INST 760 – Data Visualization

Visual Data Science

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MOTIVATING QUESTIONS:

How do I go from nothing to my hypothesis?

Designing interactive visualizations for exploratory analysis

OUTLINE

- Defining data science
  - Extract, transform, load (ETL)
- Exploratory analysis and modeling
  - NLP – Natural Language Processing
- Streaming visualization

What is a "data scientist?"

"Data Scientist (n.): Person who is better at statistics than any software engineer and better at software engineering than any statistician." - Josh Wills

- Something of a marketing term, but careers and formal data science programs have sprung up around the concept

Data science competencies

Anderson et al. (2014):

- **Information retrieval**
- **Large or streaming data sets**
- **Databases**
- AI and statistical techniques
- Software development and algorithms
- Mathematics
- Communication
- Social, ethical, and legal awareness

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Data science workflow

1. **Scope out the problem or question**
2. **Knowledge search: Research and sensemaking**
3. Data retrieval; extract, transform, load (ETL)
4. Exploratory analysis
5. Modeling

- System-building [sometimes]
- Versioning/archival
- Communication

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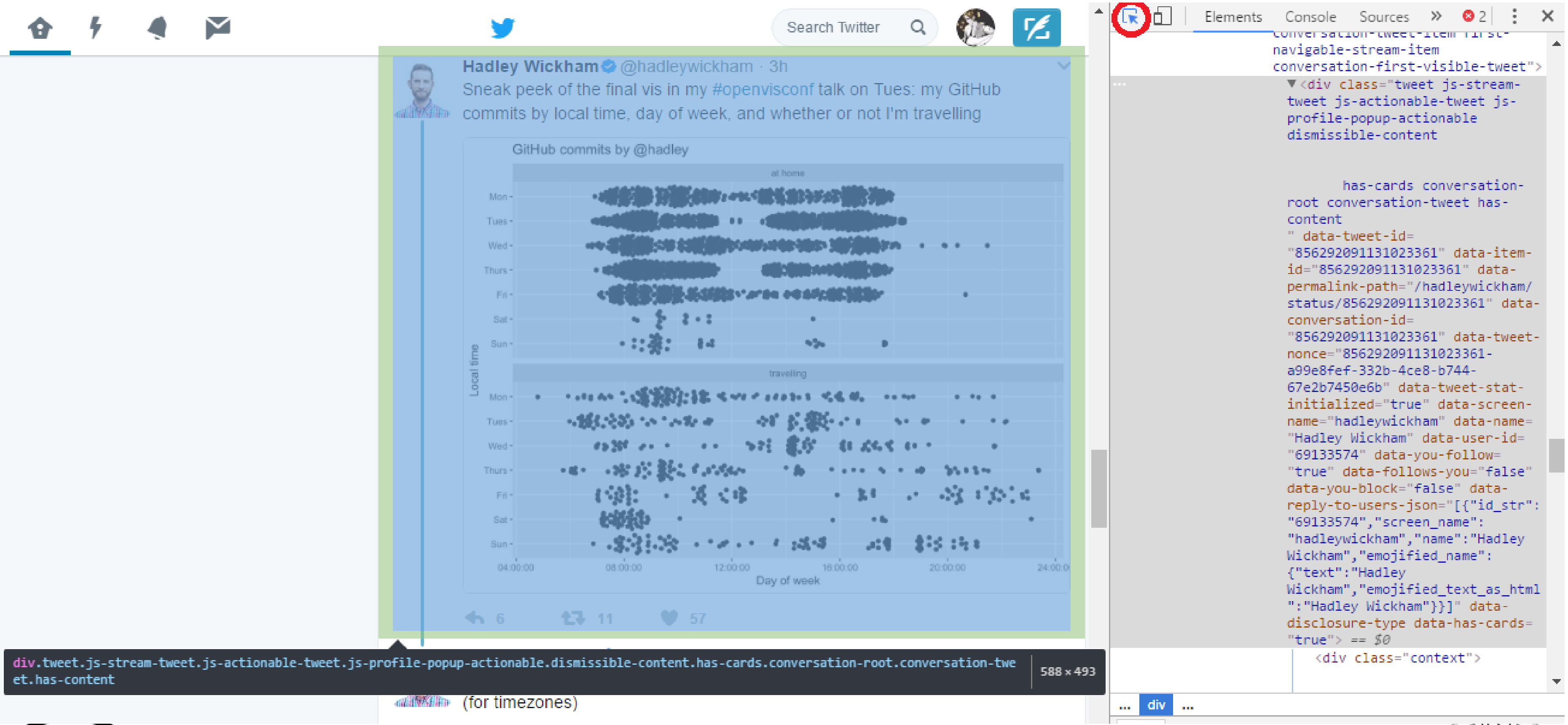
Extract: Information retrieval

- Information systems: Get data from a database

- Information studies: "Everything is data"
  - Tables
  - Text
  - Images
  - Media files (video, audio)
  - Interviews?
  - Artifacts??
- Other examples?

Extract: "Webscraping"



Hadley Wickham @hadleywickham · 3h

Sneak peek of the final vis in my #openvisconf talk on Tues: my GitHub commits by local time, day of week, and whether or not I'm travelling

(for timezones)

```
div.tweet.js-stream-tweet.js-actionable-tweet.js-profile-popup-actionable.dismissible-content.has-cards.conversation-root.conversation-tweet.has-content
```

588 × 493

```
conversation-tweet-item first-
navigable-stream-item
conversation-first-visible-tweet">
▼<div class="tweet js-stream-
tweet js-actionable-tweet js-
profile-popup-actionable
dismissible-content


         has-cards conversation-
root conversation-tweet has-
content
" data-tweet-id=
"856292091131023361" data-item-
id="856292091131023361" data-
permalink-path="/hadleywickham/
status/856292091131023361" data-
conversation-id=
"856292091131023361" data-tweet-
nonce="856292091131023361-
a99e8fef-332b-4ce8-b744-
67e2b7450e6b" data-tweet-stat-
initialized="true" data-screen-
name="hadleywickham" data-name=
"Hadley Wickham" data-user-id=
"69133574" data-you-follow=
"true" data-follows-you="false"
data-you-block="false" data-
reply-to-users-json="[{"id_str":
"69133574","screen_name":
"hadleywickham","name":"Hadley
Wickham","emojified_name":
{"text":"Hadley
Wickham","emojified_text_as_html
":"Hadley Wickham"}}]" data-
disclosure-type data-has-cards=
"true"> == $0
   <div class="context">
```

Windows: F12, Ctrl + Shift + I

Mac: Cmd + Opt + I

Transform [Info Systems]

Reshaping and restructuring data for the target database

- Clean
- Filter
- Apply models
- Business rules
- Aggregate
- Et cetera

Transform [Mathematics]

- Geometry:
  - Reflect
  - Rotate
  - Scale (resize)
  - Translate (shift position)

- Generally:
  - An invertible function mapping one domain to another

Transform [Comp & Data Sci]

Why not both?

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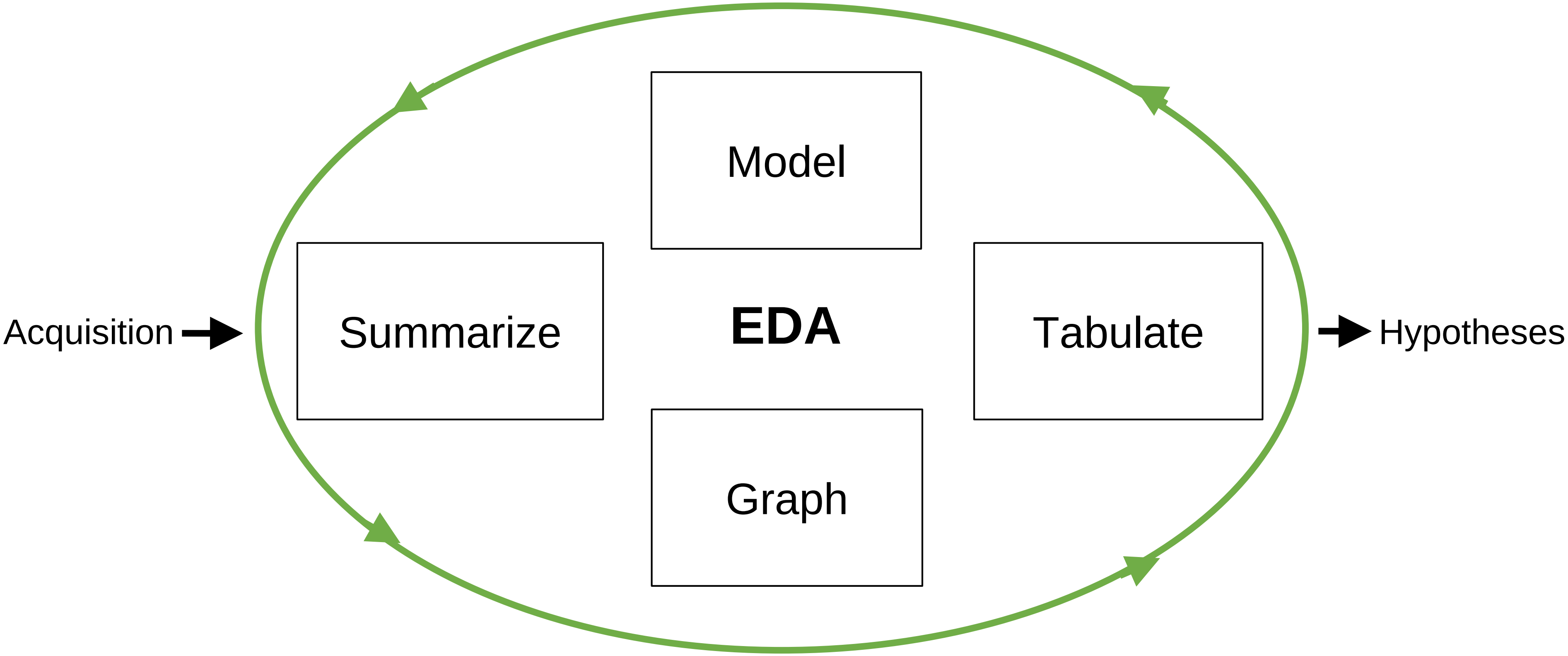
Exploratory Data Analysis (EDA)



Based on Tukey, J.W. *The Future of Data Analysis*. 1962.
and Exploratory data analysis. 1977.

[demonstration]

In-Class Exercise 1

1. git clone/DL github repo: …/DreaJulca/streamvis-lecture
2. Run Bind.R
3. (On paper) design and sketch a better (but also transitioning) visualization

Load (Stage/Publish) & Archive

- We've "loaded" the data from our chosen website into the *R* environment
  - Not a reliable way to warehouse. Why? *Low permanence*
  - Also not a great publication / communication platform
- In a more complete information or business system, we would:
  - Perform further transformations
  - Load into database with well-defined schema (*higher permanence*)
  - We're skipping that today

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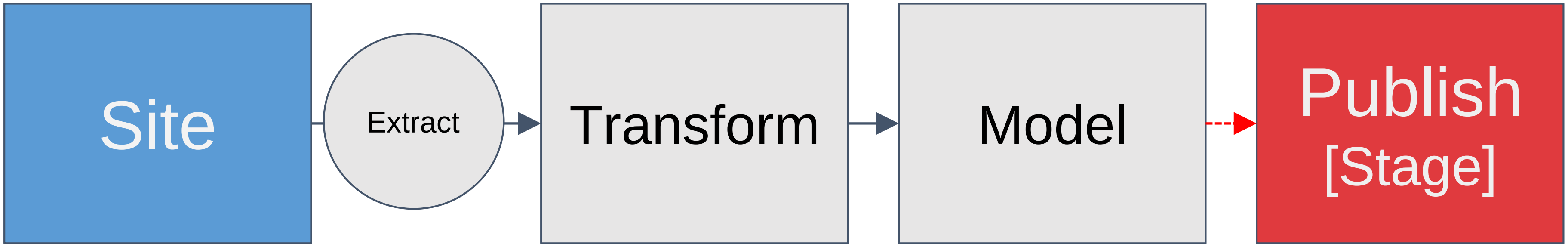
Streaming Visualization

What is "streaming?"

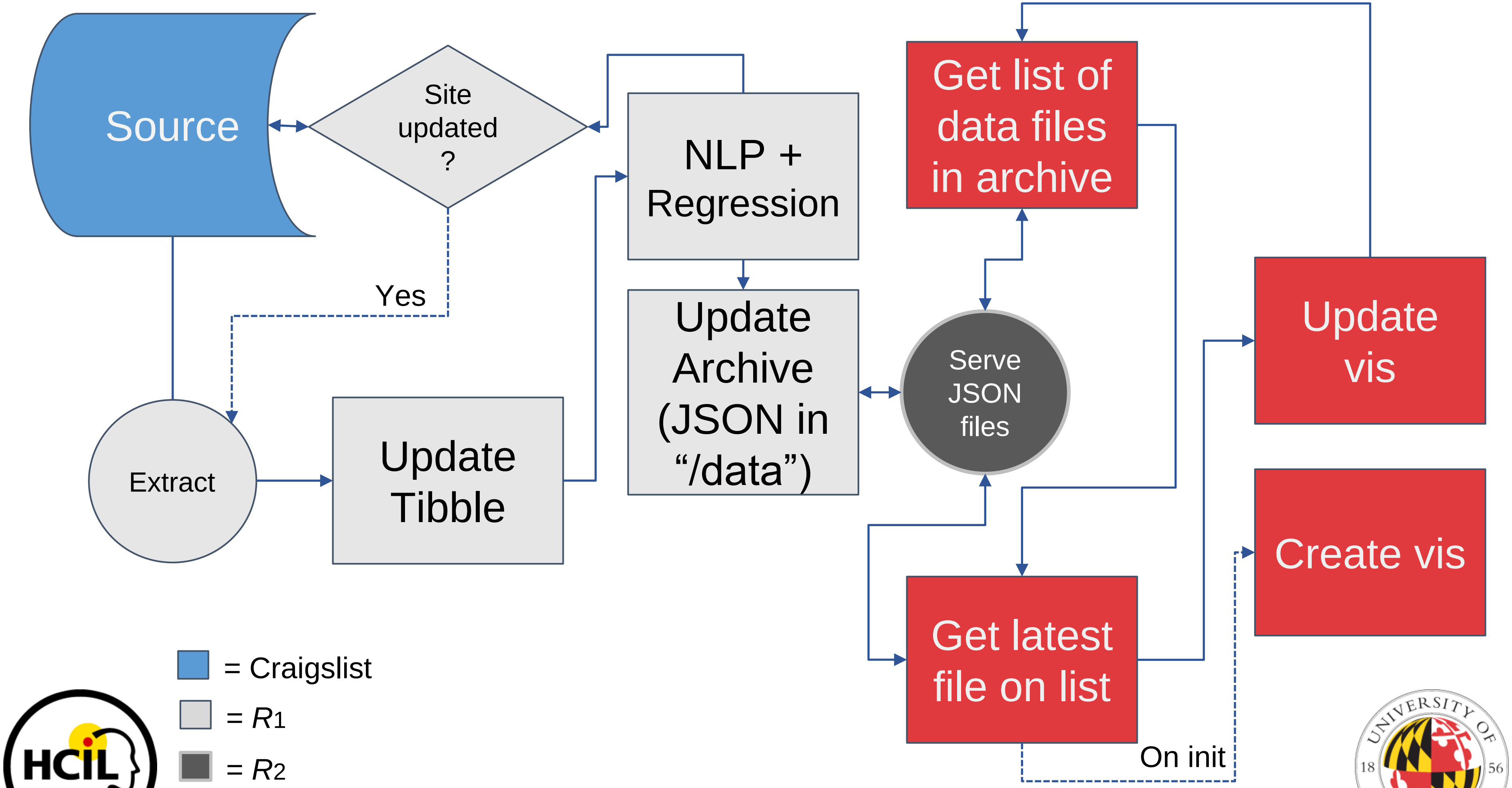
- Transfer of continuously-generated data in real time
- "Real-time" somewhat subjective, contextual

"Streaming visualization," then, is any vis that is continuously updated based on newly-generated, high frequency data

Our process so far & next step



Our finished network of continuous processes



Source

Site updated ?

Yes

Extract

Update Tibble

NLP + Regression

Update Archive (JSON in “/data”)

Serve JSON files

Get list of data files in archive

Get latest file on list

On init

Update vis

Create vis

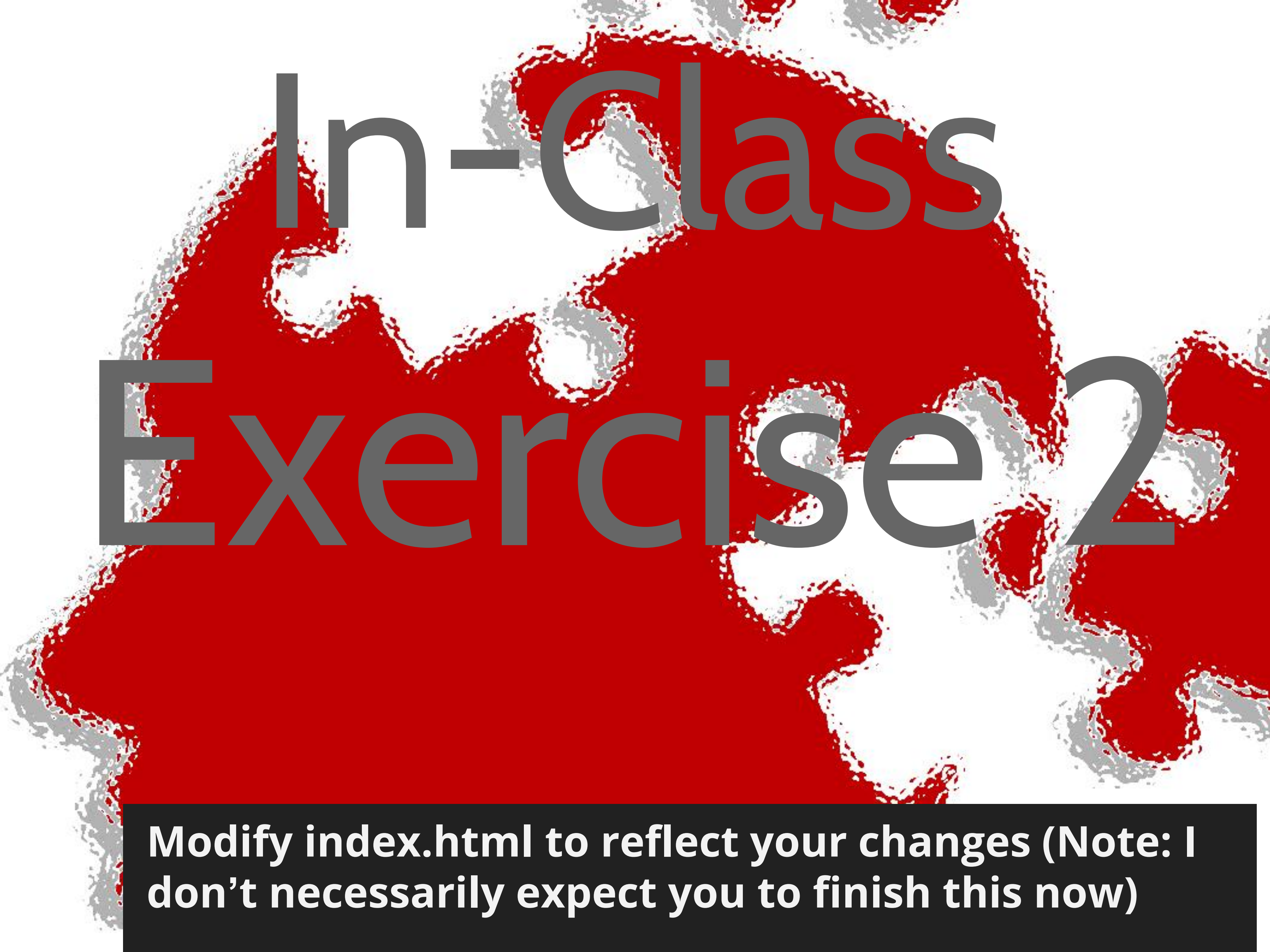
🟦 = Craigslist

⬜ = *R*1

⬛ = *R*2

🟥 = D3 JS/CSS/HTML Vis

In-Class Exercise 2



Modify index.html to reflect your changes (Note: I don’t necessarily expect you to finish this now)

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CLOSING REMARKS

QUESTIONS?