



# Cartography M.Sc.

## Beyond the Peel

Combining Art, Storytelling, and Visualization to Convey and Contextualize Projection Distortion

Esmé Middaugh

# AGENDA

- Introduction and Motivation
- Research Identification
  - Objectives & Questions
- Part 1
  - Definitions, Current Research, Conceptualization of Approach
- Part 2
  - *The Projection Flipbook* Project: Process & Creation
  - Results, Discussion, Limitations
- Conclusion

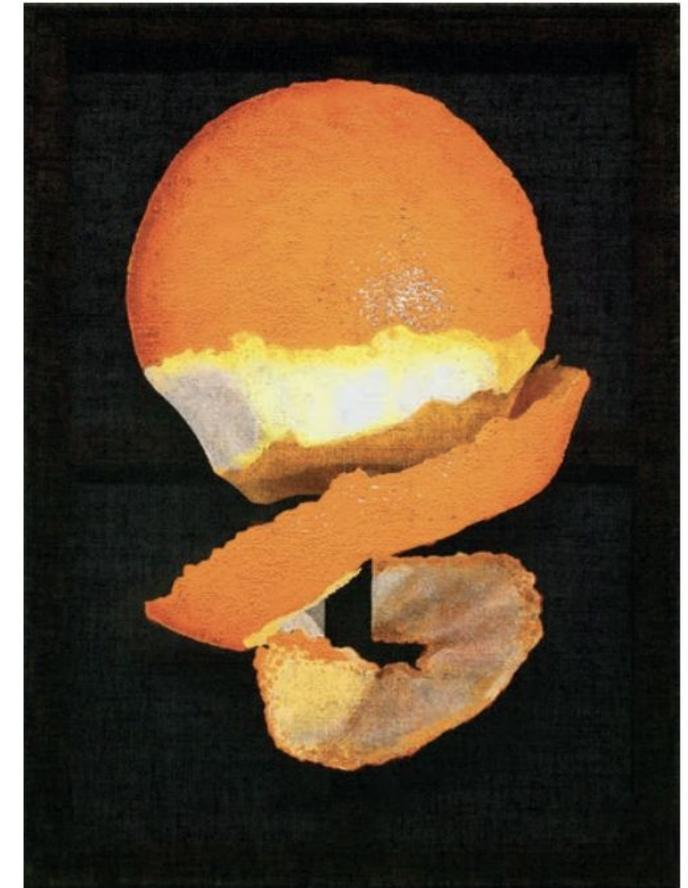


# INTRODUCTION & MOTIVATION



INTRODUCTION & MOTIVATION  
 MOTIVATION

The public at large has “little to no interest in, or ability to, understand/compensate for map projection distortion.” (Battersby, 2021)



Maja Vukoje,  
 Orange, 2017  
 Acrylic on burlap, 100 x 70cm  
 Foto: Roland



## INTRODUCTION & MOTIVATION

# RELEVANCE TODAY

*Maps Have Been Lying  
To You Your Entire Life*  
–IFLifeScience

*Your Map Is Lying to  
You*  
–Outside

*Maps have been lying to  
you all your life. Yes,  
even Google Maps*  
–AbcNews

*What are Map  
Projections? (And Why  
They Are Deceiving To  
Us)* –GISGeography

*The world map you  
know and love? It's been  
lying to you.* –Vox

*Why every world map  
you're looking at is  
**WRONG*** –Daily Mail



# RESEARCH IDENTIFICATION



## RESEARCH IDENTIFICATION OBJECTIVES

***R01** To present the benefits and limitations of current distortion visualization offerings [and explore why alternatives may be needed].*

***R02** To explore how distortion can be conveyed artistically and with storytelling methods.*



## RESEARCH IDENTIFICATION QUESTIONS

**RQ1** *In which ways could the general public benefit from a better understanding of map projections and their distortions?*

**RQ2** *What key methods are currently used to convey the effect of distortion?*

**RQ3** *How might artistic and storytelling methods help to make distortion interesting, understandable, evocative, and relatable beyond the theoretical level?*

**RQ4** *What could an artistic, thematic, storytelling approach to conveying distortion look like?*

**RQ5** *What possible insights could be gleaned from the creation of such a project and how might one evaluate said project?*



# PART ONE



# DEFINITIONS

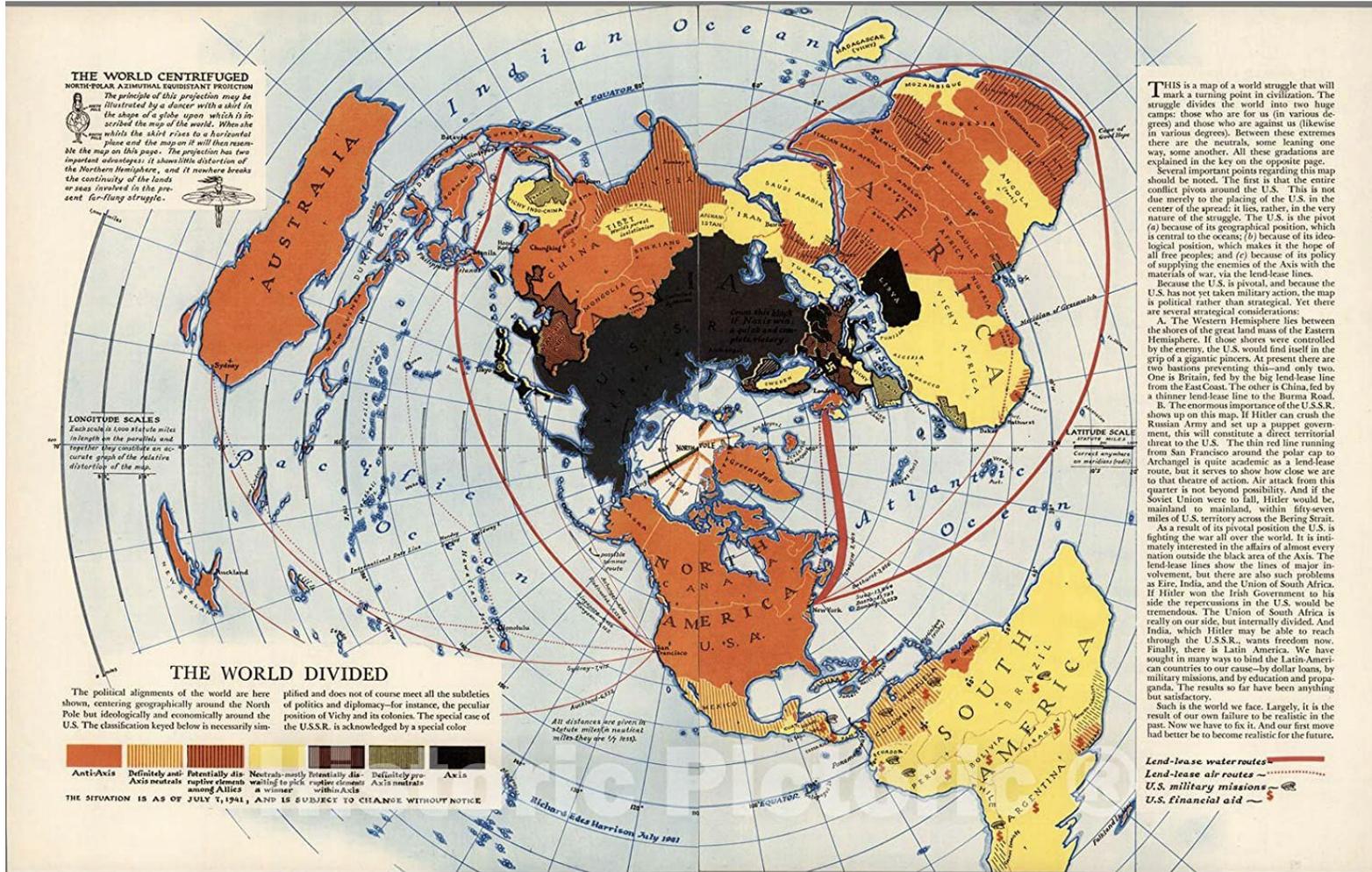
*Functional map projection literacy (FMPL)* includes “knowledge about types of map projections [...] and the ability to judge the accuracy and appropriateness of map projections for different purposes” (Hawkins et al., 1998). Additionally the knowledge:

- that all maps distort, and that they must (Monmonier, 2018; John Parr Snyder, 1987),
- that some projections are better suited than others, but all have their strengths and weaknesses (Burkalow, 1955), and
- that there can be no perfect projection (Battersby, 2021; Monmonier, 2018)
- and that a projection is not inherently good or bad, but that it depends on context and content.



PART ONE

# HISTORICAL & CURRENT IMPORTANCE



THIS is a map of a world struggle that will mark a turning point in civilization. The struggle divides the world into two huge camps: those who are for us (in various degrees) and those who are against us (likewise in various degrees). Between these extremes there are the neutrals, some leaning one way, some another. All these gradations are explained in the key on the opposite page.

Several important points regarding this map should be noted. The first is that the entire conflict pivots around the U.S. This is not due merely to the placing of the U.S. in the center of the spread; it lies, rather, in the very nature of the struggle. The U.S. is the pivot (a) because of its geographical position, which is central to the oceans; (b) because of its ideological position, which makes it the hope of all free peoples; and (c) because of its policy of supplying the enemies of the Axis with the materials of war, via the lend-lease lines.

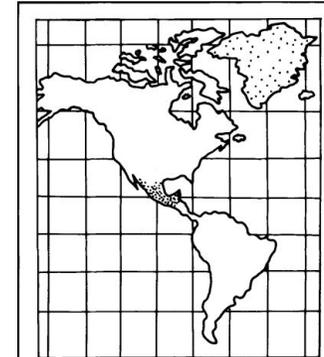
Because the U.S. is pivotal, and because the U.S. has not yet taken military action, the map is political rather than strategic. Yet there are several strategic considerations:

A. The Western Hemisphere lies between the shores of the great land mass of the Eastern Hemisphere. If those shores were controlled by the enemy, the U.S. would find itself in the grip of a gigantic pincer. At present there are two bastions preventing this—and only two. One is Britain, fed by the big lend-lease line from the East Coast. The other is China, fed by a thinner lend-lease line to the Burma Road.

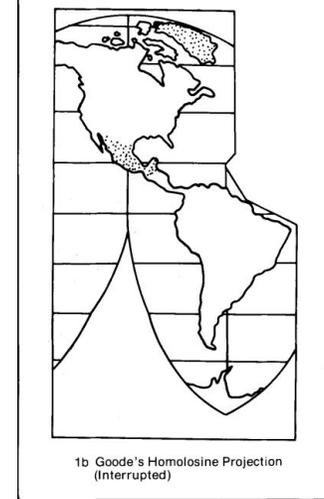
B. The enormous importance of the U.S.S.R. shows up on this map. If Hitler can crush the Russian Army and set up a puppet government, this will constitute a direct territorial threat to the U.S. The thin red line running from San Francisco around the polar cap to Archangel is quite academic as a lend-lease route, but it serves to show how close we are to that theatre of action. Air attack from this quarter is not beyond possibility. And if the Soviet Union were to fall, Hitler would be, mainland to mainland, within fifty-seven miles of U.S. territory across the Bering Strait.

As a result of its pivotal position the U.S. is fighting the war all over the world. It is intimately interested in the affairs of almost every nation outside the black area of the Axis. The lend-lease lines show the lines of major involvement, but there are also such problems as Iran, India, and the Union of South Africa. If Hitler won the Irish Government to his side the repercussions in the U.S. would be tremendous. The Union of South Africa is really on our side, but internally divided. And India, which Hitler may be able to reach through the U.S.S.R., wants freedom now. Finally, there is Latin America. We have sought in many ways to bind the Latin-American countries to our cause—by dollar loans, by military missions, and by education and propaganda. The results so far have been anything but satisfactory.

Such is the world we face. Largely, it is the result of our own failure to be realistic in the past. Now we have to fix it. And our first move had better be to become realistic for the future.



1a Miller Cylindrical Projection



1b Goode's Homolosine Projection (Interrupted)

Showing the misleading effects of projection distortion on dot density maps. Taken from Tynes (1982).

Richard Edes Harrison's 'The World Divided' first published in Fortune Magazine, 1941. Taken from Cornell University - PJ Mode Collection of Persuasive Cartography.

PART ONE

# DISTORTION = DECEPTION?

*“Changes in society (e.g., lower levels of trust in decision makers) and in mapmaking technologies and practices (e.g., anyone can now make their own maps) mean that we need to spend some time thinking about how, when, and why people trust maps and mapmaking processes. This is critically important if we want stakeholders to engage constructively with the information we present in maps, because they are unlikely to do so if they do not trust what they see.”* (Griffin, 2020)

## Boston public schools map switch aims to amend 500 years of distortion

**A district will drop the Mercator projection, which physically diminished Africa and South America, for the Peters, which cut the developed world down to size**



📷 The Gall-Peters projection, which shows land masses in their correct proportions by area, puts the relative sizes of Africa and North America in perspective. Photograph: Alamy Stock Photo



PART ONE

# SUMMARY OF IMPORTANCE

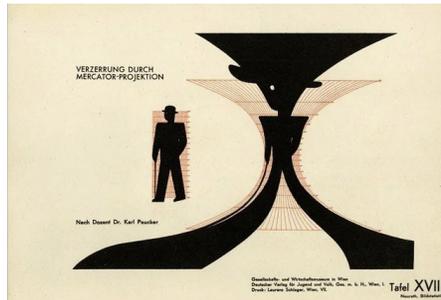
Level of Understanding	None	Partial Literacy	Full FMPL
Ability to Make Decision about Individual Map	?	✓	✓
Trust in Map Making Process	✓	?	✓



# PART ONE

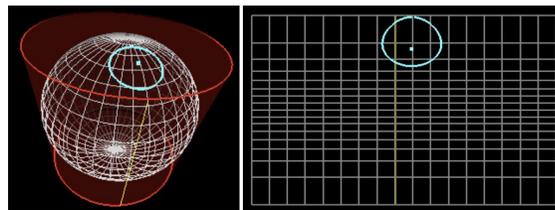
## TRADITIONAL METHODS

### Familiar Shapes



Otto Neurath's use of Familiar Shapes to show the impact of the Mercator Projection outside of map constraints. Taken from [isotyperevisited.org](http://isotyperevisited.org).

### Interactive Displays



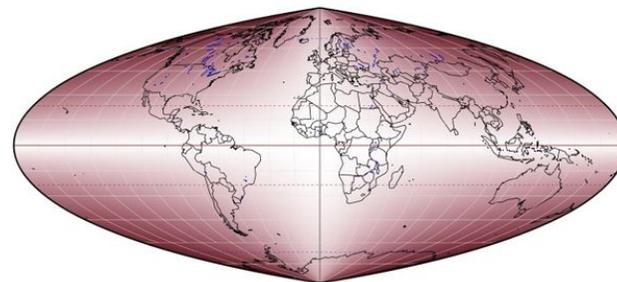
Floating Ring tool showing the Mercator Projection. Taken from Brainerd and Pang (1998).

### Comparison

#### Tissot's Indicatrices

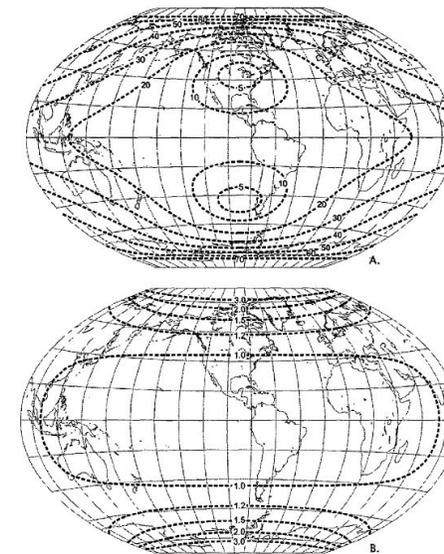
#### Visual Analysis of Map Graticule

#### Color



Color Method where darker colors represent angular distortion. Taken from Cartographic Perspectives.

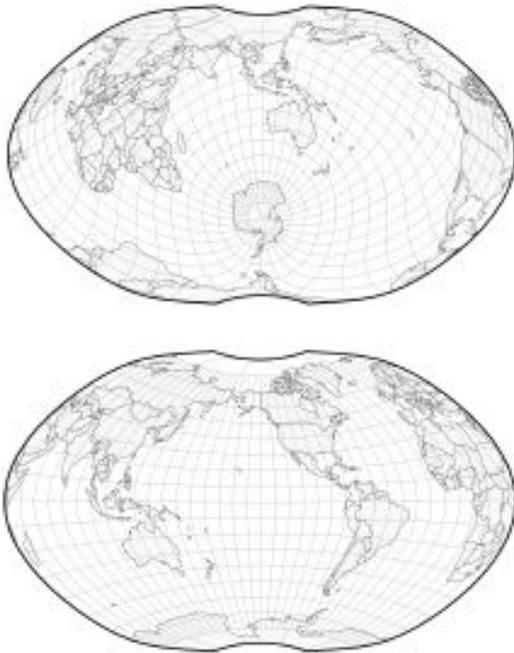
### Isolines



Isolines showing distortion of the Winkel Tripel projection. Taken from Mulcahy and K. C. Clarke (2001).

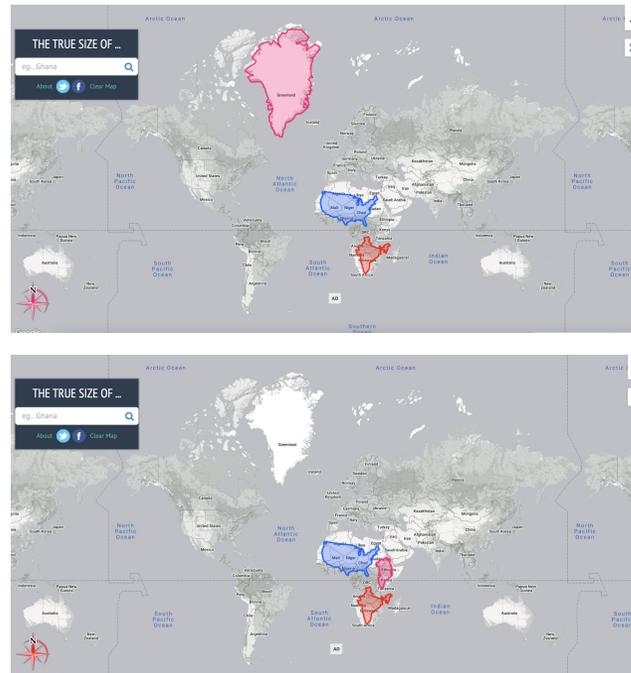


## Consistent Transitions



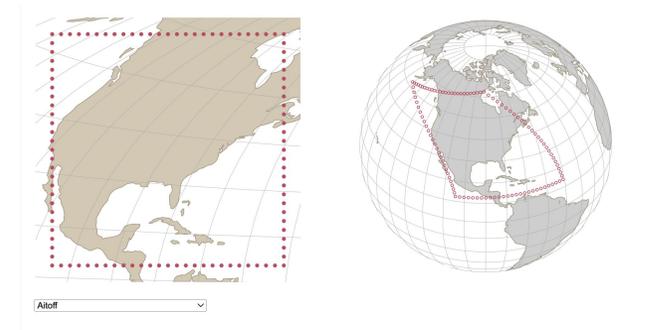
Jason Davies' Map Projection Transitions: Ginzburg IV Centered on Antarctica and Atlantic.

## The True Size Of



Screenshots of The True Size of showing Web Mercator's size distortion. Taken from The True Size Of.

## Bounding Box

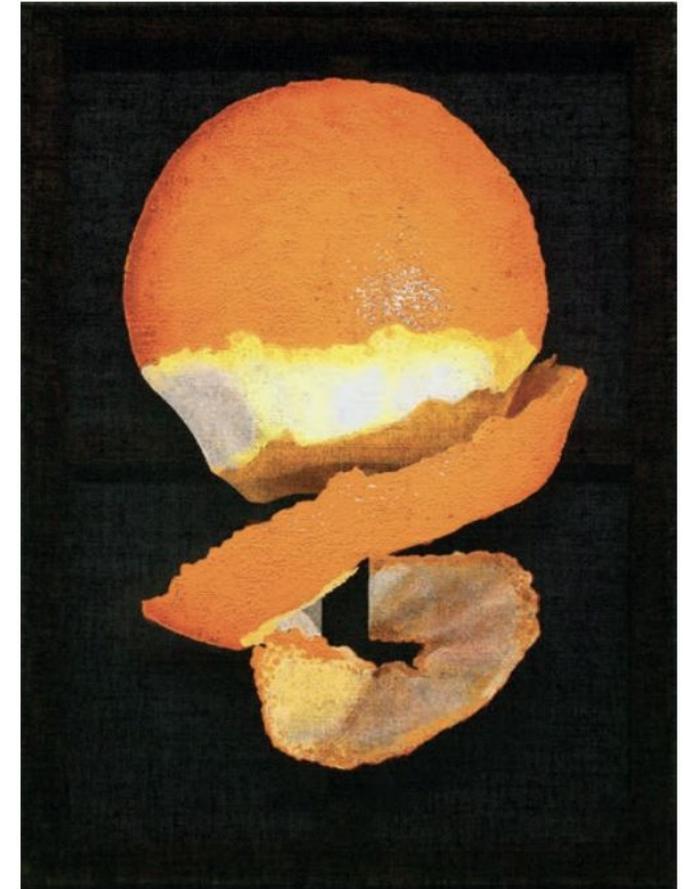


Screenshot of Aitoff Bounding Box Comparison. Taken from Johnson (2021).



PART ONE  
CURRENT STATE

The public at large has “little to no interest in, or ability to, understand/compensate for map projection distortion.” (Battersby, 2021)



Maja Vukoje,  
Orange, 2017  
Acrylic on burlap, 100 x 70cm  
Foto: Roland



PART ONE

# CURRENT LEVELS

*EFFECTIVE TECHNIQUES, BUT LOW LEVELS OF UNDERSTANDING AND INTEREST...*

?



PART ONE

# ALTERNATIVE APPROACHES

*Storytelling has the ability to “make students experience curiosity, mystery and even wonder.”*  
(Kokkotas, Rizaki, and Malamitsa, 2010)



PART ONE

# ALTERNATIVE APPROACHES

*Art can “address significant concepts and prompt viewers to think about them, perhaps for the first time or more deeply than they have before.”*

*(Marshall and Donahue, 2014)*



PART ONE  
ART?

*Now what I have been saying may sound like saying, “a work of art is an object of which someone has said, ‘I christen this object a work of art’.” And I think it is rather like that.*

*—George Dickie*



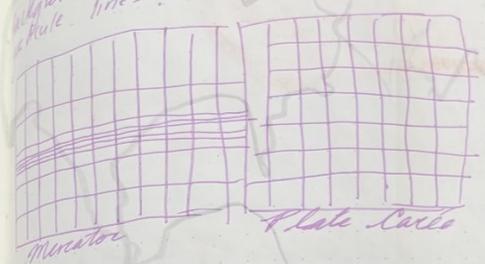
# PART TWO



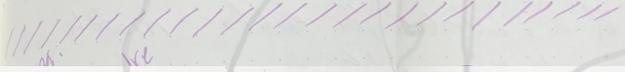
# PROCESS



VWLS. GT  
OK. SMSTFF IST  
cks  
an



Best so far:  
- personalities / horses / playing cards / prisoners.  
- inverse  
- colors.  
- monoline.



Black, White -> Blue  
If it's about undersketching  
much & I need to teach?

OR "JUST INTERESTING"  
TO REVERSE BACK  
AND SEE any image form



BEYOND THE PEAR  
A compendium of calligraphic  
CONTEMPORARIES.

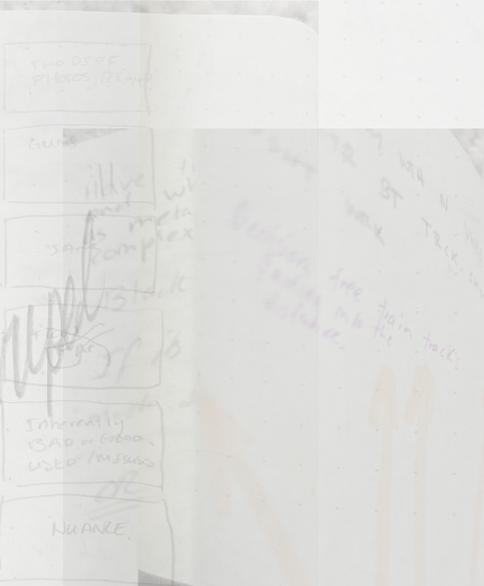


Behind  
Prison Bars  
WANTED  
SIGNS

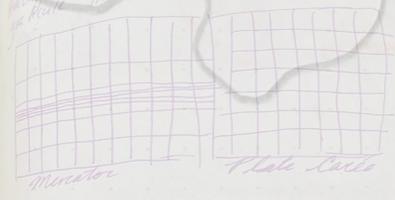
NUANCE  
distinction  
subtle his - NO SUBTLE  
modulation

called the  
meeting for  
talk things  
[with from the perspective  
of the distortions?]

One line  
projection based  
on Wenzel



made up of the different



Best so far:  
- personalities / horses / playing cards / prisoners.  
- inverse  
- colors.  
- monoline.

like an ocean; take the  
projection and slide it through, it's a different  
states  
projection, Projector, SLIDES

drawing on the slides.  
- RANK SYNERGY FOR PROJECTOR  
- drag to realize.  
show how impossible it is to make  
it accurate in all directions,



- shift between  
as you pull from  
one to the next.  
- RANK on  
each scale  
w/ distortion  
measure.



## PART TWO

# CRITERIA

1. Whether the idea presented enough artistic and creative opportunities for experimentation.
2. Whether the idea would be feasible given the limited time frame and my programming capabilities.
3. Whether the idea could incorporate the key takeaways from the literature review, namely to allow for exploration of nuance through the incorporation of thematic data and usage of existing distortion visualization techniques.



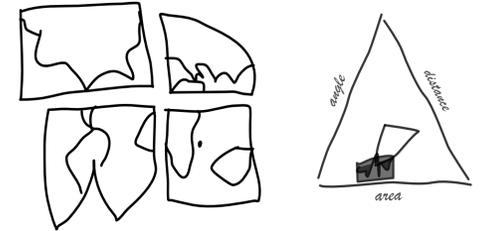
Inspiration in many forms. The Pinakothek der Moderne where an artwork using the Mercator projection stands next to a piece from Joseph Beuys.



PART TWO

# ELIMINATION

	AESTHETICS	FEASIBILITY	LIT. REVIEW
Transitional Developable Surface	✓	-	-
One Liners	✓	-	-
Puzzle Projections	✓	-	-
Triangle Selector	✓	-	-
Wanted Ads: Anthropomorphism	✓	✓	-
Subtractive TI	-	✓	✓



PART TWO

# SELECTION OF THE PROJECTION FLIPBOOK

Attribute	Benefits
Stacked	Stacking the pieces of the maps allows for more than two distortions to be compared at once and helps show the idea that every projection is but one of many possibles.
Controversial Titles	Prompts the reader to question and breakdown the dichotomous good / bad, true/false view .
Integration of Thematic Data	Show the interaction of projection distortion and thematic data symbolization techniques, making projections more relatable and important.



## PART TWO

# THE PROJECTION FLIPBOOK: DATA

### *Predetermined data?*

- Controversial
- Widely interesting
- Global
- Country Level
- Different visualization techniques\*
  
- Abortion & COVID-19 Data

DATASET	SOURCE	DESCRIPTION
<i>Thematic Data</i>		
Reproductive [Abortion] Rights	Center for Reproductive Rights	This dataset contains information on access to abortion. Data is nominative, with rankings from I to V (V being the most comprehensive access). This dataset is used for <i>choropleth</i> mapping. Note that since this data was initially collected (February 23, 2021) many countries have changed their reproductive rights policies.
COVID-19 Case and Deaths Data	World Health Organization	This dataset contained both raw and per 100,000 figures for COVID-19 cases and deaths. This dataset is used for <i>choropleth</i> and <i>dot density</i> mapping. Data last updated August 1, 2022.
<i>Additional</i>		
Country Outlines	Natural Earth, processed by D3	TopoJSON versions of Natural Earth country outlines at 110m, TopoJSONified by D3.
ISO Codes	ISO 3166	The ISO three-digit numeric code (numeric-3) was used to join the natural earth data to the thematic data within the project

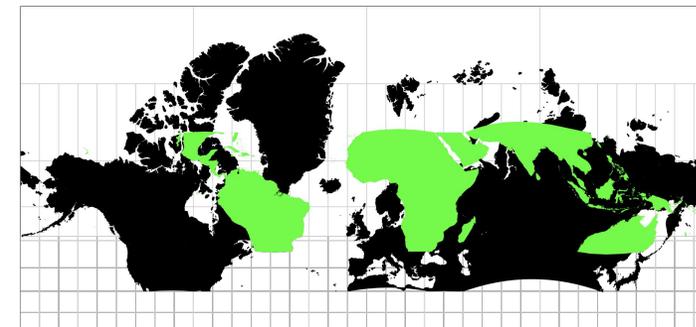
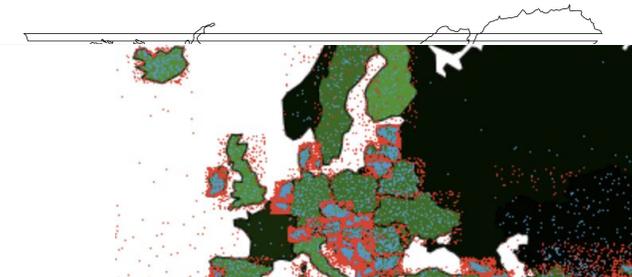
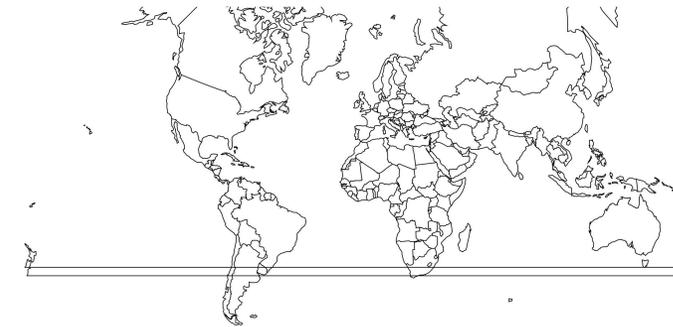
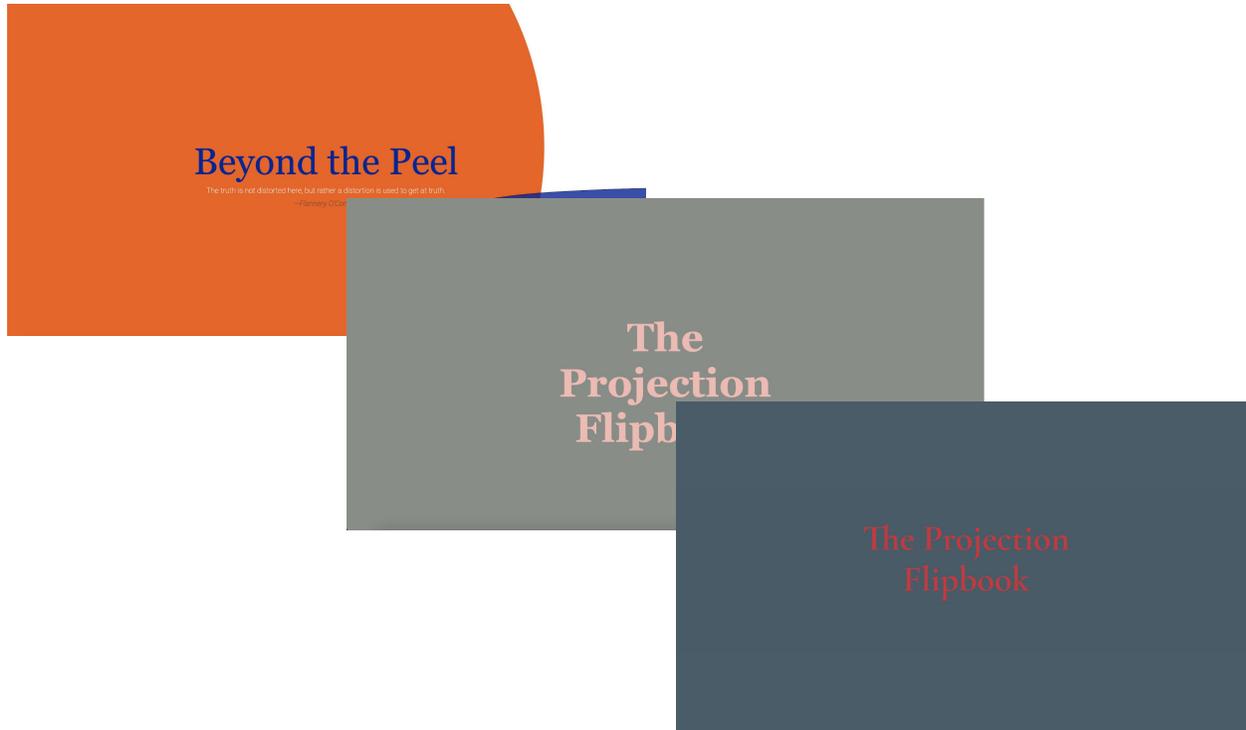
Table 6: Data Sources

*Nothing and I mean nothing, is interesting unless it is PERSONAL.*  
**—Billy Baldwin**



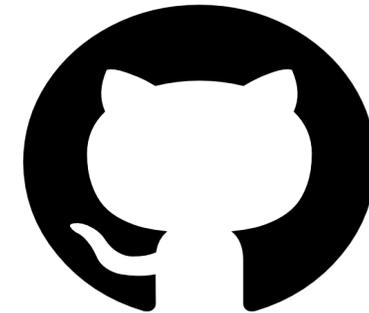
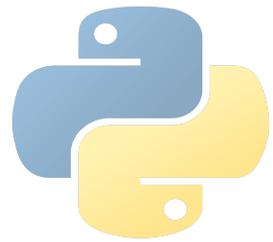
PART TWO

# THE PROJECTION FLIPBOOK: CHALLENGES



# PART TWO

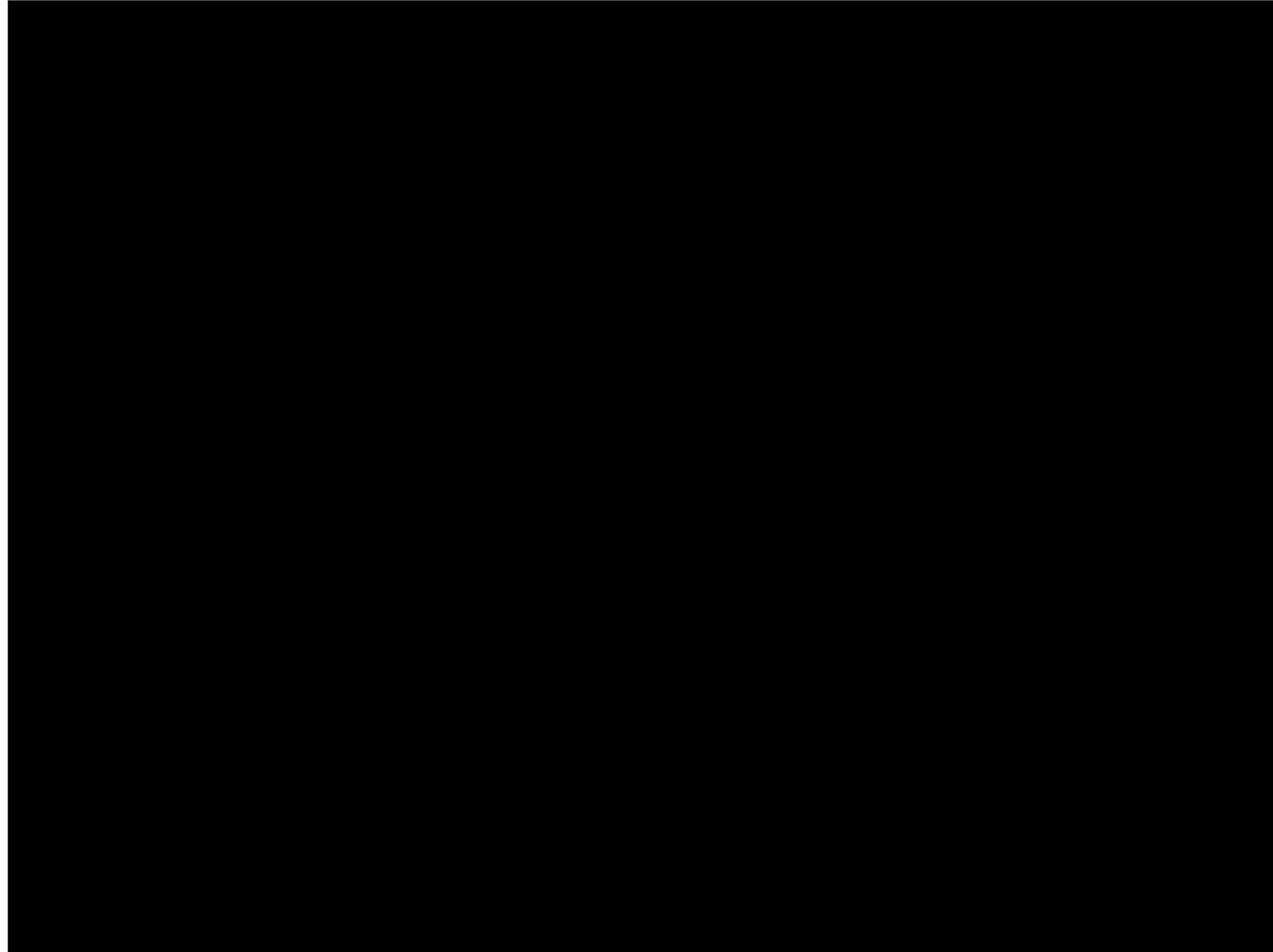
## TECHNICAL IMPLEMENTATION



# THE PROJECTION FLIPBOOK



# THE PROJECTION FLIPBOOK: VIDEO



# RESULTS & DISCUSSION



PART TWO

EVALUATION: BEFORE

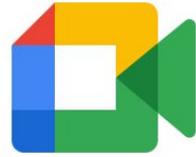
**PRIOR KNOWLEDGE OF MAP PROJECTIONS**

“Um, almost zero. Like I know what a map is I’m not sure if I know what a map projection is.”

“Better than average. And only because of that one episode on the West Wing.”

“I guess to be honest I never really thought about it that much. Obviously the experience I have is probably limited to google maps.”





## PROJECTION KNOWLEDGE

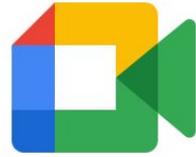
Just as “you can kind of wield statistics like a weapon where you can kind of choose what key facts you want and that might not tell the whole story. And it’s interesting to think about maps in the same way.”

“A lot better. Oddly enough I found the COVID one very interesting because I’ve been looking at COVID maps a lot and the fact that depending on how big the country is displayed on the map changes the density of the dots is very apropos because it totally changes the information that you’re getting from the map and I hadn’t realized that.”

“Every maps lies. Or not lies, but has to use some form of distortion because there is no perfect form of map projection.”

It shows how the map “maybe wasn’t a great picture. Or could have been. Or could not have been.”





“...just because it isn’t 100 percent the mirror image copy of something doesn’t make it inherently a bad representation of it. I think it’s asking viewers to reexamine the current claims of ‘we’re presenting something in this way but it doesn’t actually mean it’s an accurate presentation.’ I think it makes people recognize there isn’t ... just because we’re reexamining things doesn’t mean the old one is inherently attempting to present things in a disingenuous manner.”



## PART TWO

# DISCUSSION

### TAKEAWAYS

- Better knowledge
- Enjoyed the animation aspect
- Liked the quotes / unveiling of information:

“It’s a story where you don’t really get what’s going on until the very end.”

### CRITIQUES

- Colors
- Integration of explanation
- Simpler / lower baseline
- Scrollytelling implementation
- More clues—scale, legend, etc.

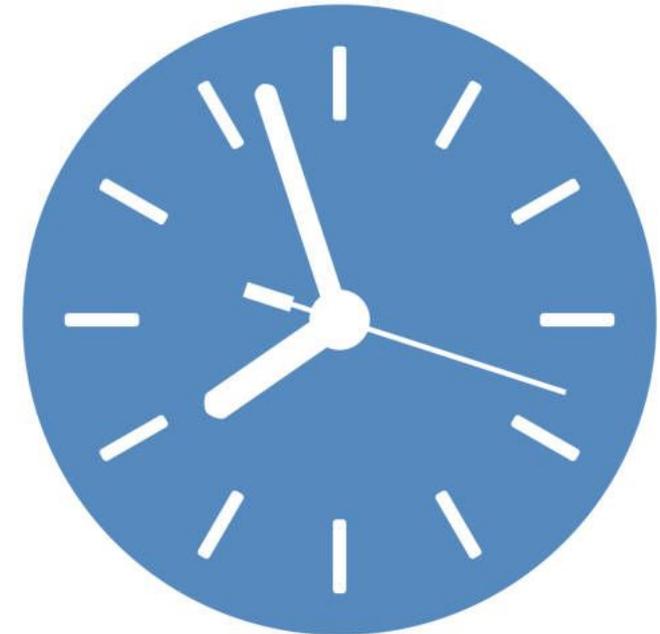


## PART TWO

## LIMITATIONS

- Time & Technical Inexperience with D3
- Combinations of Projections / Projection Types
- Visibility of Thematic Data vs Computing Requirements
- Limited Evaluation

... more work to be done!



# CONCLUSION





UNIVERSITY OF TWENTE.



TECHNISCHE  
UNIVERSITÄT  
DRESDEN

# QUESTIONS?

Thank you!

Technical  
University  
of Munich



TECHNISCHE  
UNIVERSITÄT  
WIEN  
Vienna University of Technology

# REFERENCES

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