BEST PRACTICES FOR MAP DESIGN

INTRODUCTION

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BEST PRACTICES FOR MAP DESIGN: INTRODUCTION

What makes maps effective
Cartography and design principles
Evaluating maps constructively
WHY ARE MAPS A BIG DEAL?

• Maps generate reactions!
• Esthetics or something else?
• The importance of expertise
  - Cartography
  - Graphic design
  - Subject matter
  - Institutional knowledge
  - Audience expectations
  - Technology
  - Other?
• Conceived before you are done with your “GIS work”
WHAT IS A MAP?

- A means of communications
- Everything! should support this communication
- Simple is better

A map to Grandma’s house
Zander Leff, age 4
TRADITIONAL VS. WEB MAPS

• Traditional Maps
  – Printed map or atlas
  – Static Perspective
  – Limited audience

• Web Maps
  – Digital media
  – Dynamic perspective
  – Wide audience
  – Interactive/smart components
WHAT MAKES MAPS EFFECTIVE?

- Is there data/content to support the established purpose and message?
- Who is the target audience?
- What is the map purpose and message?
- Is the necessary contextual data available?
- What are the overarching design considerations?
MESSAGE / PURPOSE

AUDIENCE

• User and use case, not data
• One map per user-use case

As the …[role category] when I look at the map, I need to …[action <> see].
MESSAGE / PURPOSE

AUDIENCE

- User and use case, not data
- One map per user-use case

As the ...[role category] when I look at the map, I need to ...[action <> see].
INFOGRAPHIC, NARRATIVE OR DATA VISUALIZATION?
WHEN IS A MAP MEETING AUDIENCE NEEDS?

- When you cannot ask “why” anymore
- When there is no “and” in the map purpose definition
- When you hear “need”, not “want” in the map message
INFOGRAPHIC / SIMPLE MAPS ARE FOR...

One variable/message maps

- Management/executive audience
- Fast and easy decision making
- Actionable information
- 2 second engagement
- Not always a map
- 1-2 colors
INFOGRAPHIC / SIMPLE MAPS ARE FOR...

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NARRATIVES ARE FOR…
Targeted message maps

- Public audience
- Engage and excite
- 6 second engagement
- Standard mapping conventions (up to 6 colors)
- Strong visual hierarchy and grammar
NARRATIVES ARE FOR...
Targeted message maps

- Public audience
- Engage and excite
- 6 second engagement
- Standard mapping conventions (up to 6 colors)
- Strong visual hierarchy and grammar
- Motifs/redundancy is important
NARRATIVES ARE FOR...
Targeted message maps

- Public audience
- Engage and excite
- 6 second engagement
- Standard mapping conventions (up to 6 colors)
- Strong visual hierarchy and grammar
- Humor/whimsical/picturesque quality
NARRATIVES ARE FOR…
Targeted message maps

• Public audience
• Engage and excite
• 6 second engagement
• Standard mapping conventions (up to 6 colors)
• Strong visual hierarchy and grammar
• Story telling
DATA VISUALIZATIONS ARE FOR...
Complex data explorations with GIS-like capabilities

- Staff or expert audience
- Big data visualization
- Knowledge sharing
- Multiple and complex ideas
- Minutes engagement
- Custom mapping conventions
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MAP CONCEPT

Drivers
- Audience
- Purpose/message
- Design considerations

Limiting factors
- Got data?
- Got context?
- Wants!
- Performance
BASEMAPS

- Light
- Dark
- Grayscale
- Topo
- Physical
- Community Base
- Street/Reference
- Imagery
- Ocean
- Stamen
WHY CUSTOM BASEMAPS?

- Different projections and custom tiling schemes
- More appropriate regional/cultural context
- Richer detail
- Branding/identity
WHO MADE THIS MAP?
WHO MADE THIS MAP?
WHO MADE THIS MAP?
WHAT MAKES MAPS RECOGNIZABLE & EASY TO READ?

- **Recognizable**
  - Purposeful colors
  - Custom meaningful symbology
  - Font use
  - Standards/conventions driven

- **Easy to read**
  - Effective
  - Engaging or actionable
  - Recognizable
  - Good design
BEST PRACTICES FOR MAP DESIGN: INTRODUCTION

What makes maps effective

Cartography and design principles
HOW DO I CREATE GOOD DESIGN?

• Simple and clear (effective and easy to read)
• Purposeful (design and cartography principles)
• Appealing (esthetics)
Continuous/Sequential
Symbology blurs boundaries, use for hotspot effect

Discrete/Qualitative
Symbology emphasizes boundaries, use for classifying data
VISUALIZING IN ONE OR MORE COLORS

Monochromatic/Sequential
Single color/hue, sequential values (can be continuous or discrete)

Diverging
Spans 2 or more colors, implies average, above and below average (can be continuous or discrete)
VISUALIZING TWO OR MORE VARIABLES

Using color alone
(red and blue work well)

Using color and symbology
SURFACE / POLYGON MAPPING

**Choropleth mapping**

2012 US Presidential Election

*Democrats vs Republicans*

Difference in Votes By County

**Cartogram**

Land Area is Resized Based on Population

*Also Proportionate Symbols*
MEASUREMENTS VS. INTERPOLATION

Measurements

Interpolation
HEAT MAP VS. HOTSPOT MAP

Heat map

Hotspot map
STATISTICS FOR CARTOGRAPHERS

Natural breaks

Equal interval

Quantile
CLASSIFICATION SCHEMES

Natural breaks
Equal interval
Quantile *

* Start here unless you know otherwise
SCALE DEPENDENCY

Map de-compilation through feature simplification or query selection
Need for the map element, graphical balance
Design your maps as if they won’t have any map elements
INTERACTIVE ELEMENTS

Minimal and targeted

- Popups
- Widgets
- Application functionality
VISUAL HIERARCHY AND WEIGHT

Is the user’s eye drawn to the desired location?

Downtown Discovery - A Banff Heritage Walking Tour

A 2 km, 45 minute loop, with a focus on Banff’s early commercial and institutional buildings. This route crosses the Bow River and provides excellent views of Cascade Mountain down Banff Avenue.

Walking through Banff’s history

Many of the buildings on the tour are private residences and may only be viewed from the sidewalk or street. Their owners thank you for your respect.
VISUAL CONTRAST

What is the relationship between foreground and background?
VISUAL HIERARCHY & COMMUNICATION

Use visual hierarchy and weight to
Prioritize content and visualize map element relationships to
Create meaning for the map users/audience
INTENDED VS. PERCEIVED HIERARCHY

- Author intended
  - Read
  - Understand
  - Learn
  - See
- Reader looks for
  - Interesting
  - Familiar
  - Actionable
GRAPHIC / VISUAL VARIABLES

Color

Value

Shape

Size

Orientation

Texture

Position
BERTIN’S VISUAL VARIABLES

Position  changes in the x, y loc

Size  change in length, area, repetition

Shape  changes in shape

Value  change from light to dark

Color  changes in hue

Orientation  changes in alignment

Texture  variation in “grain”
BERTIN’S VISUAL VARIABLES

- Use for 2-3 types of features
- Use for 4-5 types of features
- Use for 6 types of features
- Use for 7-8 types of features
- Use for 9-12 types of features
COLOR AND IMPLIED MEANING

Is the use of color consistent with the map message?
COLOR BLINDNESS

Deuteranopia
DESIGNING FOR COLOR-IMPAIRED AUDIENCE

Avoid color alone
- Pure green: Avoid
- Pure red: Avoid

Shape & Color
- Blue-green, blue: Use
- Orange, gold: Use

Size & Color
- Light/dark green: Use
- Dark/light red: Use

Label attributes
- 1
- 2
- 5
SPECIFYING COLOR: HSV

Saturation

Value

Hue
SPECIFYING COLOR: HSV

Hue

0 194 360

Saturation

0 16 46 100

Value

0 75 100

194 H 16 S 99 V

194 H 46 S 75 V
SPECIFYING COLOR: HSV

- Hue: 0 - 360
- Saturation: 0 - 100
- Value: 0 - 100

CARTOGRAPHIC STANDARDS

• Consistency
• Effectiveness
• Efficiency
• Trade craft
WEB CONTENT ACCESSIBILITY GUIDELINES 2.0

• Perceivable
  - Provide **text alternatives** for non-text content.
  - Provide **captions and other alternatives** for multimedia.
  - Create content that can be **presented in different ways**, including by assistive technologies, without losing meaning.
  - Make it easier for users to **see and hear content**.

• Operable

• Understandable

• Robust
SYMBOLOGRAPHY STANDARDS & GUIDES

Homeland Security Working Group

Symbology Reference

Standard

Custom
MAP DESIGN ELEMENT: LABELING
Do the labels help the reader?
TYPE BASICS FOR CARTOGRAPHY

Map

- Book Antigua
- Cambria
- **Copperplate**
- Georgia
- Times New Roman

Map

- Arial
- Candara
- Tahoma
- Verdana
TYPE BASICS FOR CARTOGRAPHY
BEST PRACTICES FOR MAP DESIGN: INTRODUCTION

Effective maps
Cartography and design
Evaluate map?
WHY QAQC YOUR MAP SERVICE?

• Map purpose is clear, relevant and unique
• Map is for a specific audience who’s needs are known
• Information makes sense and is easily understood
• TOC, popups and metadata work as expected
• Data is appropriate, enriched, current, and properly compiled
• Color and symbology are appropriate and appealing
• Scale dependency is logical
• Map performance is good
MAP EVALUATION METHODS

• Peer review
• Checklist
  - The Intelligent Map Checklist
  - Map Evaluation Guidelines
  - Custom Checklist
MAP CONCEPT

- Is the map purpose clear?
- Is the audience defined?
- Does the information make sense and is it easily understood?
MAP CONTENT

- Is the subject matter relevant, current and enriched?
- Is the appropriate context provided?
CARTOGRAPHY

- Is the cartography simple, appealing and appropriate?
- Is a visual hierarchy present?
CARTOGRAPHY

- Limit rich, solid colors
- Gray/neutral instead of white
- Use 6 or fewer colors
- Avoid using red and green
- Use standards where those apply and consider the implied meaning of colors
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OVERVIEW

Hawaii received $7.6 billion in Defense spending in Fiscal Year (FY) 2014, which provides direct funding for DOD personnel salaries, defense contracts, and construction of military facilities in the state. This spending by DOD personnel, contractors, and their families creates significant economic activity, attracts related industries and investment, and generates important state and local government tax revenues.

The Readiness and Environmental Protection Integration (REPI) Program is a key tool used by DOD and its partners to protect the military’s ability to train, test, and operate in the state. REPI created the REPI Program in response to the development of lands and loss of habitat in the vicinity of or affecting its installations, ranges, and airspace that can lead to restrictions or costly and inadequate training and testing alternatives. Through REPI, DOD works with state and local governments, conservation organizations, and willing private landowners to address these challenges to the military mission and the viability of DOD installations and ranges. The REPI Program has enjoyed broad bipartisan support both in the U.S. Congress and among groups representing state and local officials. As of FY 2014, DOD and its partners have spent over $60 million on REPI projects at 2 installations in Hawaii.

MILITARY PRESENCE

- The Hawaii Chamber of Commerce reported that military-related activities directly or indirectly generated over 103,000 jobs and $14.7 billion in economic impact in 2012.
- U.S. Army Garrison – Hawaii (USAG-H) is responsible for the day-to-day operations and services offered at 22 Army installations and sub-installations on the islands of Oahu and Hawaii, and includes a workforce comprised of more than 800 civilian employees.
- Hawaii is the only location in the world hosting the headquarters for the largest U.S. combatant command (U.S. Pacific Command), the Pacific command commander for the U.S. Army, Air Force, Marine Corps, and Coast Guard, and combat ready land, sea, and air forces.
- Hawaii’s population includes more than 116,800 veterans, of which nearly 17,000 are military retirees; this represents 1.7% of Hawaii’s population.
- The Pearl Harbor Naval Shipyard is Hawaii’s largest industrial plant, employing more than 4,600 engineers and skilled technicians to service naval surface ships and submarines based in Hawaii, and responding to emergency repair calls throughout the Pacific.
- The Pacific Missile Range Facility on Kauai is the world’s largest multi-dimensional testing and launching range, and it is the only range in the world where submarines, surface ships, aircraft, and space vehicles can train and be tracked simultaneously.

REPI BUFFER PARTNERSHIPS * IN HAWAII

<table>
<thead>
<tr>
<th>REPI Project</th>
<th>County</th>
<th>Congressional District</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint Base Pearl Harbor - Hickam/Waimanalo</td>
<td>Honolulu</td>
<td>2nd</td>
</tr>
<tr>
<td>U.S. Army Garrison Hawaii</td>
<td>Honolulu</td>
<td>2nd</td>
</tr>
</tbody>
</table>

For all REPI Project Fact Sheets visit: http://www.repi-mil bufferterrains/ProjectList.aspx

For more information about the REPI Program, visit www.repi-mil?
Solar Resource at Contiguous U.S. Navy Shore Bases
Annual Average Solar Photovoltaic (PV) Resource Potential

Solar Resource (kWh/m²/Day)
CNIC Ranking for Solar Resource

Excellent
Very Good
Good
Moderate
Satisfactory

Deuteranopia
Solar Resource at Contiguous U.S. Navy Shore Bases
Annual Average Solar Photovoltaic (PV) Resource Potential

Solar Resource (kWh/m²/Day)

- 6.3
- 5.5
- 4.8
- 4.2

CNIC Ranking for Solar Resource

- Excellent
- Very Good
- Good
- Moderate
- Satisfactory

SUMMARY

- Single and clear message/purpose
- For a specific audience/use case
- Infographics, narratives and data visualizations
- Content simplified but enriched
- Appropriate context

- Effective maps
- Cartography and design
- Evaluating maps

- Simple, effective and attractive
- Proper visual hierarchy and contract
- Leverage standards, guides and Bertin’s visual variables

- Map is effective and follows cartography and design principles
- All map components work as expected and map services perform
CARTOGRAPHY SESSIONS OF INTEREST

Best Practices for Map Design: Advanced
Wednesday, 3:00 pm – 4:00 pm, 143C
Thursday, 11:00 am – noon, 149AB

Mapping for the Non-GIS Staff in Your Agency
Wednesday, 4:15 pm – 5:15 pm, 147B
Thursday, 5:15 pm – 6:15 pm, 151A

Smart Mapping - Make Brilliant Maps Quickly & With Confidence
Wednesday, 4:15 pm – 5:15 pm, 152B
Thursday, 1:30 pm – 2:30 pm, 152B

Great Story Maps and How to Emulate Them
Wednesday, 4:15 pm – 5:15 pm, 152A
Thursday, 5:15 pm – 6:15 pm, 152B
PLEASE TAKE OUR SURVEY!

Download the Esri Events app and find your event

Select the session you attended

Scroll down to find the survey

Complete Answers and Select “Submit”
Print your customized Certificate of Attendance
Print stations located in the 140/150 Concourse
Networking Reception

Smithsonian National Museum of the American Indian

Thursday, 6:30 p.m. – 9:30 p.m.
Bus pickup on L Street
GIS Solutions Expo, Hall A

Wednesday, 12:30 p.m. – 6:30 p.m.
Welcome Social, 5:15 p.m. – 6:30 p.m.
Thursday, 10:45 a.m. – 4:00 p.m.

• Exhibitors
• Hands-on Learning Lab
• Demo Theaters
• Esri Showcase
QUESTIONS?

Resources

• Esri Mapping Center Cartographer’s Favorites
• ArcGIS Resources Favorite Tools and Resources for Cartographers
• Sites: Cartonerd Blog and Coolmaps
• Books: How to lie with maps and Tufte

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