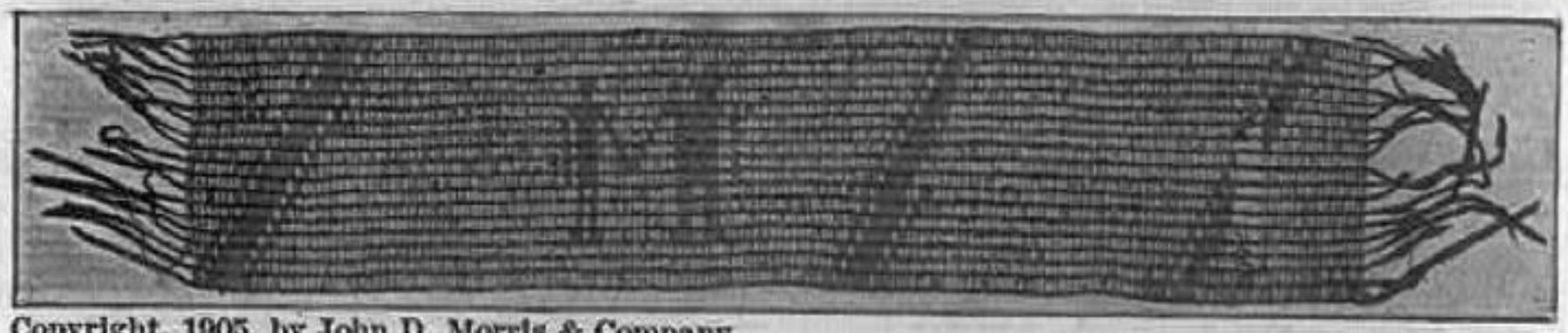
Accounting for Every thing
(Experience Logging)

Andrew Maffei
(amaffei@thevisualconnection.com)

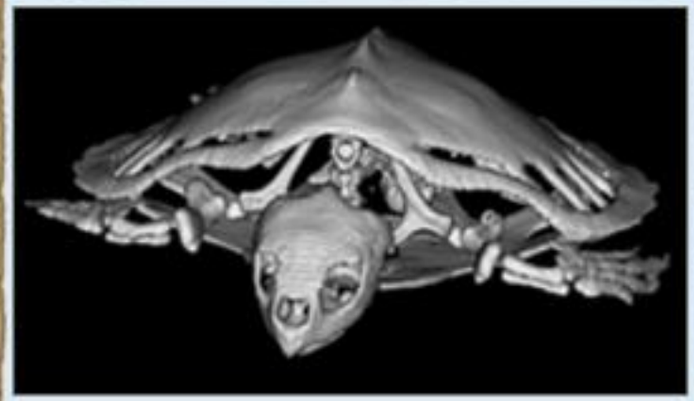
A work in progress



THE BELT OF WAMPUM DELIVERED BY THE INDIANS TO WILLIAM PENN AT THE "GREAT TREATY" UNDER THE ELM TREE AT SHACKAMAXON, IN 1682

Story as the Value

Applied Ocean Physics & Engineering

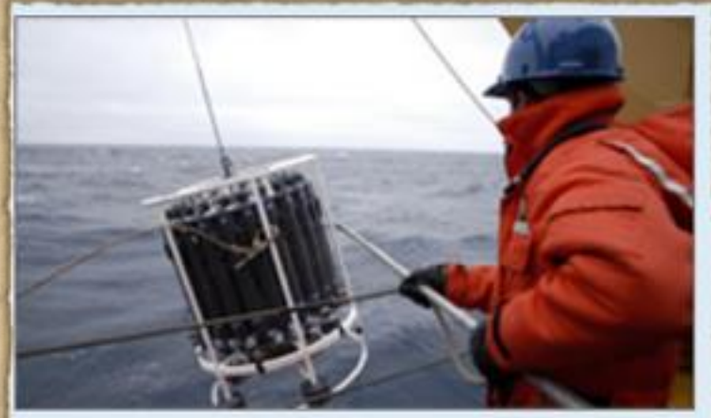


Biology

Geology & Geophysics

Marine Chemistry & Geochemistry

Marine Policy



Physical Oceanography

Oceanography

How can we merge stories from different perspectives?

IoT = Opportunity

- Move from "counting" everything to"accounting" for everything.
  - Deal with the data format "tower of babel" problem
  - Find a consistent way to record contextual metadata at the source (not after the fact)
  - ability to track analysis results back to the original data
  - Support translation of experience collection contexts to experience analysis contexts

21st International Congress on Modelling and Simulation, Gold Coast, Australia, 29 Nov to 4 Dec 2015
www.mssanz.org.au/modsim2015

PROV and Real Things

Simon J.D. Cox [a] **and Nicholas J. Car** [a]

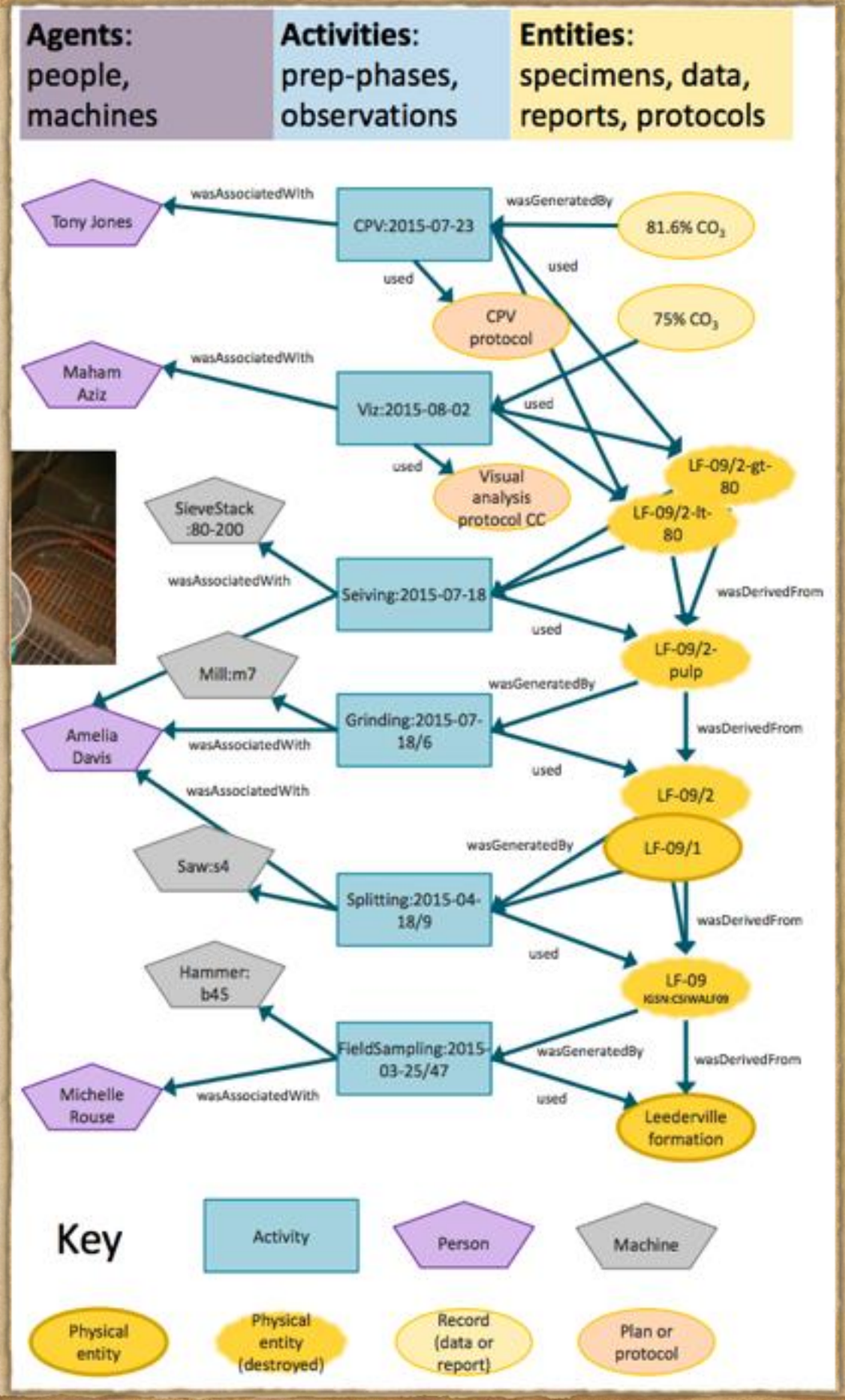
[a] *Land & Water Flagship: CSIRO, Melbourne Vic and Brisbane, Qld, Australia*
Email: simon.cox@csiro.au

Abstract: The PROV data model is becoming accepted as a flexible and robust tool for formalizing information relating to the production of documents and datasets. Provenance stores based on the PROV-O implementation are appearing in support of scientific data workflows. However, the scope of PROV does not have to be limited to digital or information assets. For example, specimens typically undergo complex preparation sequences prior to actual observations and measurements, and it is important to record this to ensure reproducibility and to enable assessment of the reliability of data produced. PROV provides a flexible solution, allowing a comprehensive trace of predecessor entities and transformations at any level of detail. In this paper we demonstrate the use of PROV for describing specimens managed for scientific observations. Two examples are considered: a geological sample which undergoes a typical preparation process for measurements of the concentration of a particular chemical substance, and the collection, taxonomic classification and eventual publication of an insect specimen. We briefly compare PROV with related work.

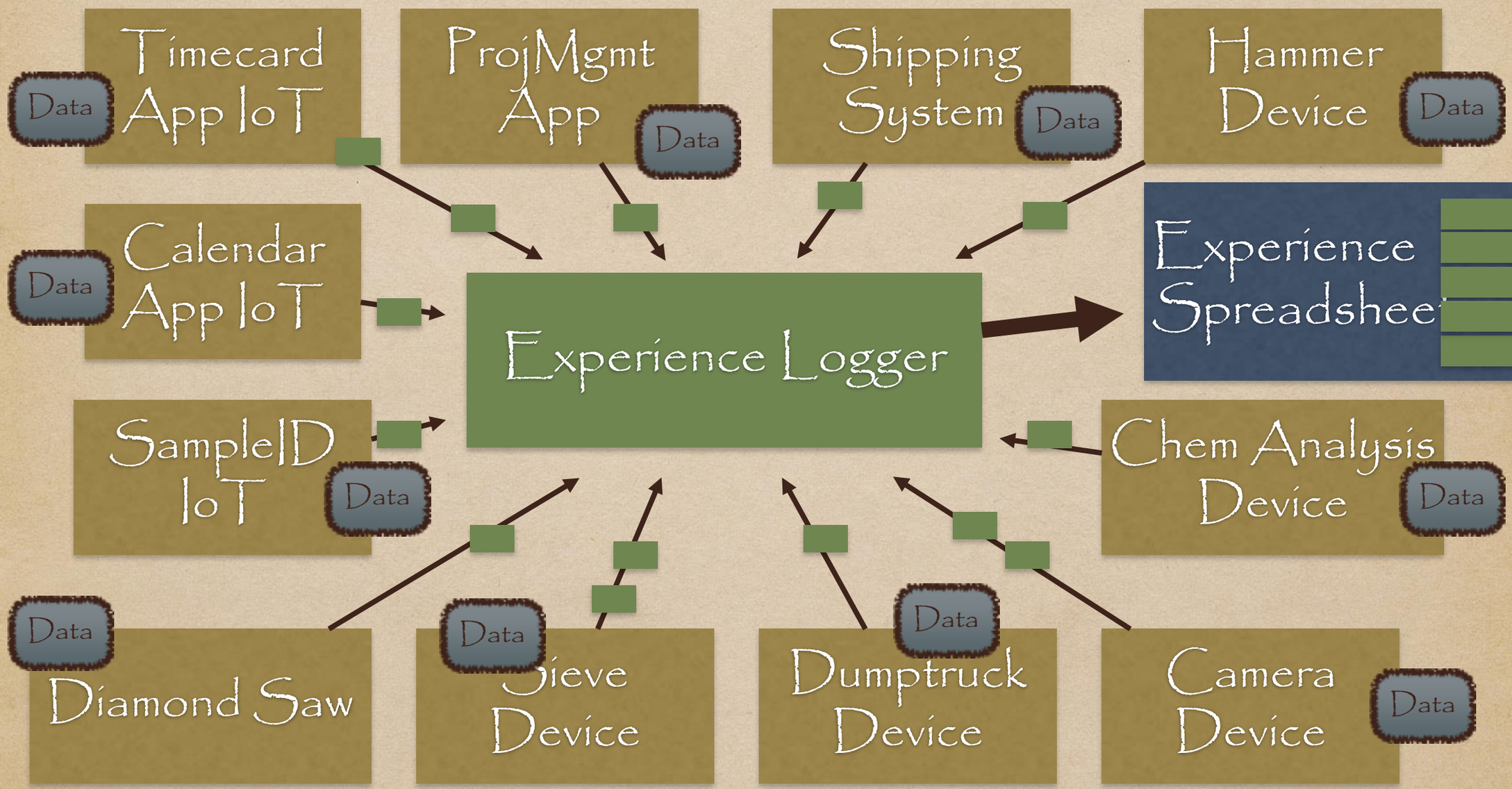
Keywords: *Provenance, PROV, sampling, specimen*

Prov Data Model Approach to storytelling

- Static snapshot
- Highly abstract & Non-intuitive (hard for others to understand)
- Composed after the fact (prone to errors)
- Only 1 interpretation of what happened.

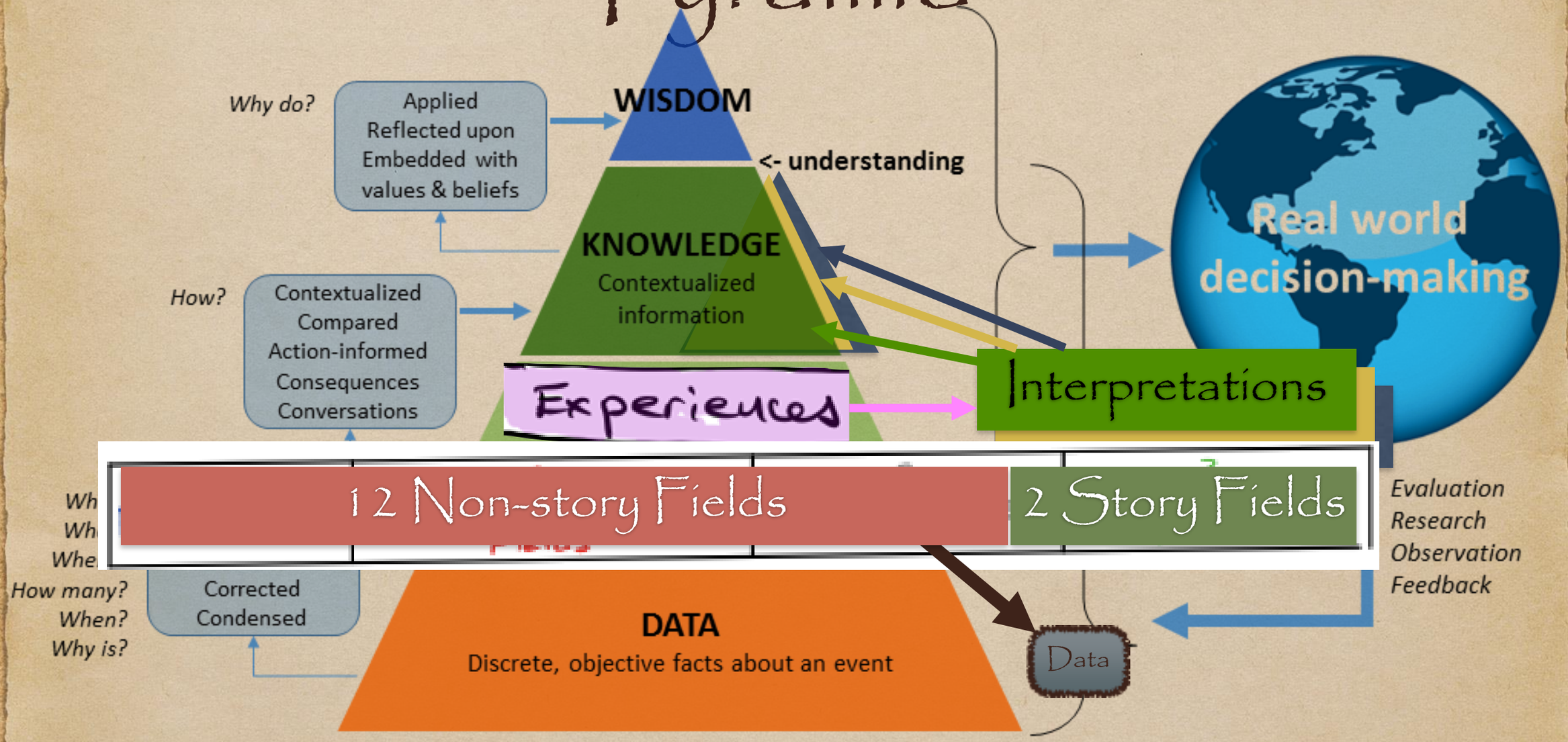


Experience Logging



Experience Records

Updating the DIKW Pyramid



Modified version of image found on Dennis Bours' blog entry found here:
https://www.climate-eval.org/blog/answer-42-data-information-and-knowledge

Non-story vs Story Fields

12 NON-STORY FIELDS

- measurables
- more quantitative
- more objective
- observables
- more permanent
- the counts

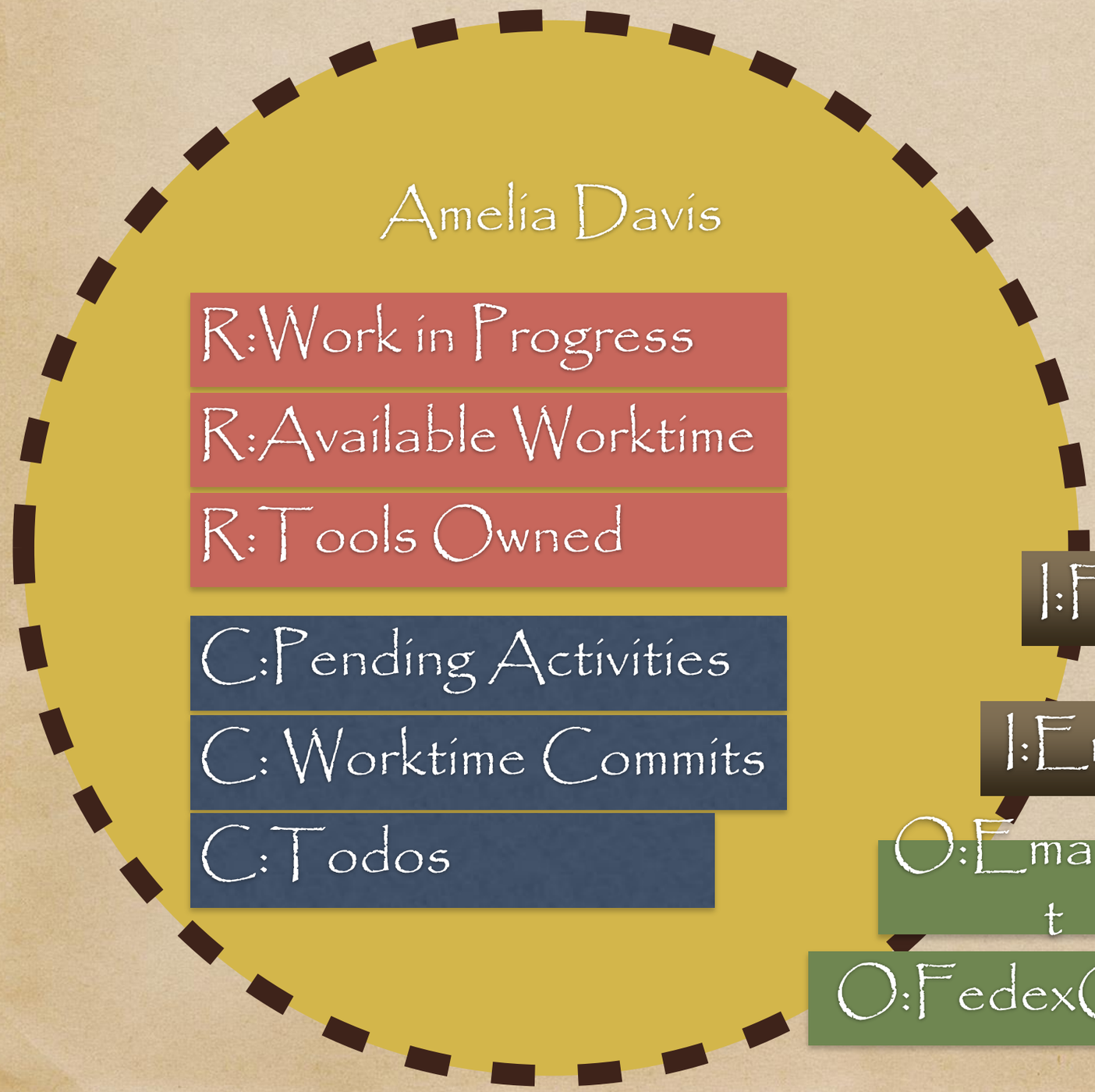
2 STORY FIELDS

- meanings
- more qualitative
- more subjective
- thoughts
- more changeable
- the accounts

CONTEXTUAL INTERPRETATIONS

- multiple POV

Modeling Entity Structure



4 account types

I:FedexIn

I:EmailIn

O:EmailOut

O:FedexOut

Example 'Accounts' in various Contexts

	Software Entity Context	Human Being Entity Context	Science Experiment Context	Personal Finance Context
InFlow	Input Variables	5 Sensory Organs	Sensor Outputs	Revenue (Salary)
OutFlow	Output Variables	Action Organs (mouth, hands, feet)	Actuator Actions	Expenses (Car fuel, rent)
Resources	Populated Data Structures	Internal Organs, Memories	Sensor data, ships, AUVs	Assets (home equity)
Commit-ments	Code	Organ Functions, Todo List thoughts	Sensor Control code, Proposal Deliverables	Liabilities (Credit cards, mortgage, contracts)

Fields for 2 Different Experiences

Memo: Andrew Maffei Sends LF-09 Rock Speciman to Amelia Davis

Collection Context: Staples_Shipping_IoT

Experience PID: FUsflPbt

Experience Pair PID: iFSXTeGa

Evidence: URL Link

Count: 550.01

Type: Rock GM

Timestamp: 2003-01-08

Location: Falmouth Staples

Subject: Andrew Maffei

Object: Amelia Davis

Predicate: Send Rock Mass

Memo: Amelia Davis Receives LF-09 Rock Specimen from Andrew Maffei

Collection Context: CSIROShippingDepartment_IoT

Experience PID: iFSXTeGa

Experience Pair PID: FUsflPbt

Evidence: URL Link

Count: 550.01

Type: Rock GM

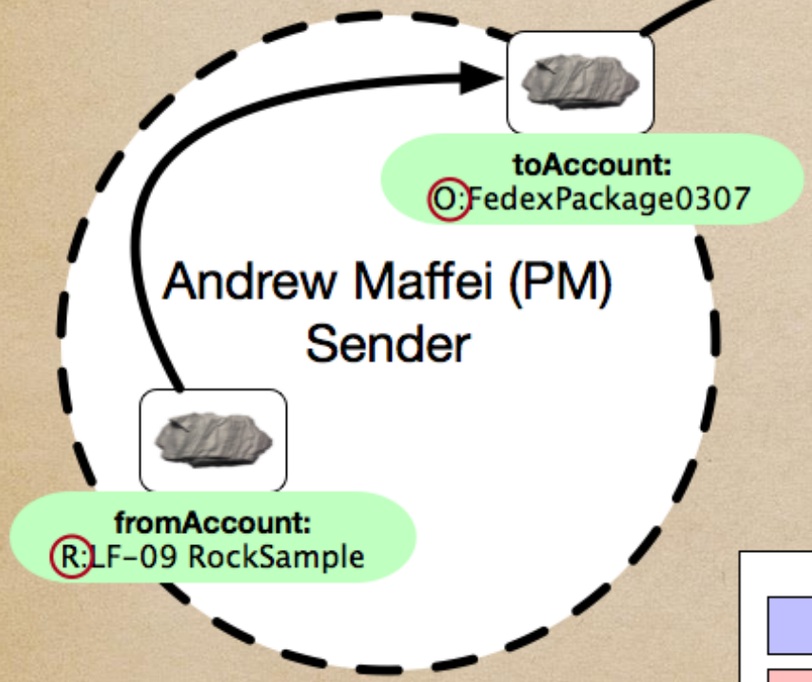
Timestamp: 2004-01-07

Location: CSIRO Shipping Facility

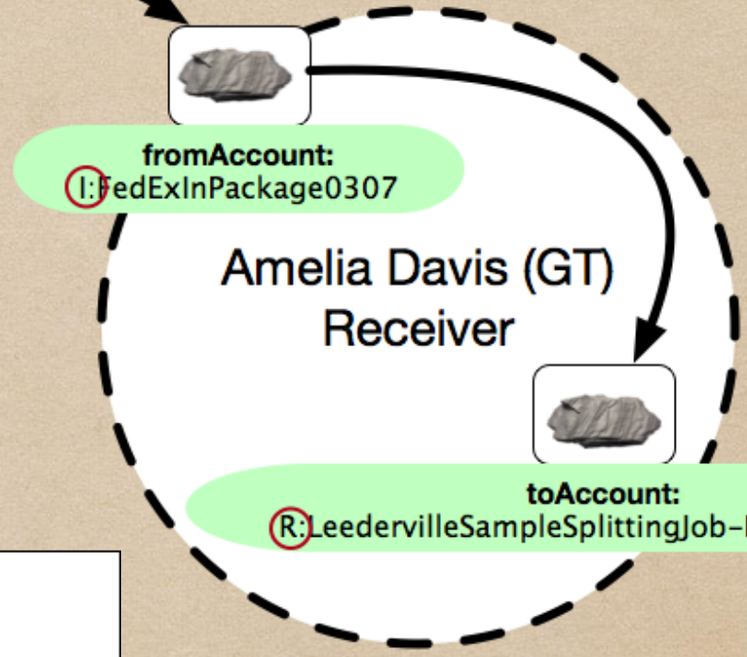
Subject: Amelia Davis

Object: Andrew Maffei

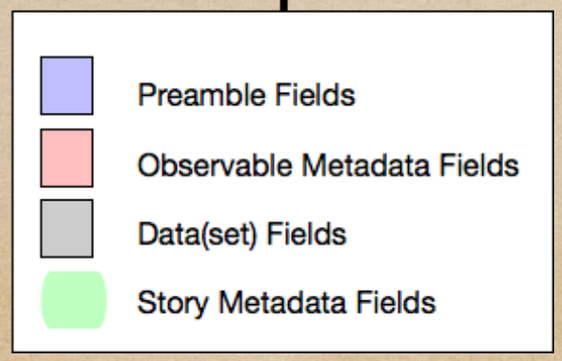
Predicate: Receive Rock Sample



Experience 1



Experience 2



Analysis account names represent mental models of 'story-teller'

- Collection context account name
  - R:LF-09 Rock Sample
- Corresponding analysis context account name
  - R:Projects:NationalScienceFoundation:FY2016:LedervilleFormation:CarbonateAnalysis:FieldSamples:LF-09
  - Can be used to represent scientific mental models

Analysis Software

Exp2DE.py

220 Experience Records

Interpreted Experiences

Experience Analysis Software

Contextual Interpretations

RDADTR Federated Repositories !!!!!!!!

Reports about System Dynamics

- Experiment Deliverable Status
- Entity State
- Energy/Mass Flow between Entities
- Process Status

Visualizations

Experience Analysis Software

Welcome to ledger

Ledger is a powerful, double-entry accounting system that is accessed from the UNIX command-line. Ledger, begun in 2003, is written by John Wiegley and released under the BSD license. It has also inspired several ports to other languages.

To get started with Ledger, add transactions to a text file in Ledger's own textual format. Here's what a single transaction might look like:

```
2015/10/12 Exxon
    Expenses:Auto:Gas          $10.00
    Liabilities:MasterCard    $-10.00
```

You use the `ledger` command line program to see the balance of your accounts:

```
$ ledger -f your-file.dat balance
              $10.00  Expenses:Auto:Gas
             $-10.00  Liabilities:MasterCard
--------------------
                   0
```

or the history of a particular account:

```
$ ledger -f your-file.dat register Expenses
15-Oct-12 Exxon                Expenses:Auto:Gas           $10.00       $10.00
```

Read more about Ledger's features.

Experience Logging Terminology	Financial Transaction Mapping
Story Fields	
From Account Name	Account that debit is posted to
To Account Name	Account that credit is posted to
Account Types	
InFlow (I)	Revenue Account Type
Outflow (O)	Expenses Account Type
Resources (R)	Assets Account Type
Commitments (C)	Liabilities Account Type
Reports	
State of system components over a time period	Balance Reports (Stocks)
Flow of energy/matter over a time period	Cash Flow Reports (Flows)
.....	Many, many, many other report types
Non-Story Fields	
Experience PID	Transaction ID
Memorandum	Transaction description / vendor
Timestamp	Transaction timestamp
Predicate	Transaction type
Count	Transaction amount
Type	Transaction currency or commodity
Evidence	Transaction document (audit record)

Double Entry

1) Debits = Credits (a check)
2) Categorizing credits and debits allows you to understand 'stocks and flows'.

Biz Goal: optimize systems of interest for maximum equity/profit

What good can Double Entry do for scientific research ?

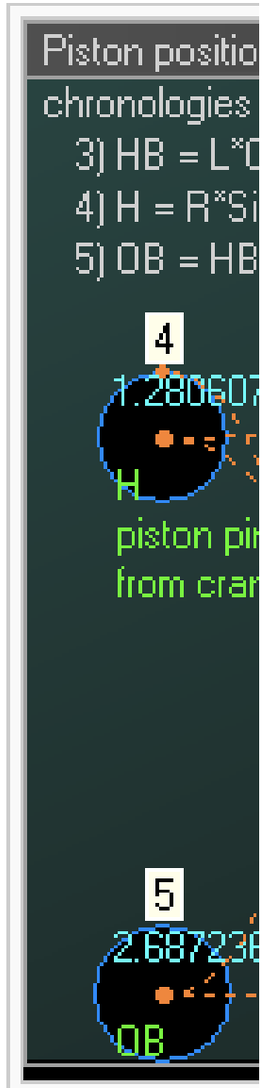
Candidate Science Goal: Employ System Dynamics to monitor stocks and flows to double entry based experience records

.

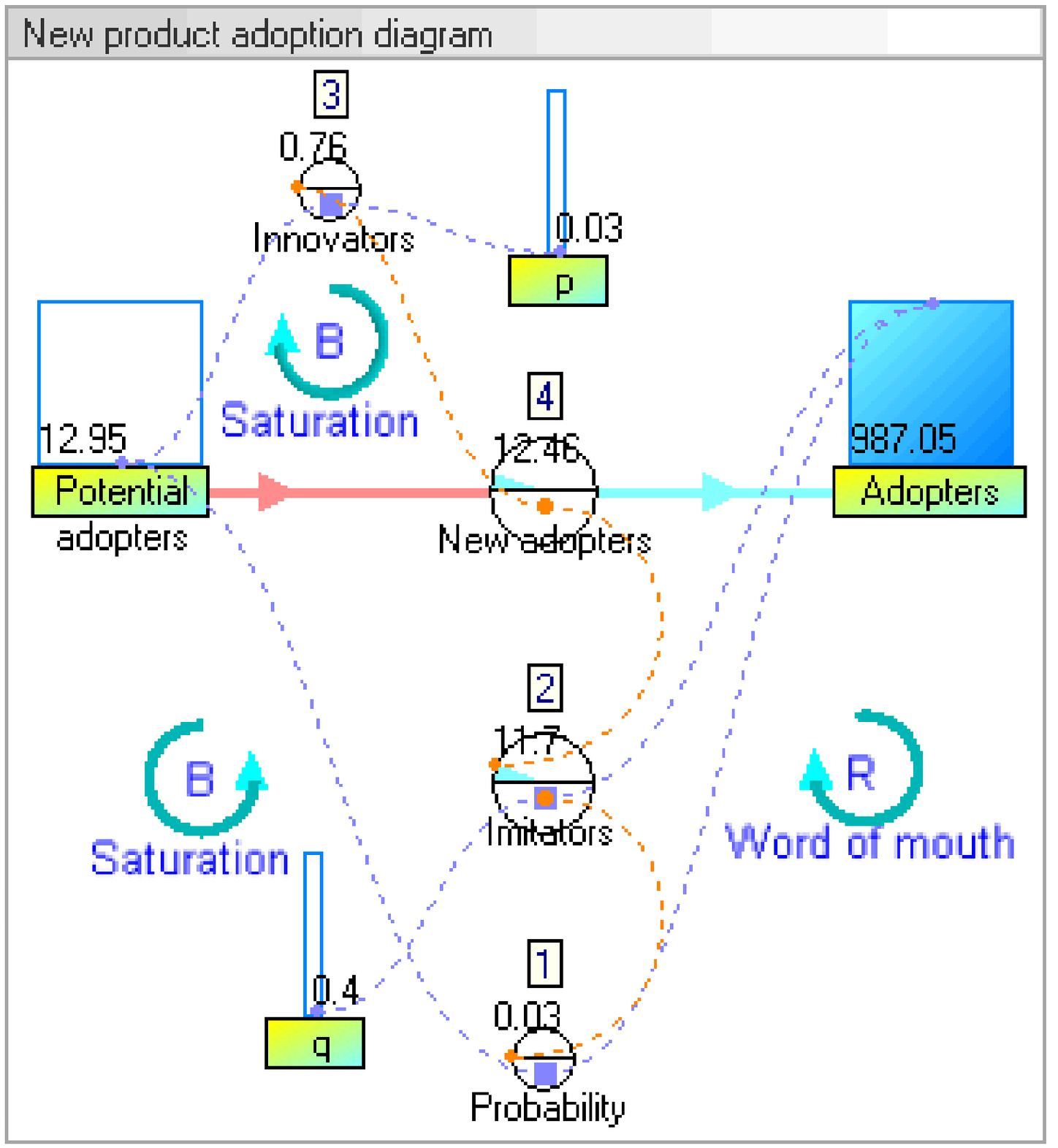
Stocks and Flows

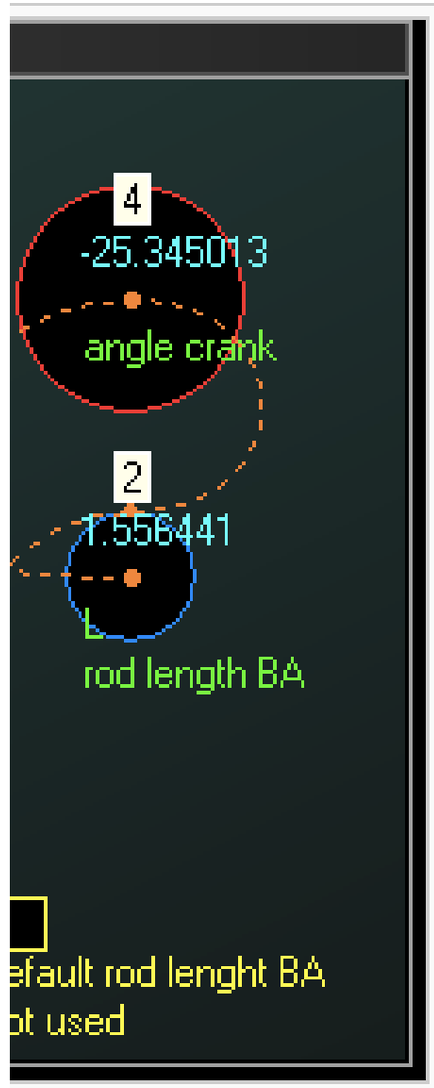
2. System dynamic moc stem dynamic logic.

The figure below sho



Stock and fl

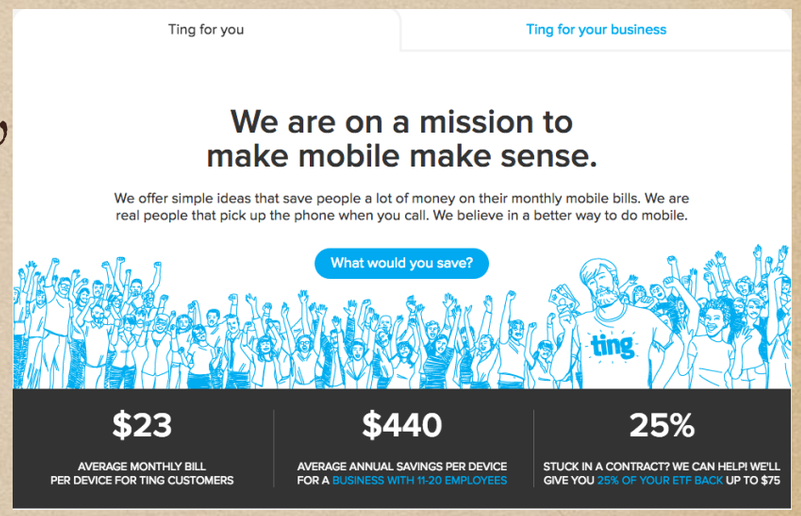




Two Stories

"The Stocks and Flows sing to me!"

~Elliot Noss

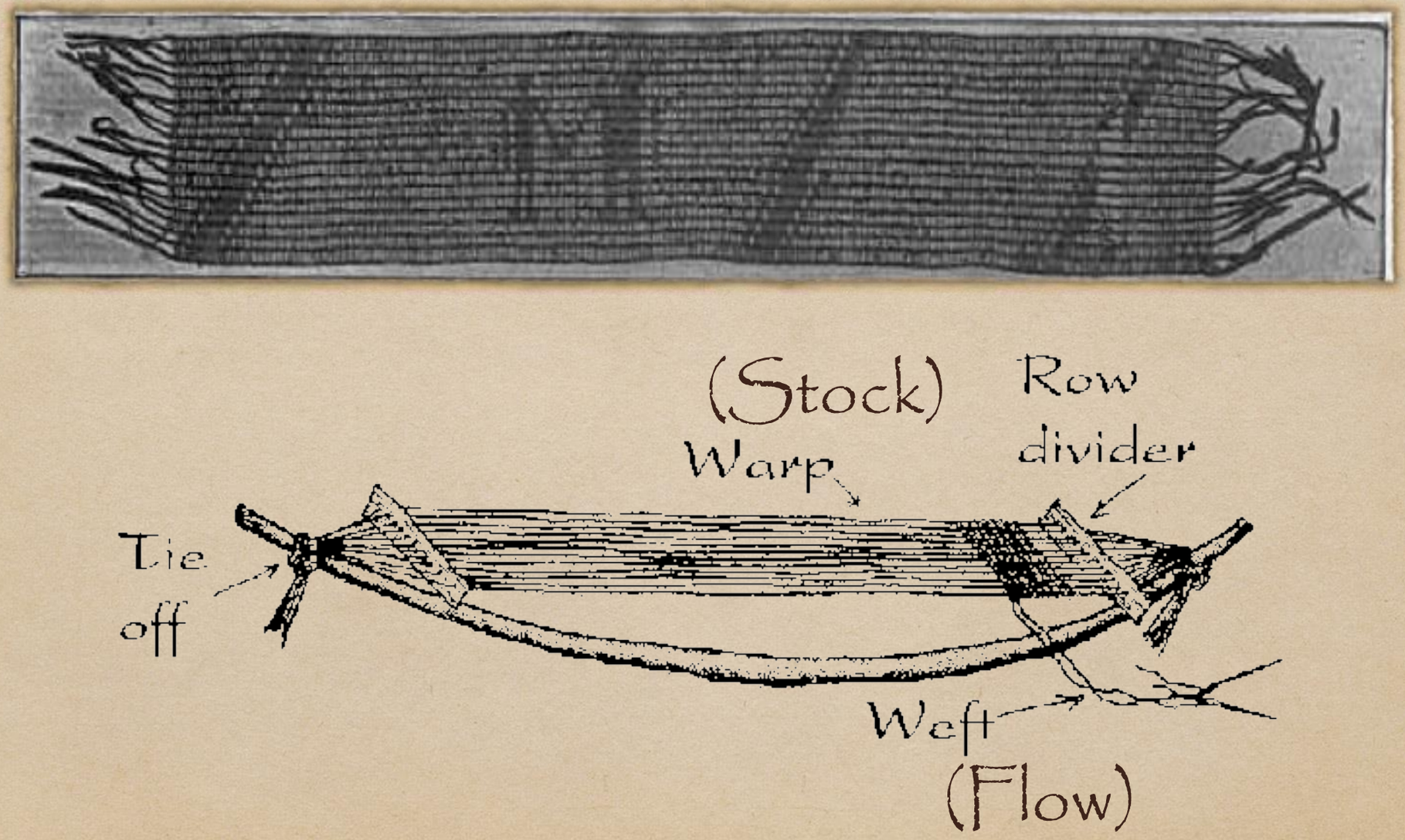


UNIVERSITY OF MASSACHUSETTS AMHERST 1863

UMassAmherst

ISENBERG SCHOOL OF MANAGEMENT

Stocks and Flow Again



Current 'Resources'

- Spreadsheet with 220 Experience Records for the Carbonate Analysis Usecase described here.
- Python code that translates these experience records into an double entry journal
- Jupyter notebook that generates reports using financial accounting software with the double entry journal as input
- I've reached my limit for working on my own, it's time for a team. With this talk I start my recruiting of students and other 'Resources' required to fully develop the potential of this new approach.

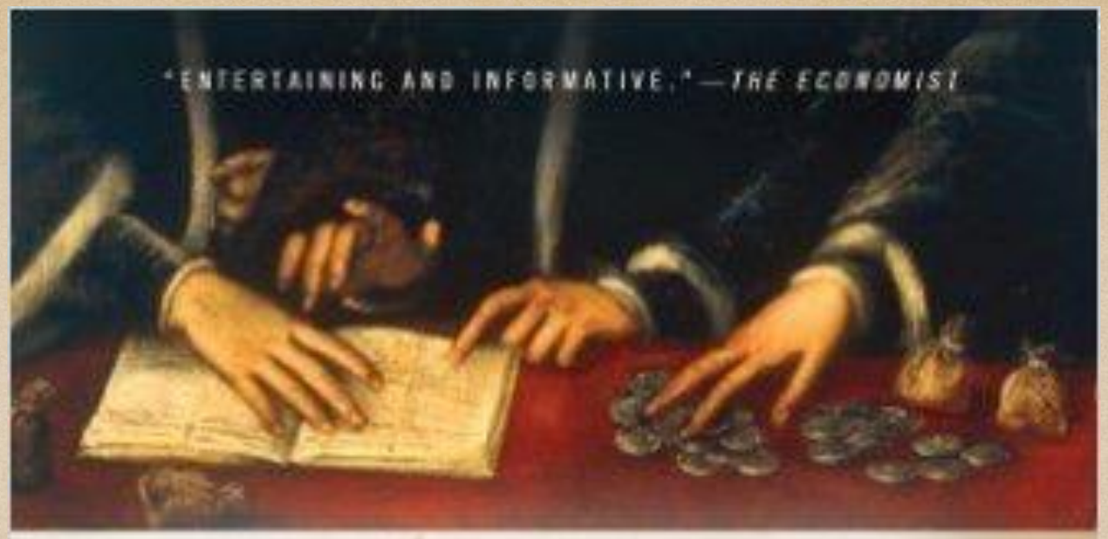
A Possible Future Commitment

Record a full research cruise full of multi-discipline shipboard 'douhle entry experiences'

Acknowledgements

- Dan Palanza (my DEB mentor)
- Patience, advice, and unders
  - Larry Lannom
  - Cyndy Chandler
  - Joyce Searls
  - Doc Searls
  - Peter Fox
  - Steve Lerner
  - Jane Gleeson-White
  - Stace Beaulieu

- plus many, many, many, others!



JANE GLEESON-WHITE

DOUBLE ENTRY

HOW THE MERCHANTS OF VENICE CREATED MODERN FINANCE