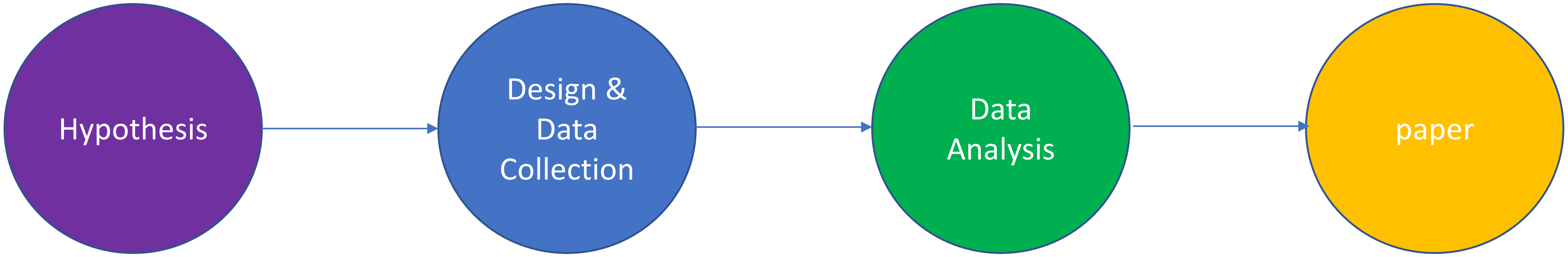
Workflows & Tackling Problems

5 October 2017

N.G. Swenson

BIOL709B

What is it? Is this a workflow?



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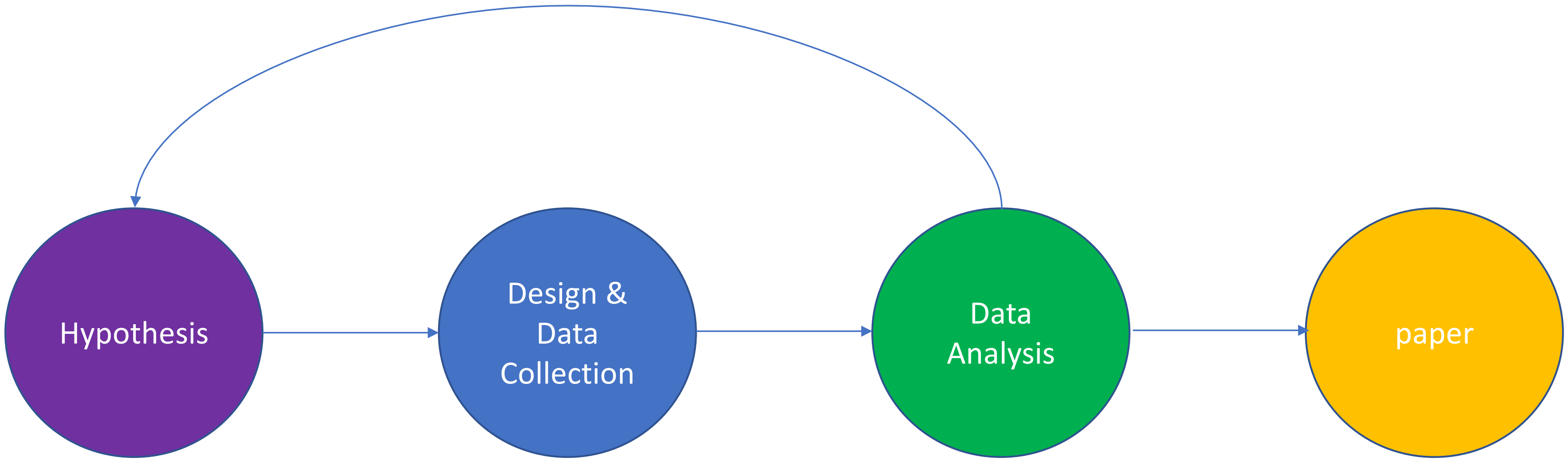
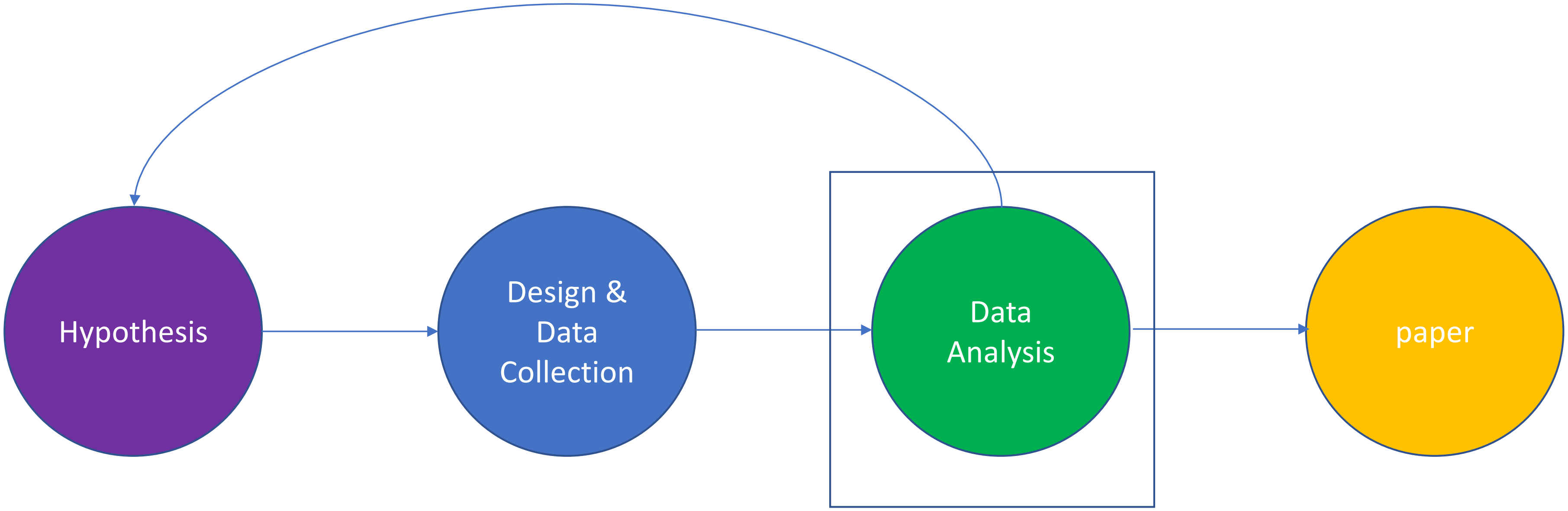


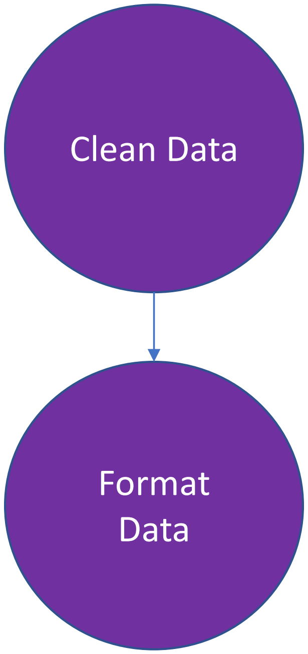
A lot goes into each of these steps



Data analysis workflow?

Clean Data

Data analysis workflow?



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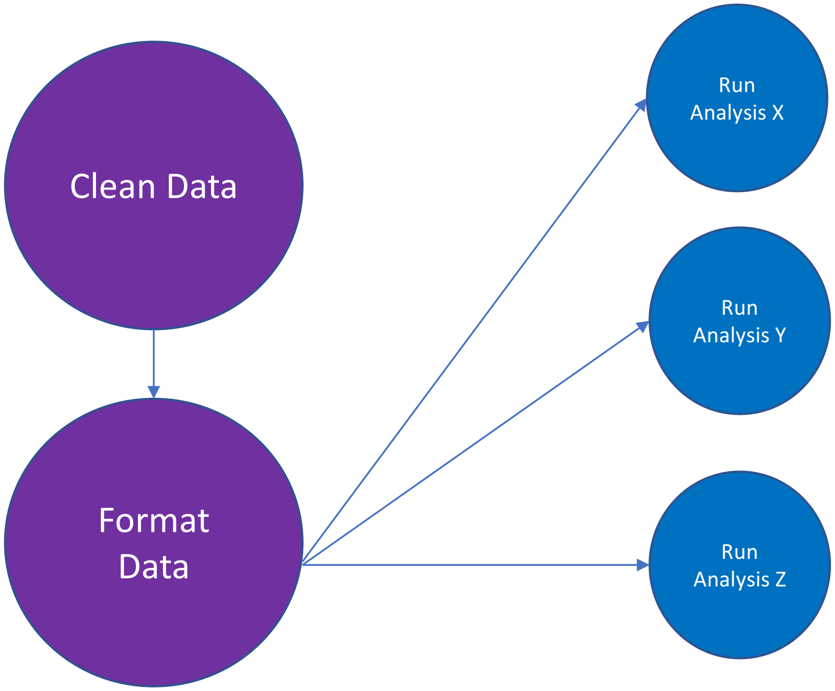

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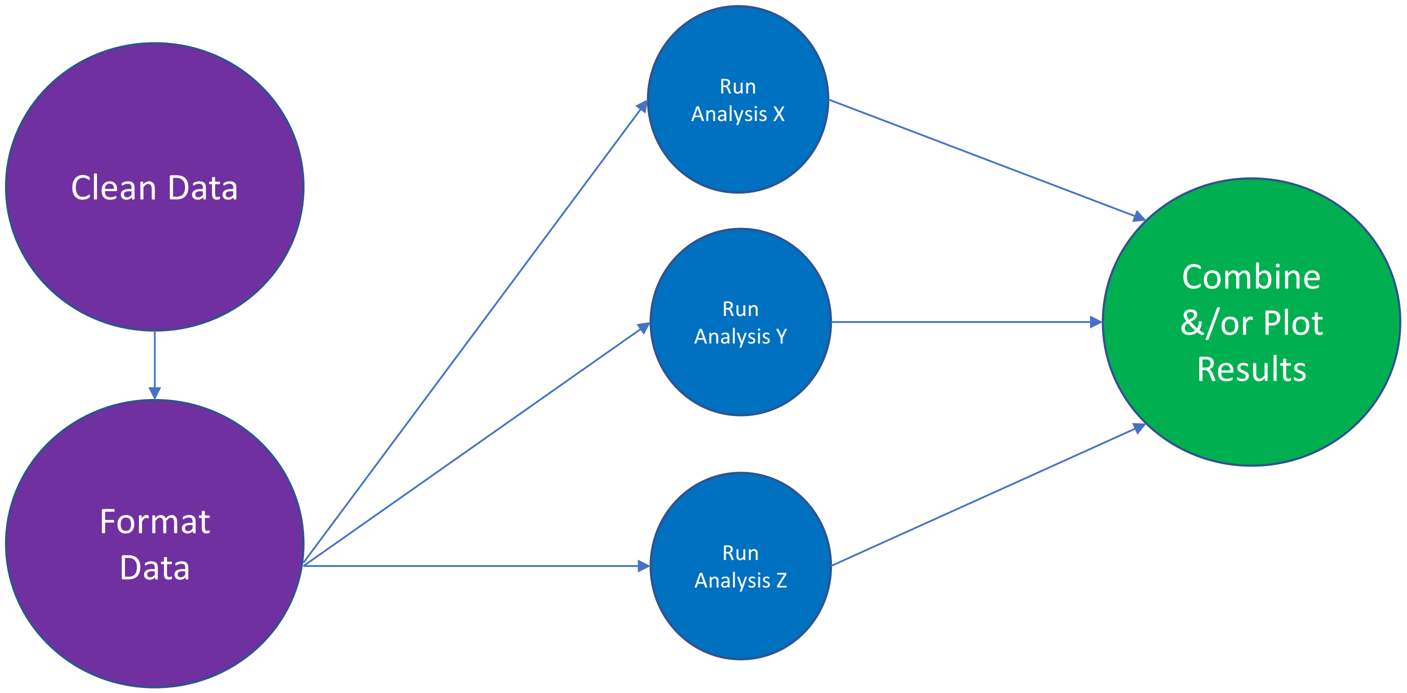


Clean Data

Format Data

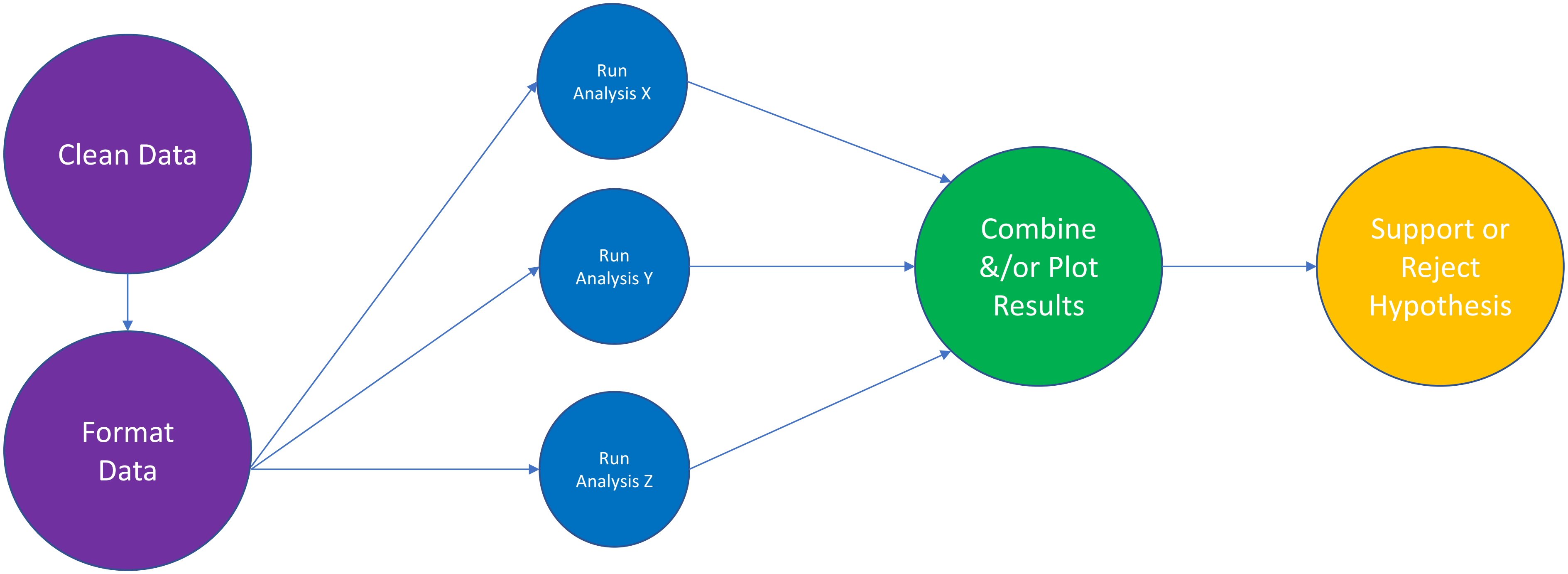
Run Analysis X

Run Analysis Y

Run Analysis Z

Combine &/or Plot Results

Data analysis workflow?



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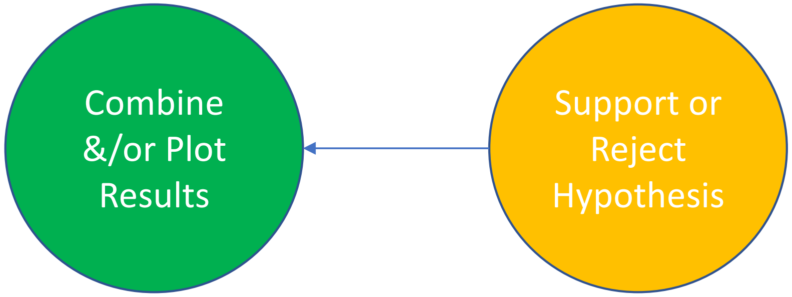

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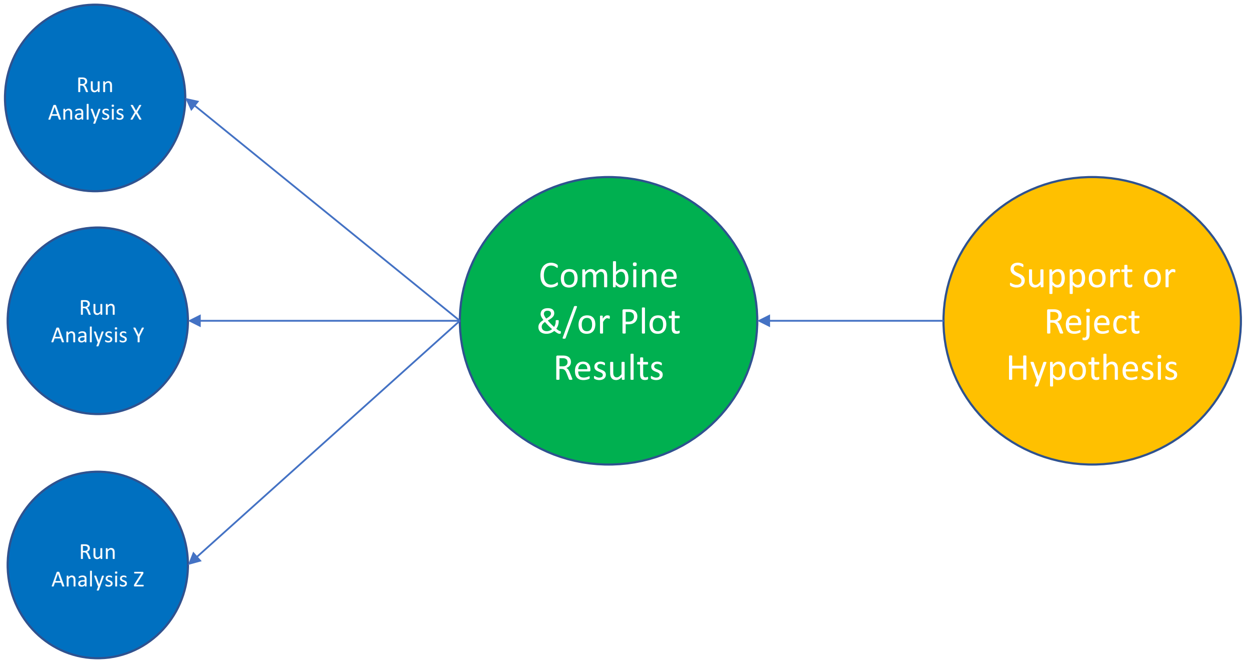

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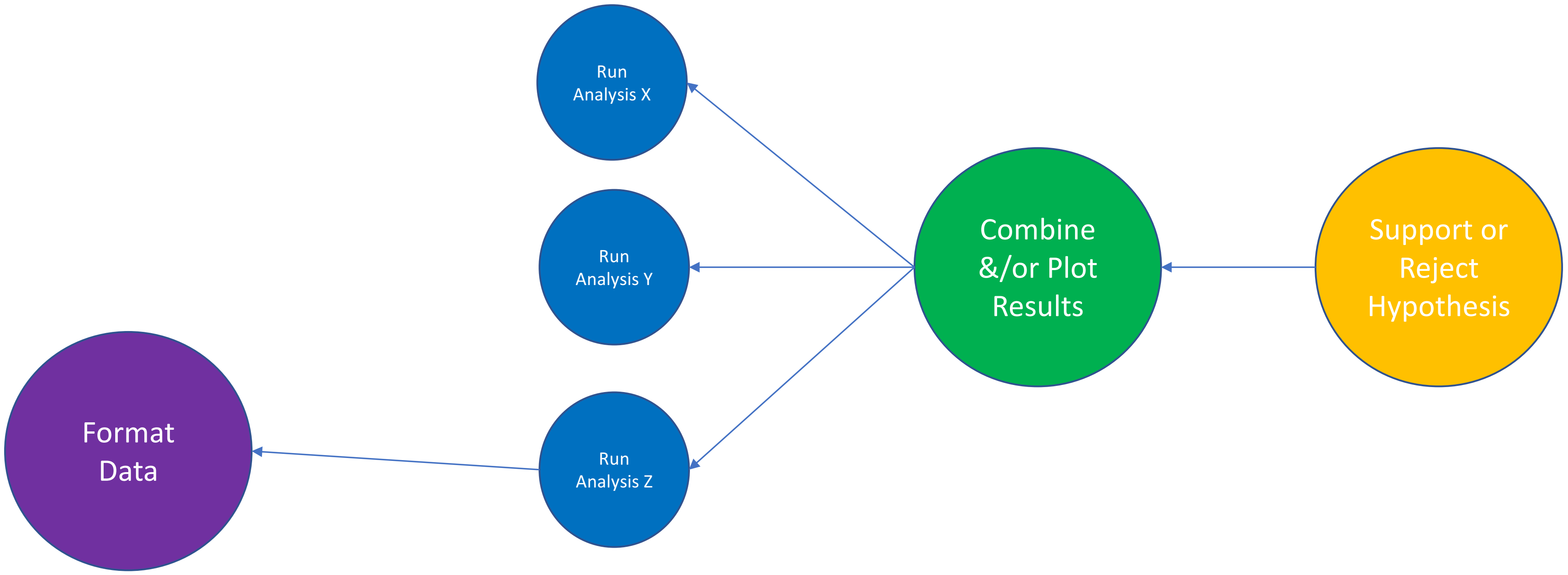
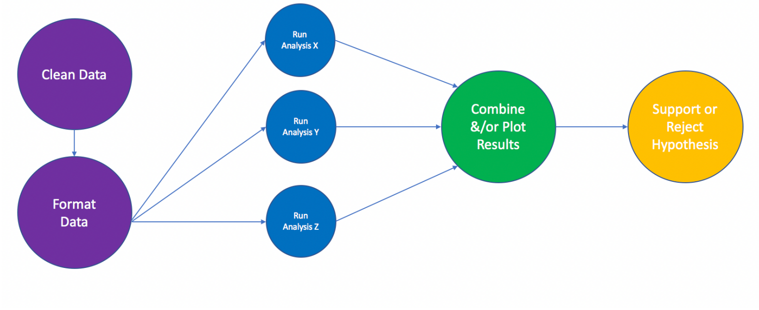
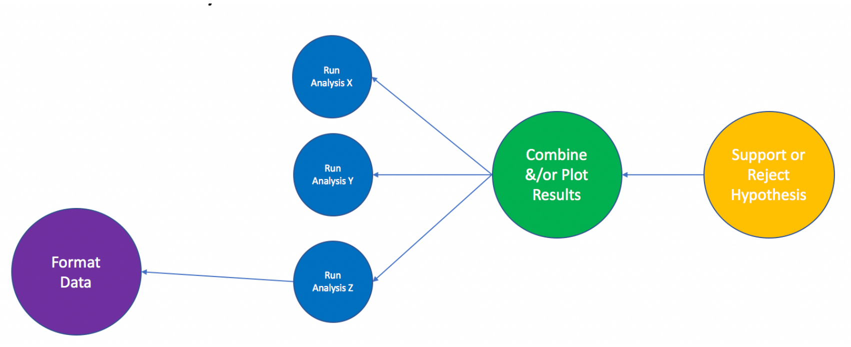
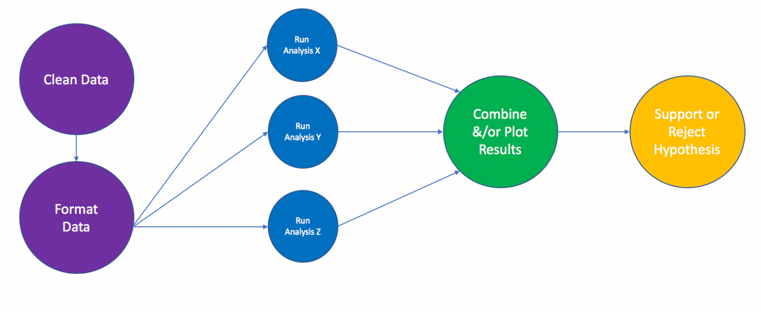


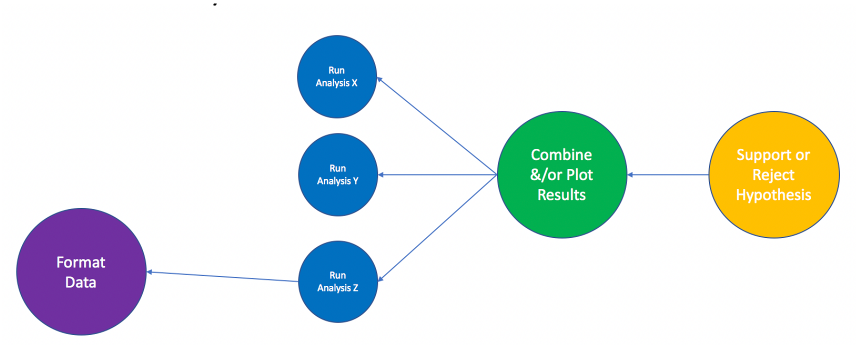
Which workflow is operationally how you would (or do) do things?





What is missing here? Anything important?





What is missing here? Anything important?

- Documentation?
- Data Storage (including backups)?
- Detail (what is actually described)?

Why workflows?

- Replication of your work
  - Often for future self
  - Replication is a fundamental component of good science
  - Time savings
    - Finding and fixing errors
    - Adjustments to approach are easier
- Collaboration
- Dissemination of knowledge

Obvious and hidden work

- What obvious/explicit steps have you taken in your work?
  - May be easily explained, described and documented

- What is not obvious or is implicit or all together hidden in your work?
  - May be steps that you think are obvious that are actually not clear to anyone else in the world (including your future self)
  - How does this limit reproduction of your work?

How many decisions were made to get to your endpoint?

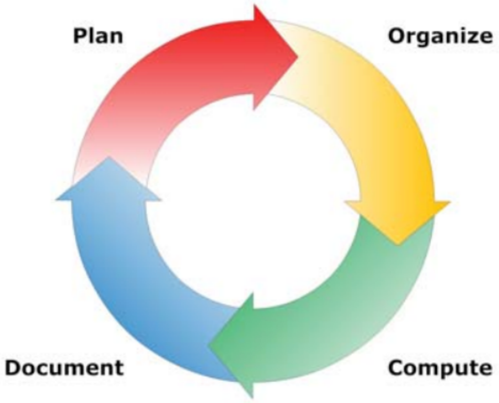
- 10 binary decisions leads to 1,024 possible outcomes. These decisions may seem minor/non-important or obvious. Often they are not.

Optimal Criteria for a Workflow (via Scott Long - IU)

- Accuracy
- Efficiency (careful vs quick)
- Standardization (techniques/code/steps)
- Automation (reduce typing or re-writing code)
- Simplicity (less complicated = fewer mistakes?)
- Usability (how you work)
- Scalability (useful for different projects?)

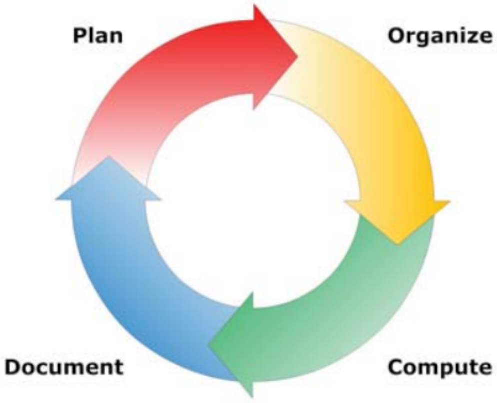
Workflow Steps (via Scott Long)

- Project Idea
- Prepare data
  - Can take up to 90% of your time in workflow
- Carry out analyses
- Presentation of results
- Protection and archiving of files

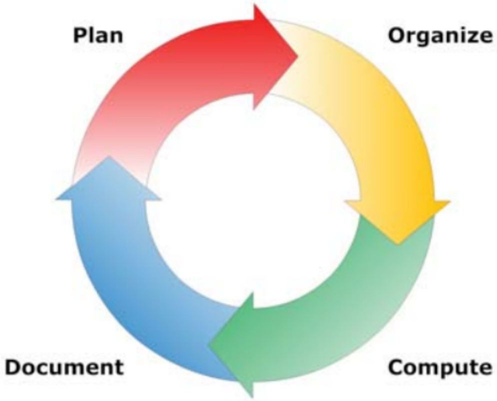


Planning and Organizing

- General goals and firm deadlines
  - Any division of labor?
  - Anticipated output (not the actual result, but what you want to look into) and analyses (how)
- Organizing the project
  - Reduce duplication
  - Standardize
    - tmp.csv
    - Data.csv
    - Wisconsin.trait.data.2015.3.10.csv
    - Swenson.trait.MS.2017.10.5.docx
    - Swenson.trait.MS.2017.10.5.KP.docx

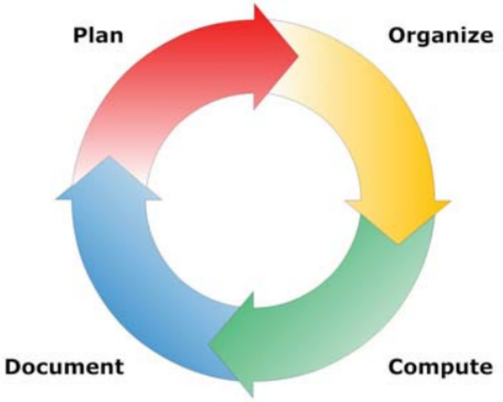


Compute



- (Reusable) modular computation
- Saved version of code
- No saving of “duplicate” versions of data. Conduct your workflow/computation in such a way that you can start from ‘scratch’ each time
  - Save derived products (of course)
- Look at your data and output from many angles along the way

Documenting



- Annoying to almost everyone
  - Can we automate it somehow?
  - Way easier (and better) in the moment than later
- Future self and others will find it extremely useful
  - No documentation on how you did it = much harder (or impossible) to do it again
  - Lab notebook