the author's life, but a dialogue on all his or her readers' lives. *The Glass Castle* is meant for everyone to remember and understand their Rex and what gives them that "Rex Walls-style."

## Senior Exit Response

### *1. What topics should be covered in a high school wellness curriculum? Explain.*

In my opinion, high school wellness should include topics about building good habits for when they are in college and away from the guidance of their parents. It should probably be long-term skills, and ones that will not already be covered in other classes. If it pertains to high school too, it makes sense that it should come earlier in the wellness curriculum, such as **healthy relationships, physical fitness, and substance abuse**. For advice about decisions more associated with later stages in life (college and beyond), **leisure pursuits/lifetime fitness, nutrition, alcohol poisoning, the and the baby project should be in the junior/senior curriculum.**

I also believe that there should be physical activities interspersed throughout all four years, rather than being concentrated in freshman and junior years. This will not only encourage students to be more active throughout the year, but may also help keep things more interesting and lively for the students. Perhaps, if it can be tied into the curriculum, this would be very interesting.

However, there are a few parts of the wellness curriculum that I feel were very necessary, but it's possible that this is due to my more introverted personality. For example, I don't feel that ballroom dance is a very necessary skill in the future. I also feel that a lot of the topics covered are better learned through experience than through a classroom setting, such as teambuilding. Yet other topics, such as bias/stereotypes/discrimination, self reflection/making changes, and advocacy are skills learned in other classes, and I don't think they are very necessary units in the wellness curriculum.

### *2. What dimensions of wellness are more critical in the next chapter of your life? What skills are you leaving with that will help you stay healthy?*

Occupational and intellectual wellness are the ones that come to mind immediately for me. We are entering a time when we all have to go out in the world and live on our own, studying hard in college (intellectual wellness), so that we can develop the mental skills

necessary to have a career in the competitive job force. During and after college, students will be focusing on finding a job and working up their way on the career ladder so that they can secure a stable future for themselves and their future families. Social wellness is also important because it has to do with the connections necessary to find better jobs.

After intellectual and occupational wellness, I believe that emotional wellness is most important after leaving high school. With all of this competitive learning and job-seeking, there's guaranteed to be a lot of stress, and not being able to handle the stress can lead to physical harm or lowered mental performance. On top of that, the increased level of hormones that teenagers and people in their early-twenties have make emotional swings more likely.

I think that finding a way to decrease mental stress to keep emotional wellness up is the most important way to stay healthy after high school. A lot of people may find solace in physical fitness (physical wellness), which is a great solution because it helps two dimensions of wellness at once. Whatever a person can do to keep themselves calm and focused will help a person persevere through these tough stages and improve their intellectual and mental growth.



# SENIOR PROJECT: VOLUNTEERING AT THOMAS HOOKER

Jonathan Lam

# MY PROJECT

My project was to be a volunteer at the Lighthouse Program in Thomas Hooker School in Bridgeport. This was my Spanish 6 Community Outreach Project.

- Homework tutor
- General volunteer



# WHAT IS LIGHTHOUSE?

The Lighthouse Program is an after-school program for K-8 graders with working parents throughout Bridgeport.

Every day consisted of:

- An hour of homework
- An hour of activity
  - Rugby
  - Tennis
  - Puzzles
  - Much more

# WHAT DID I DO?

- 17 visits (34 hours)
- Homework help
- Help facilitate the activities
- Taking photos and interviews for Spanish class
- Maintained the Senior Project website



# THE SPANISH PROJECT

# GOALS (SPANISH)

- Learn about the academic perspectives of Hispanic children, and compare them to our community
- Speak Spanish more fluently
- Learn about the Hispanic-American culture for young children

# VOCABULARY

Cociente, dividendo, divisor, divisor, división larga	Quotient, dividend, divisor, long division	Bola	ball	mascota	pet
ajedrez	chess	Fracciones mixtas, fracciones impropias	Mixed fractions, improper fractions	El soccer	soccer
Segundos nombres	Middle names	Pato	duck	Parque infantil	playground
lapicero	pen	Disculpe	Excuse me	Alubia	beans
gringo	White foreigner (derogatory)	Cinco y tres de cuatro	5 $\frac{3}{4}$	pilla-pilla	Tag (the game)
coreografia	choreographed	Darse bien	To be good at [something]	Helado italiano	Italian ice
Fracción, denominador, numerador	Fraction, denominator, numerator	rugby	rugby	Volúmenes de prismas	Volumes of prisms
terapeuda	therapist	La simulacro de incendio	Fire drill		



# REFLECTION

# COMMUNITY IMPACT

- Helped out students in the greater Bridgeport area
- Helped take care of students whose parents were working
- Helped students with their homework, encourage learning

# FACETS OF WELLNESS

- **Intellectual:** tried to encourage fun in learning, help them with homework
- **Physical:** the kids did many physical activities during the activity period, such as:
  - Rugby
  - Soccer
  - Tennis
  - Tag
  - Basketball
  - Football

# PERSONAL GROWTH

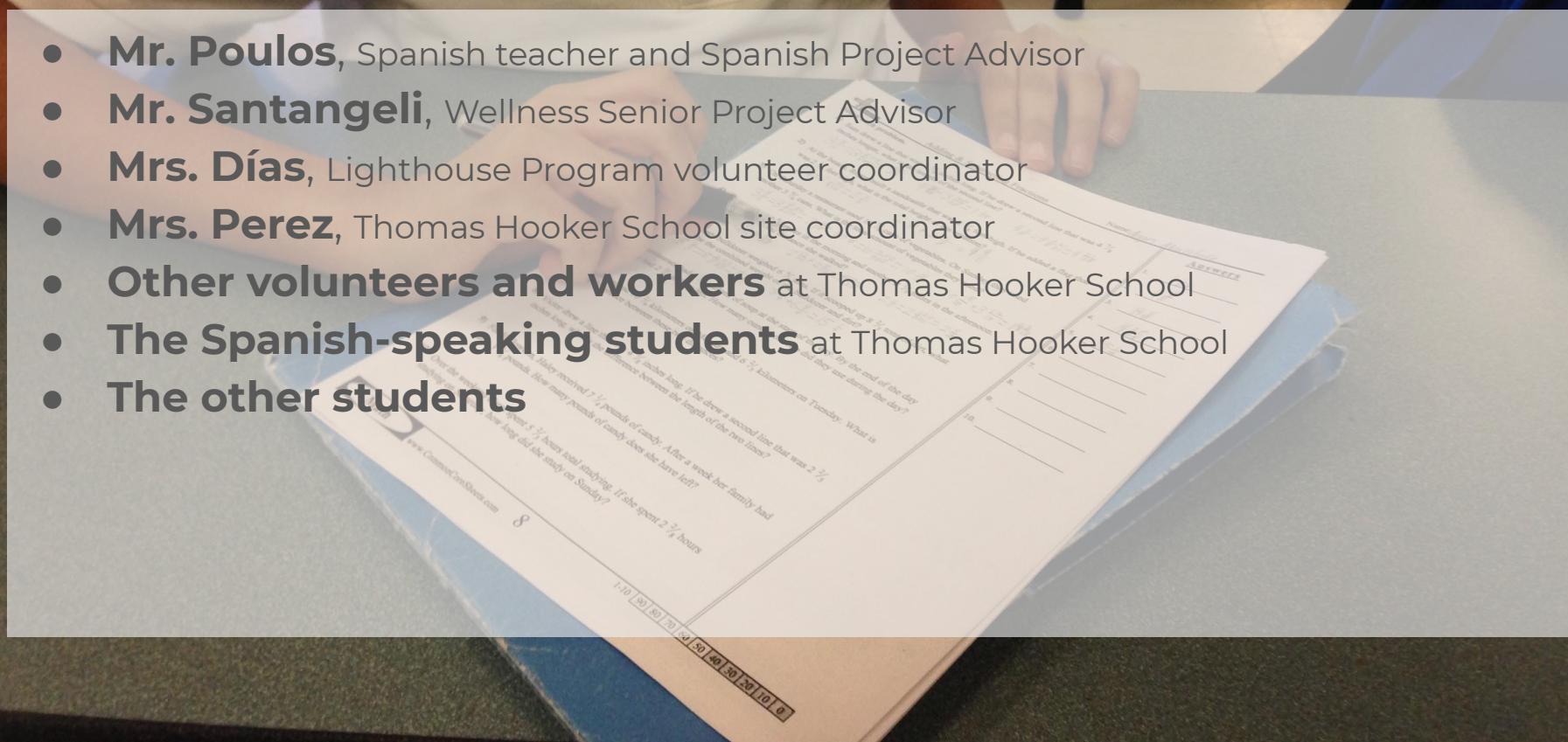
- First time volunteering for an extended time
- First time working with children
- Learned how to be a responsible volunteer and role model

Thanks for watching!



# BIG THANKS TO:

- **Mr. Poulos**, Spanish teacher and Spanish Project Advisor
- **Mr. Santangeli**, Wellness Senior Project Advisor
- **Mrs. Días**, Lighthouse Program volunteer coordinator
- **Mrs. Perez**, Thomas Hooker School site coordinator
- **Other volunteers and workers** at Thomas Hooker School
- **The Spanish-speaking students** at Thomas Hooker School
- **The other students**



## Senior Wellness Journal 1

- Social: I am not a very social person. I don't like the idea of aimlessly chatting with someone else if I don't have to, because a lot of the "social" conversation of high schoolers seems awfully superficial: video games, TV shows, prom, etc. That means that my conversations are often limited to school, or occasionally about track and field or programming. But I very rarely engage in social activities outside of school as well (except track and field) because I spend much of my time at home studying or programming software. That being said, I am not too worried about my social skills, because I feel that I can still communicate what is important, when I need to—I just don't see the same value in being social just for the sake of being social. The only social skill I am worried about is presenting myself in a professional environment (e.g., interview, job settings) with some pride for my current achievements but also modestly and genially (see the occupational wellness field below).
- Occupational: I haven't had an official, paying job, but I have held multiple volunteer positions, including at a bakery, at the Easton Public Library, and at an elementary school in Bridgeport for the Senior Project. While I haven't really enjoyed any of these positions, I think that each of them made me uncomfortable (in a good way) simply by the virtue of forcing me to try new things. I hope that as I get more job or volunteer positions, hopefully moving toward my expected field of study in college (computer science and/or electrical engineering), these jobs will become more comfortable and more interesting to me. I think the only change I can really make right now to improve my interpersonal skills so that I will be prepared for difficult interviews and working with coworkers.
- Spiritual: I'm not religious, but I think I follow a generally agreeable set of Chinese values. Chinese culture has a strong emphasis on loyalty to the family (especially elders), as well as a hardworking modesty—I think this makes up a good part of my belief system. A strength is that I don't think I ever really clash against these values; rather, I think they are my main drivers, especially the theme of simply being hardworking and persevering when things get difficult. On long nights, on tough running races, on tight deadlines, on convoluted program flows, this ingrained value keeps me going because my beliefs tell me it is possible to do it. This probably has had the greatest impact on my schoolwork (intellectual wellness) by pushing me through my toughest courses. I don't feel much need for change—these basic values have served the Chinese people well for thousands of years.
- Intellectual: I enjoy learning. I love to call myself an intellectual, a nerd, a mathematician, a programmer. I like to think that I have an aptitude for learning, or at least having an interest in a lot of material so that I delve deep and retain a lot of that learning as a result. As a result of this, my strength is that I can handle tougher

coursework and maintain good grades, while still enjoying a lot of the process. However, I think that a difficulty that will come up in the next few years is deciding on an appropriate course load, so as to not overwhelm me intellectually. I am most likely going to major in electrical engineering, but I also love the computer science and mathematics fields, and it might be too much for me if I try to take all at once. A change I might want to undertake, then, would be to learn how to better prioritize class choices based on what I think will interest me most and what will be most beneficial to my future.

- Physical: While I don't enjoy exercising (running cross country or track), I still try to stay somewhat active and eat healthy. One strength of mine is that I do not feel much craving to regularly eat unhealthy foods, such as fast food or ice cream, because I grew up eating rice two times a day and many plain, cooked vegetables (which I enjoy). I also think that my ability to persevere while running long distance is good for my health. A weakness, however, is that a lot of my exercise is caused by peer pressure (both from my friends and from my family, almost all of whom are runners), which might disappear when I attend college. As a result, I need to find the motivation to run (or other types of exercise) on my own regularly enough to keep me fit.
- Emotional: I'm not too sure how well my emotional wellness is. I don't have emotional breakdowns, but I do get frustrated when I have to work late into the night to finish homework or something for college. Sometimes I procrastinate because of this frustration, which leads to a problem that gets worse and worse until the deadline approaches and I'm forced to cram. Luckily, I'm getting better at time management and this is becoming less of a problem. Other than that, I think a strength of mine is to stay relatively calm throughout the day, meaning that my emotions don't affect my performance negatively or distract me. I don't see too much need for change here.
- Environmental: I don't actively think about environmental wellness, so this is definitely a weak spot for me. While our family does like to conserve as much as possible (we don't use plastic water bottles, we reuse plastic bags at least once, and we often use reusable bags) and we never litter in nature, I know that our family does throw out a large volume of trash on a daily basis. Our house is large, so it uses a lot of energy (the pool consumes especially much and isn't used too often); we use fertilizers, pesticides, and herbicides on the lawn, and we use a lot of water to clean dishes. It's not ideal. Unfortunately, I do not have too much control over the family's consumer needs and cannot affect it too much, but I will try to keep waste to a minimum.