



R4ARCTECTURE

Integrating R4R Learnings in Architecture

Asif Hasan Zeshan

MS.Arch Candidate, CAPLA, University of Arizona
 R4R Fellow, Fall 2023





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WHO ARRANGED THIS:

WHAT ARE WE DOING?:

FOSS WORKSHOP



WEEKLY MEETING



The Shell and Git
Open Science
Managing Data
Project Management
Documentation and Communication
Version Control
Reproducibility I: Repeatability
Reproducibility II: Containers

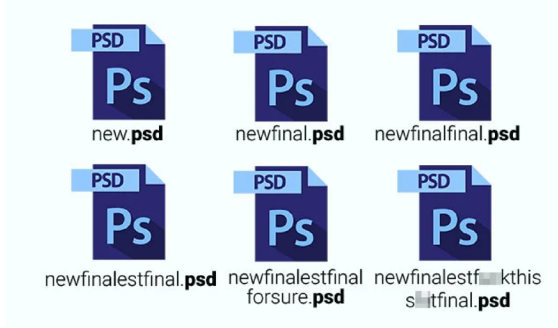
WHAT DO WE WANT OUT OF IT:

- Develop **Data science capabilities** across the AIR participating departments and research groups.
- Accelerate **research projects** of participating fellows and their home department research groups.
- Build **professional networks for addressing large-scale challenges** and research questions of interest to AIR faculty.
- Develop **new interdisciplinary collaborations** across AIR, DSI, CyVerse, and other academic units for writing new proposals.
- Develop a **cohort among participants (and Data Science Ambassadors)** to support each other in their own research and efforts to engage their departments.

DO YOU EVEN HAVE DATA?



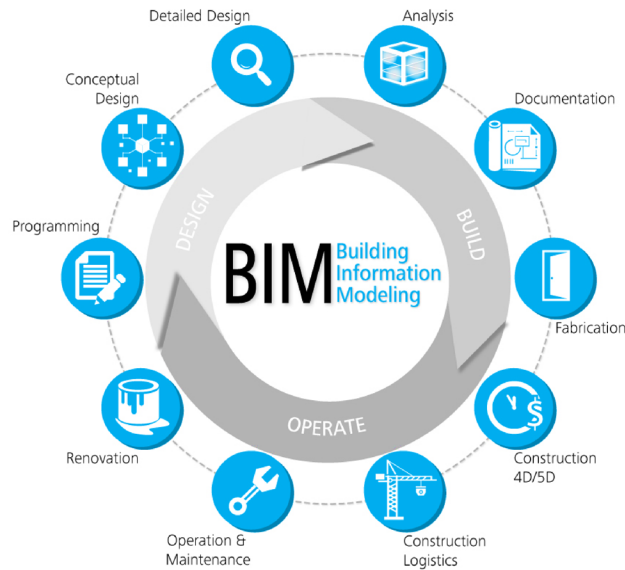
HOW NOT TO MANAGE DATA



WHICH PARTS ARE FOR US:

- The Shell and Git
- Open Science
- Managing Data
- Project Management
- Documentation and Communication
- Version Control
- Reproducibility I: Repeatability
- Reproducibility II: Containers

DO YOU EVEN HAVE DATA?



What is 6D B.I.M.?

3D (3D Model)	4D (Schedule)	5D (Cost)	6D (Building Lifecycle Information)
		<ul style="list-style-type: none"> _____ \$ _____ \$ _____ \$ _____ \$ 	eLibrary: <ul style="list-style-type: none"> > Who? > When? > Where? > How much?
Idealized B.I.M.			
Actual B.I.M.			

“The problem with working with data in architectural design is not the lack of it, rather, it the abundance”

Stanislas Chaillou

IAAC, A Paris native,
Data Scientist & Architect at Spacemaker.ai.



WHERE ELSE IS MY DATA?

DATA SCIENCE IN ARCHITECTURE



WHICH PARTS ARE FOR US:

The Shell and Git
Open Science

Managing Data

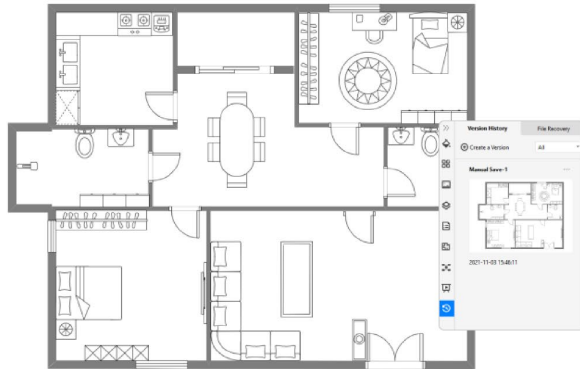
Project Management

Documentation and Communication

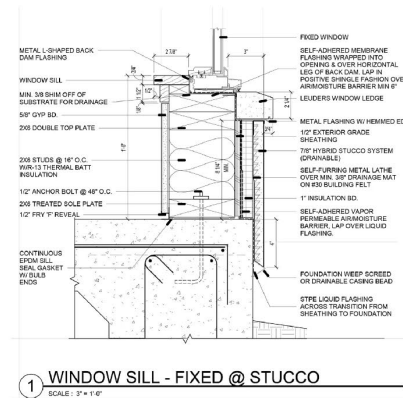
Version Control

Reproducibility I: Repeatability

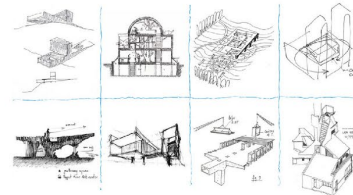
Reproducibility II: Containers



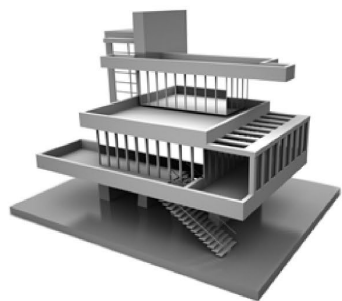
2D Drawing (Vector Data)
2D Drawing (Image Data)



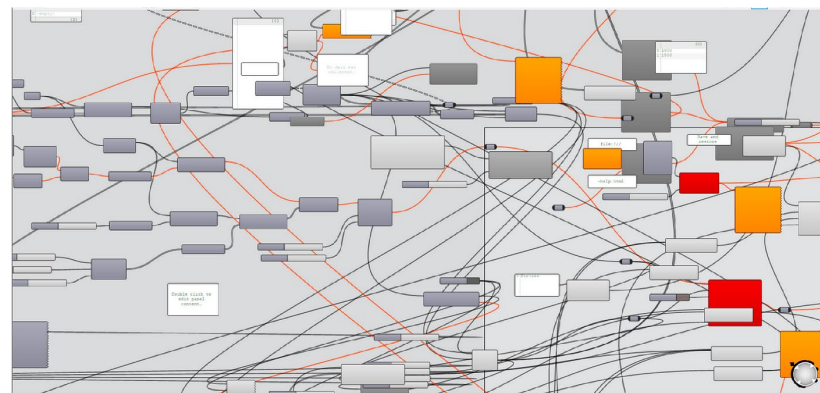
2D Specification (Vector Data)
2D Specification (Image Data)



Architectural Sketches
(Image data)
Source: ArcDaily



3D files (Object Data)
2D Rendering (Image Data)



Visual Coding (Binary data)
3D Output (Parametric data)



Portfolio
(Compiled Data)

“The problem with working with data in architectural design is not the lack of it, rather, it the abundance”

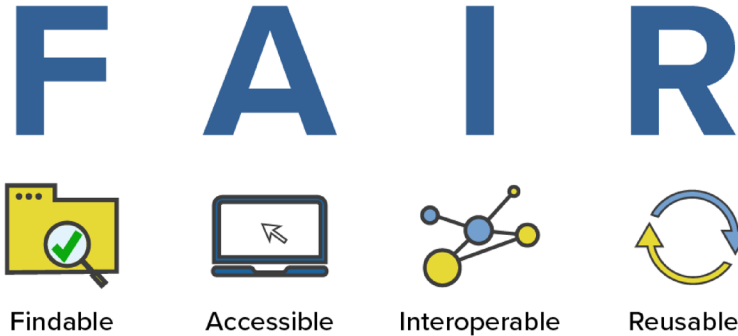
Stanislas Chaillou

IAAC, A Paris native,
Data Scientist & Architect at Spacemaker.ai.



WHAT TO KNOW ABOUT MY DATA?

DATA SCIENCE IN ARCHITECTURE



Findable

- F1. (meta)data are assigned a globally unique and persistent identifier
- F2. data are described with rich metadata (defined by R1 below)
- F3. metadata clearly and explicitly include the identifier of the data it describes
- F4. (meta)data are registered or indexed in a searchable resource

Accessible

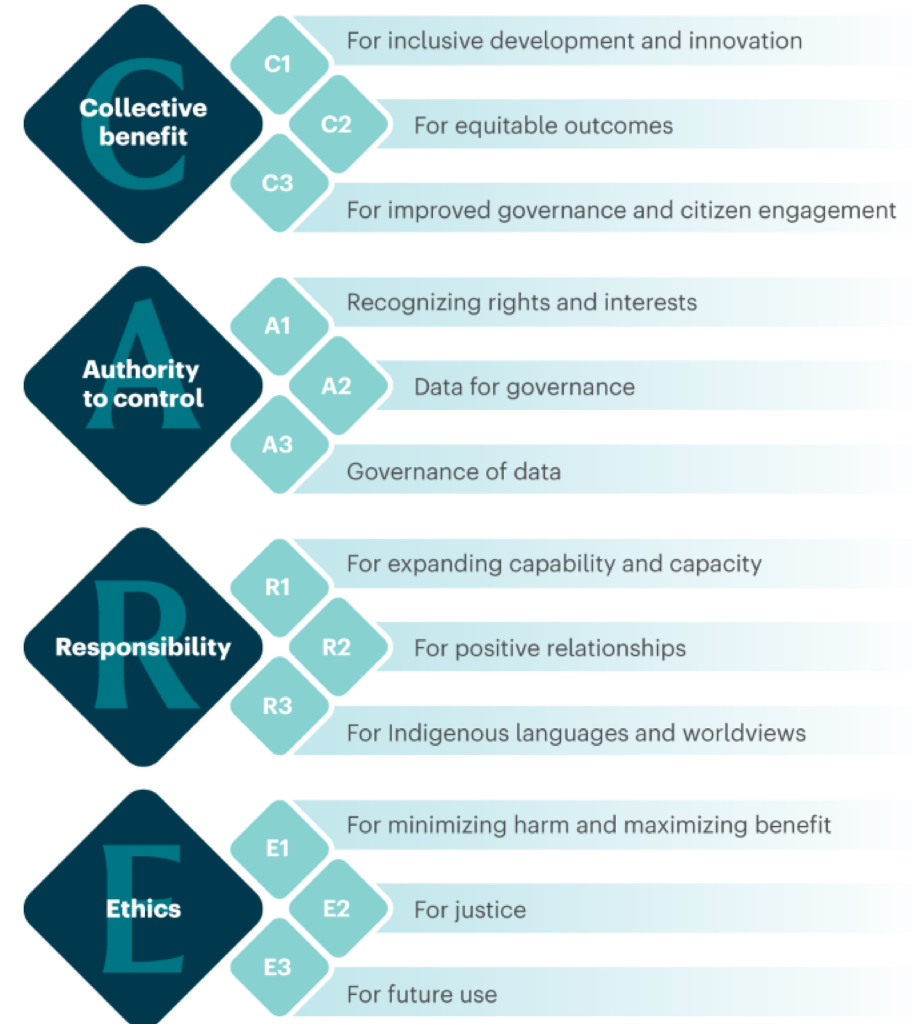
- A1. (meta)data are retrievable by their identifier using a standardized communications protocol
 - A1.1 the protocol is open, free, and universally implementable
 - A1.2 the protocol allows for an authentication and authorization procedure, where necessary
- A2. metadata are accessible, even when the data are no longer available

Interoperable

- I1. (meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.
- I2. (meta)data use vocabularies that follow FAIR principles
- I3. (meta)data include qualified references to other (meta)data

Reusable

- R1. meta(data) are richly described with a plurality of accurate and relevant attributes
 - R1.1. (meta)data are released with a clear and accessible data usage license
 - R1.2. (meta)data are associated with detailed provenance
 - R1.3. (meta)data meet domain-relevant community standard

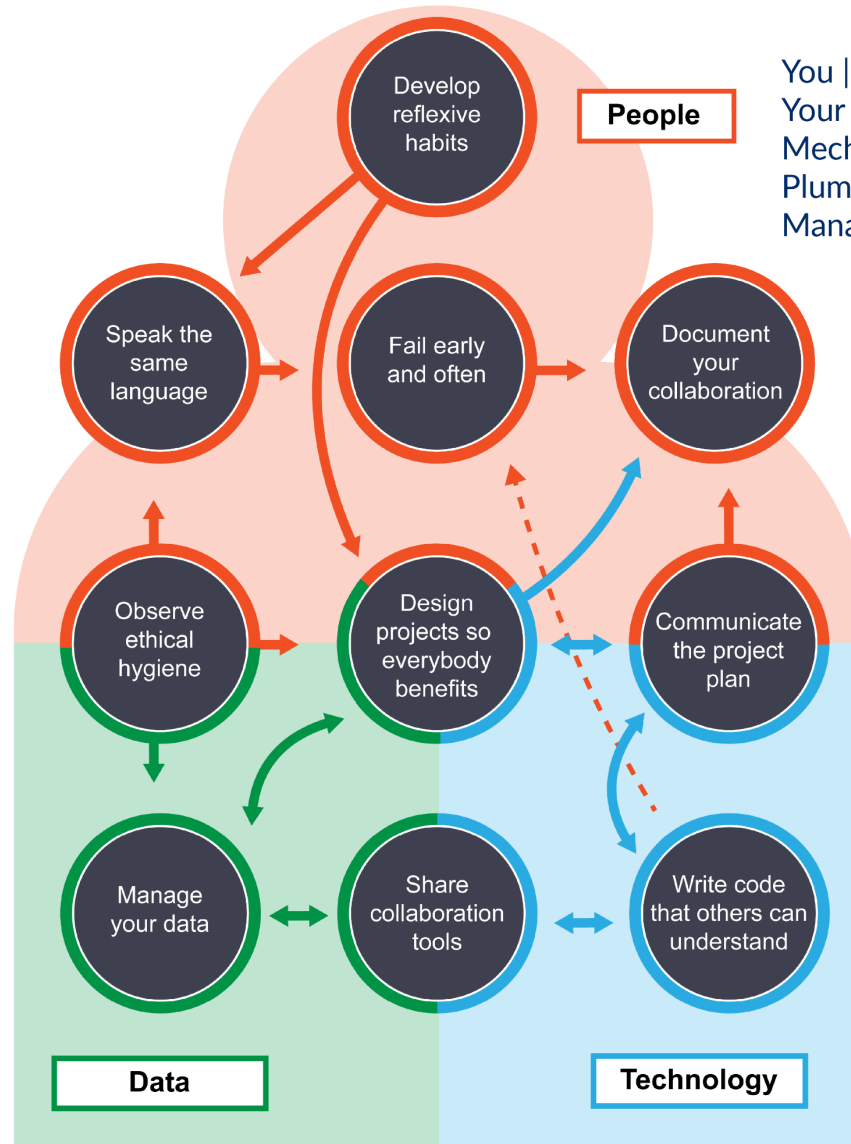


WHERE DO WE MANAGE DATA IN OUR WORK?

DATA SCIENCE IN ARCHITECTURE



People
You | Your academic project group member,
Your professional office team | Civil Engineers,
Mechanical Engineers | Electrical Engineers,
Plumbing engineers | Site Manager | Construction
Manager | Worker | Client | Stakeholder | Developer



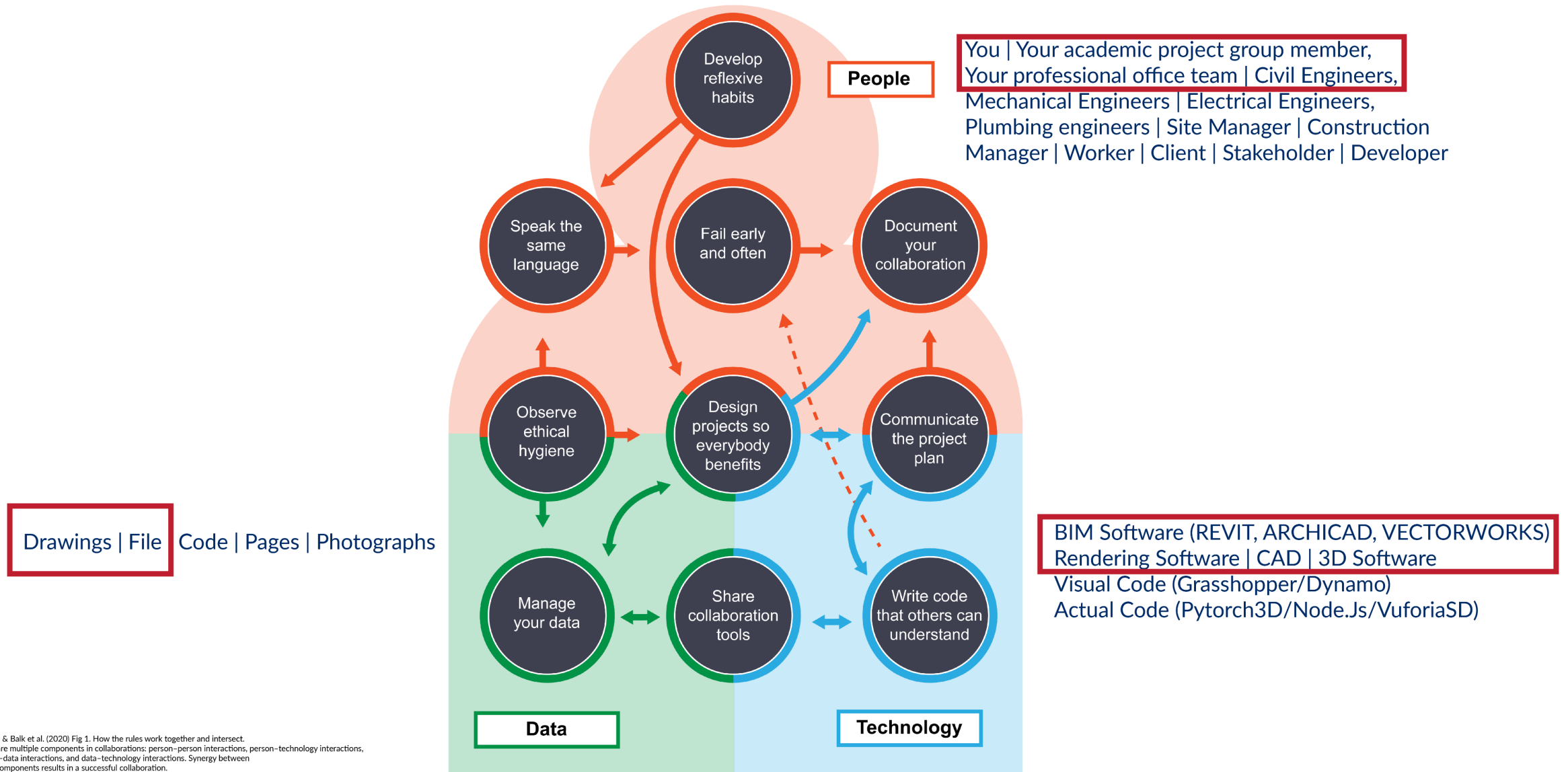
BIM Software (REVIT, ARCHICAD, VECTORWORKS)
Rendering Software | CAD | 3D Software
Visual Code (Grasshopper/Dynamo)
Actual Code (Pytorch3D/Node.js/VuforiaSD)

Drawings | File | Code | Pages | Photographs

Sahneh & Balk et al. (2020) Fig 1. How the rules work together and intersect. There are multiple components in collaborations: person-person interactions, person-technology interactions, person-data interactions, and data-technology interactions. Synergy between these components results in a successful collaboration.

WHERE DO WE MANAGE DATA IN OUR WORK?

DATA SCIENCE IN ARCHITECTURE



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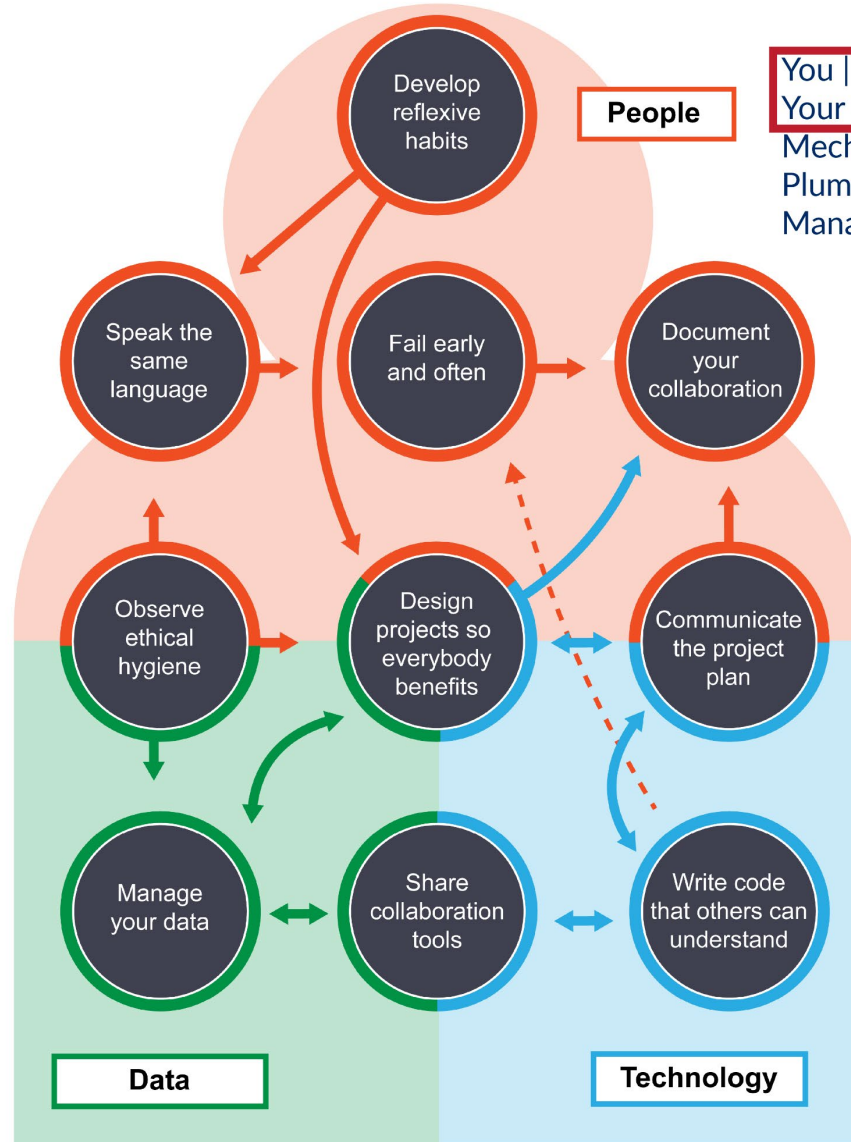
WHERE DO WE MANAGE DATA IN OUR WORK?

DATA SCIENCE IN ARCHITECTURE



D1 Park | Purbachal American City, Bangladesh

Drawings | File Code | Pages | Photographs



People
 You | Your academic project group member,
 Your professional office team | Civil Engineers,
 Mechanical Engineers | Electrical Engineers,
 Plumbing engineers | Site Manager | Construction
 Manager | Worker | Client | Stakeholder | Developer

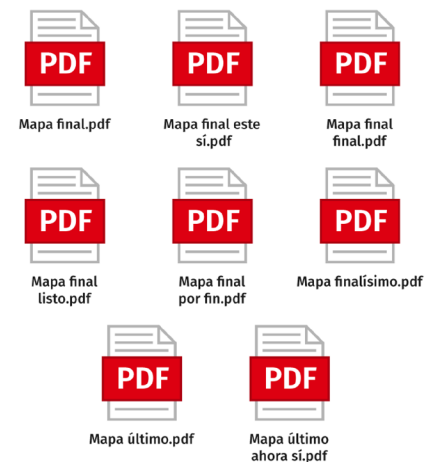
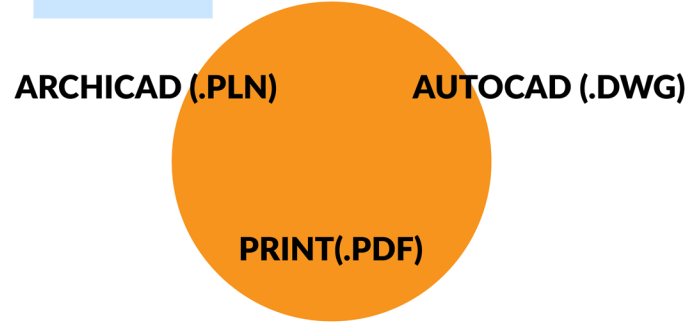
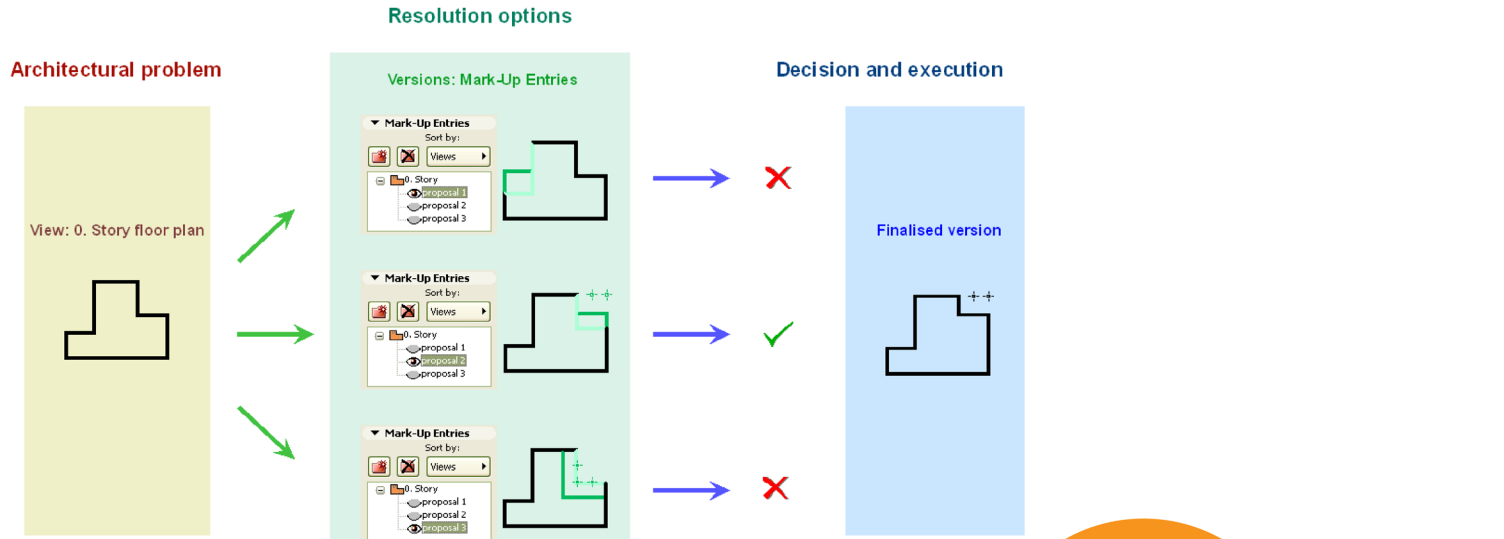
ARCHICAD (.PLN)

AUTOCAD (.DWG)

PRINT(.PDF)

BIM Software (REVIT, ARCHICAD, VECTORWORKS)
 Rendering Software | CAD | 3D Software
 Visual Code (Grasshopper/Dynamo)
 Actual Code (Pytorch3D/Node.js/VuforiaSD)

Sahneh & Balk et al. (2020) Fig 1. How the rules work together and intersect. There are multiple components in collaborations: person-person interactions, person-technology interactions, person-data interactions, and data-technology interactions. Synergy between these components results in a successful collaboration.



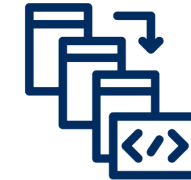
Sahneh & Balk et al. (2020) Fig 1. How the rules work together and intersect. There are multiple components in collaborations: person-person interactions, person-technology interactions, person-data interactions, and data-technology interactions. Synergy between these components results in a successful collaboration.

SURE Method



Systematic File Naming

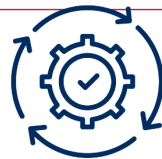
Project initial_Date_Phase_Feedback.extention
e.g:SynPellicle_29JAN_MS.ARCHFall22_Reveiw1.dwg



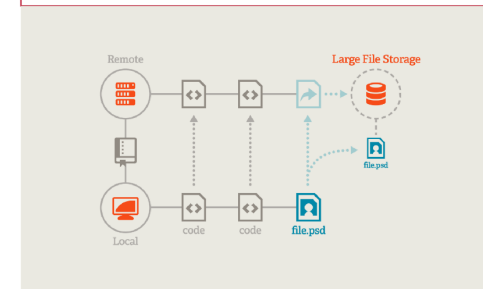
Use of Version Control Software

GIT/GIThub, ArchiCAD/REVIT
Keep a journal of your work on daily basis

Regular Commits and Clear Documentation



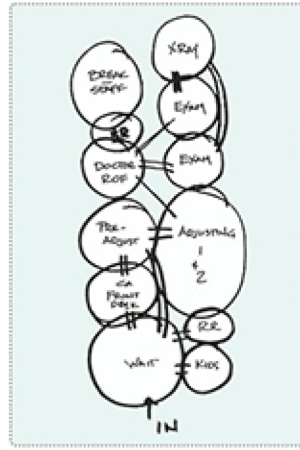
Enhanced Review and Backup Practices



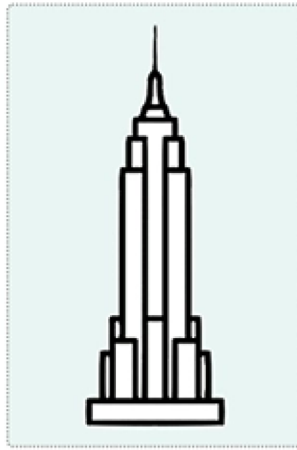
**Cloud based
Storage
Sync.**

IS THIS “PROJECT MANAGEMENT?”

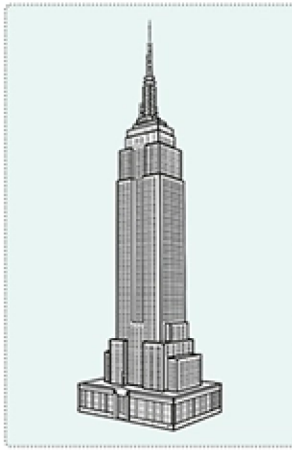
HOW DID WE GET HERE?



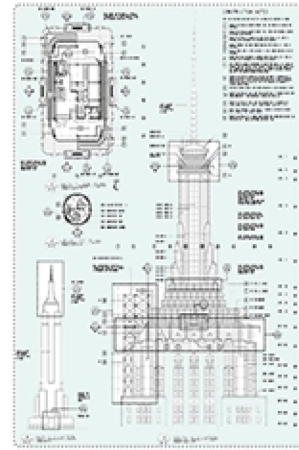
PROGRAMMING



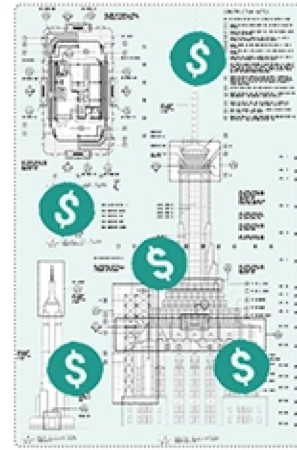
SCHEMATIC DESIGN



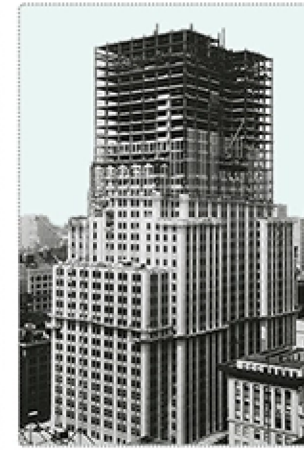
DESIGN DEVELOPMENT



CONSTRUCTION DOCUMENTS



BIDDING



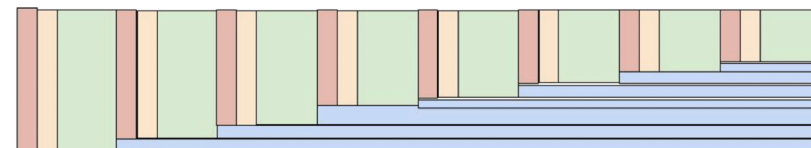
CONSTRUCTION ADMINISTRATION

- a. What are we building?
- b. How will this work?
- c. How do we build this?
- d. What are the components?
- e. How do we get the components?
- f. How much do we spend?
- g. How do we communicate?
- h. There is a problem. Should we change anything?
- i. Its complete. But how do we repair certain parts?
- j. The building is ending it's lifecycle. How do we increase it/get rid of it?

Waterfall



Agile/Iterative



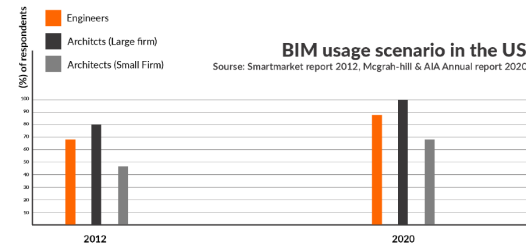
CAN WE MAKE IT AGAIN?

HOW DO WE KNOW WE DID IT RIGHT

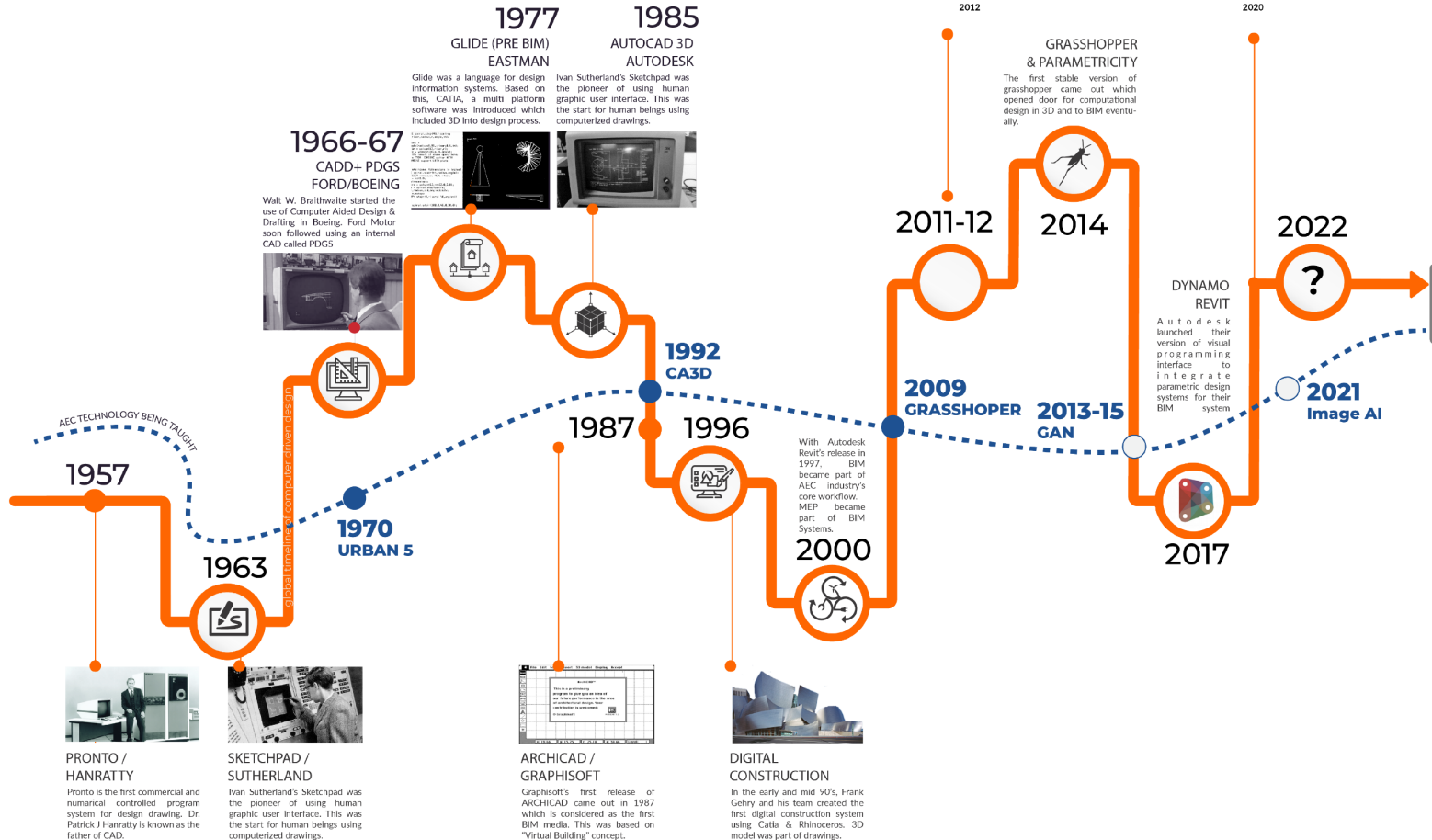
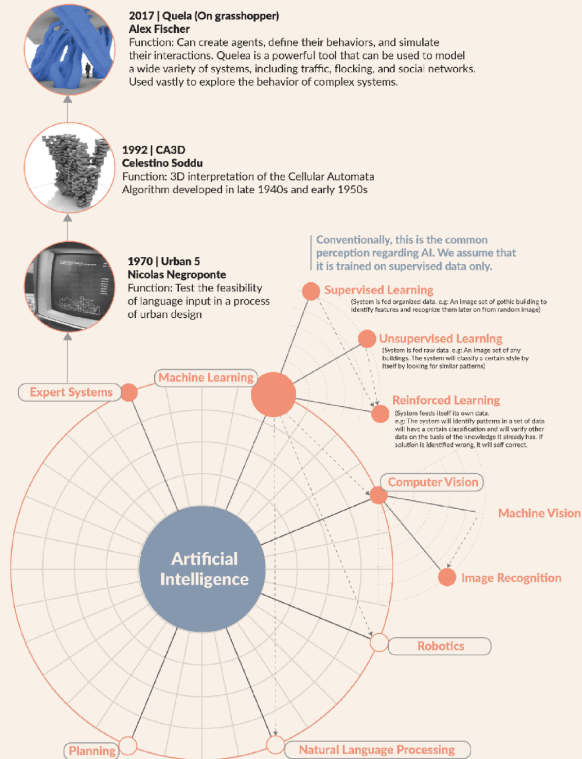


WHY DO WE MAKE IT AGAIN?

AI & DATA GOES HAND BY HAND



LOOKING AT OTHER BRANCHES OF ARTIFICIAL INTELLIGENCE

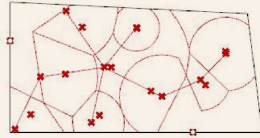


WHY DO WE MAKE IT AGAIN?

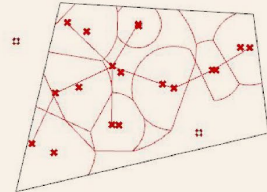
FLOOR PLAN AUTOMATION (SPATIAL INTELLIGENCE)

Tool: Termite Nest

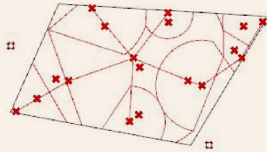
Iteration 1



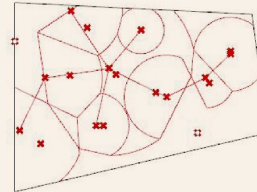
Iteration 3



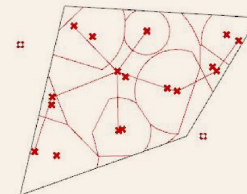
Iteration 5



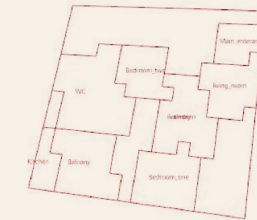
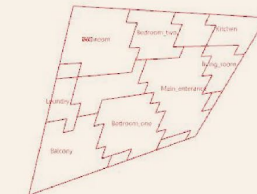
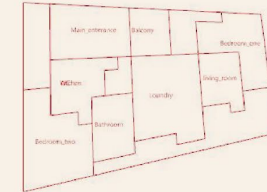
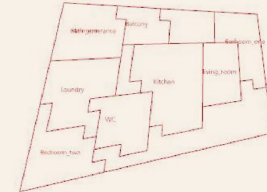
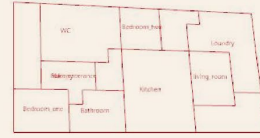
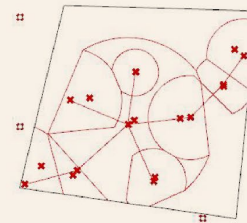
Iteration 2



Iteration 4



Iteration 6



FOOD FOR THOUGHT

HOW WILL YOU CONTRIBUTE WHEN THE REVOLUTION COMES?
THANK YOU

