COSMIC AND QUALITY OF REQUIREMENTS

Sylvie Trudel, PhD, professor, UQAM
软件的老市，蒙特利尔魁北克大学

IWSM-Mensura 2018, Beijing, China, September 18-20

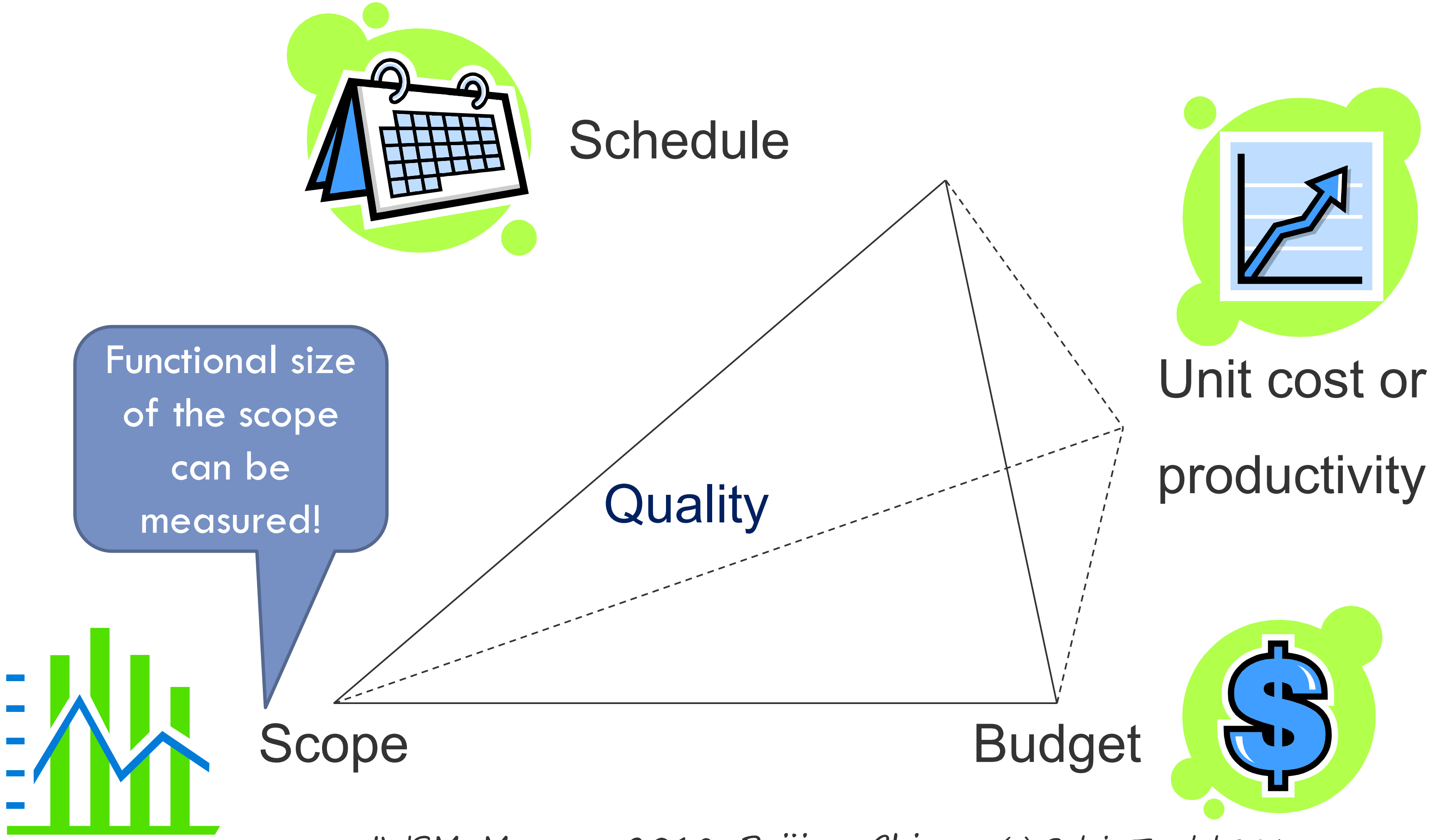
Agenda

- Quality of requirements
- The COSMIC method overview
- Defect detection experiments
- Requirement defects vs. Functional size
- Discussion

QUALITY OF REQUIREMENTS

Why and how it influences software project performance indicators

Frequent project performance indicators



Typical requirements defects

- Incomplete
- Ambiguous
- Inconsistent
- Inadequate
- Wrong
- Irrelevant
- Misplaced
- Etc.

Why the requirements' quality is important → effect of defects

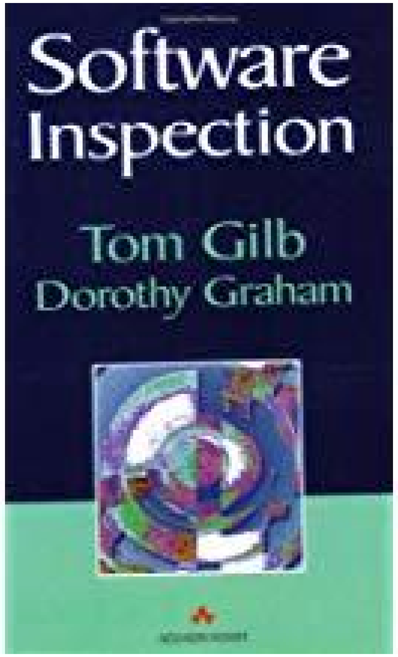
- Requirements usage:
  - Estimating → underestimation
  - Scoping → partial or wrong software product
  - Reporting → wrong accomplishment data
  - Agreement with the client → dissatisfaction

Identifying requirements defects

- Peer reviews, including inspections
- Formal requirements reviews
- Simulations
- Proof of concept
- Modelling
- Etc.

Example of an inspection method

- Adapted by CRIM from Gilb & Graham (1993)



1. Plan the inspection

[Document ready for inspection]

2. Open the inspection

[Commitment obtained from participants]

3. Inspect the product

[Defects found]

4. Explain issues (logging meeting)

[Defects understood by author]

5. Update the inspected product

[Defects corrected]

6. Re-check with issues

[No new defect introduced]

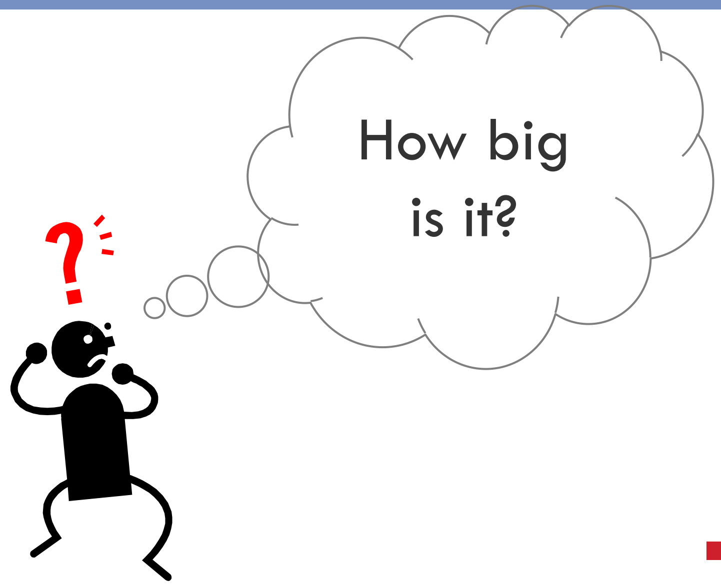
7. Close the inspection

[Defects corrected and inspection data collected]

The COSMIC Method Overview

Why and how it measures
the software functional size

Why do we measure the software size of projects?



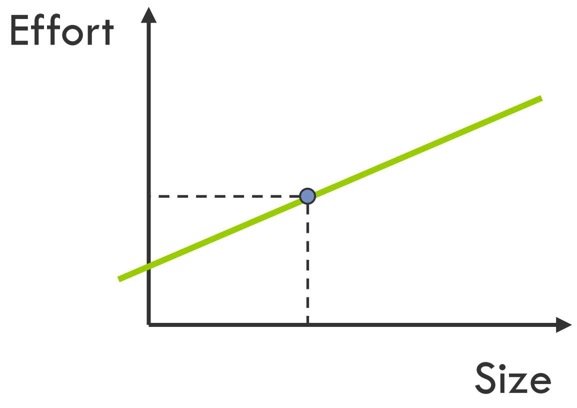
Four typical needs:

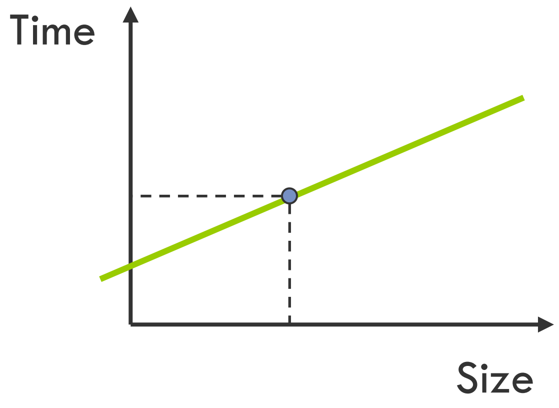
1. Process productivity
2. Estimation
3. Benchmarking
4. Governance

- Need for objectivity, repeatability, and reproducibility
- How to measure software size independently from technology?
  → Solution:
    Measure functional size with the ISO 19761 standard

Productivity of software projects

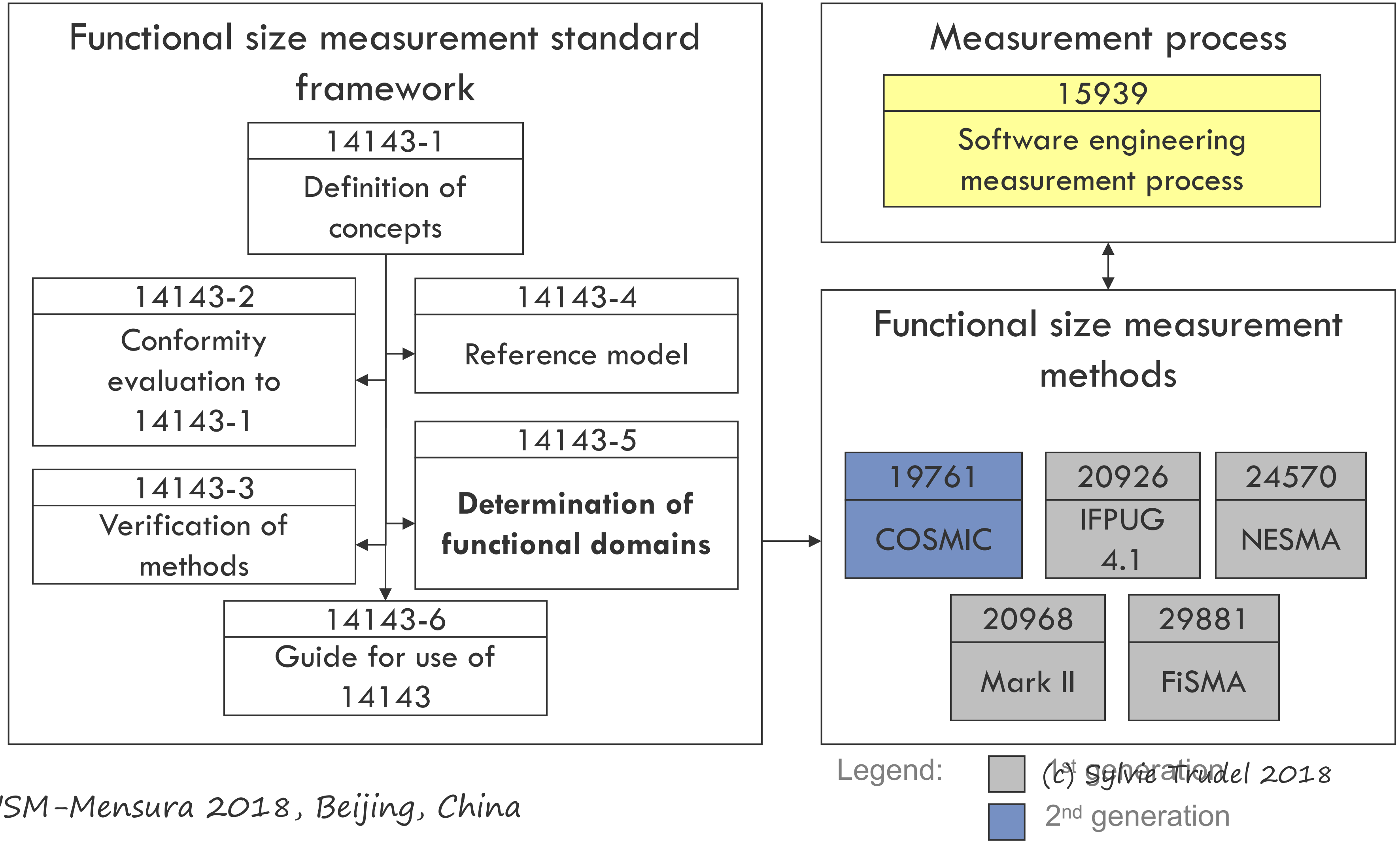
- Strong correlation between:



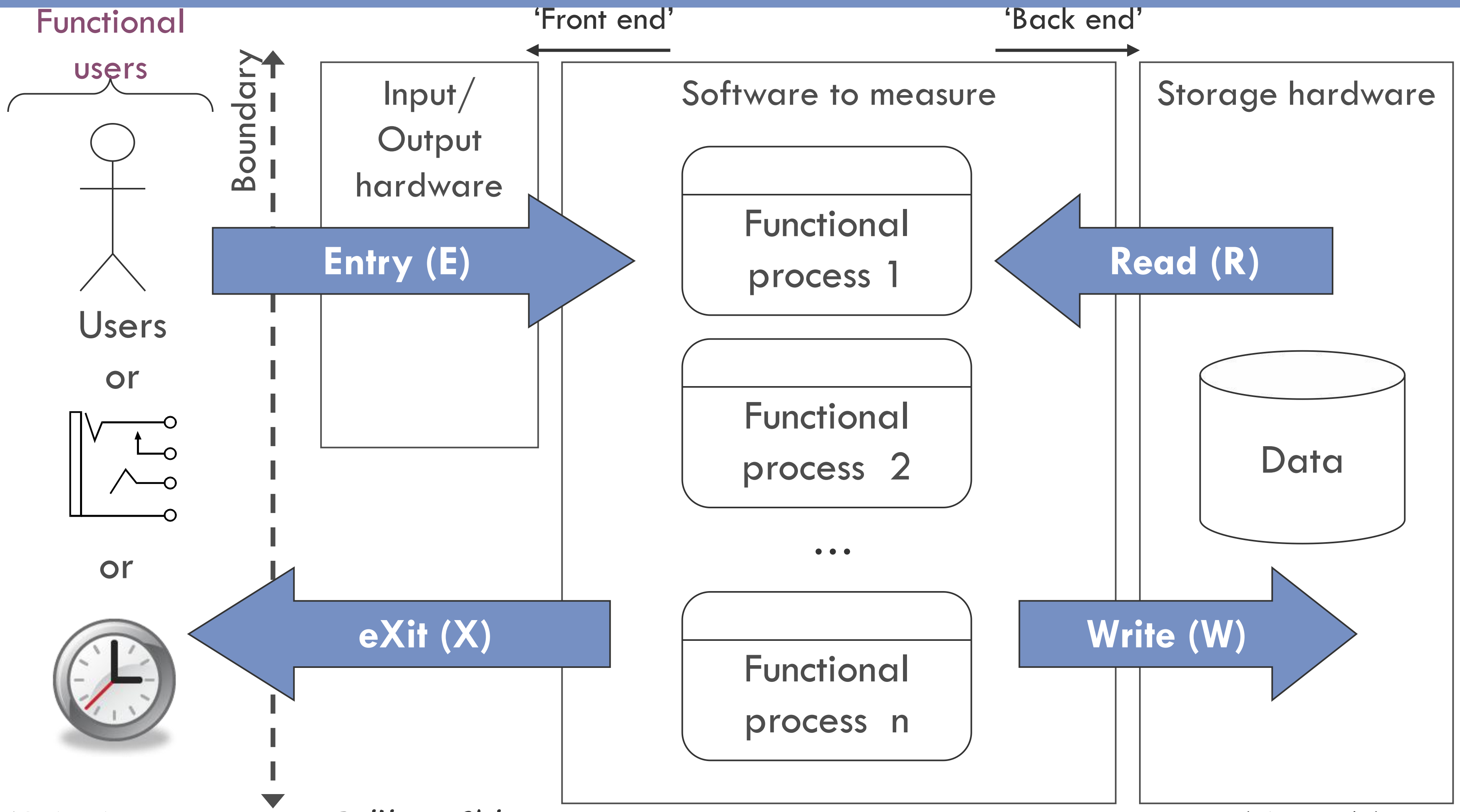


- Unit cost = Effort / Size → hours/size-unit
- Productivity = Size / Effort → size-unit/person-month
- Delivery rate = Size / Time → size-unit/month

ISO/IEC standards related to functional size measurement



COSMIC Overview



Defect Detection Experiments

Comparative study to assess the efficiency and effectiveness of peer reviews and COSMIC as a means to identify defects in software requiments

COSMIC

Research goal

- Contribute to improve the quality of functional software requirements by assessing efficiency and effectiveness of the COSMIC method as a means to identify defects and then compare the results with a peer review approach

Peer reviews derived measures

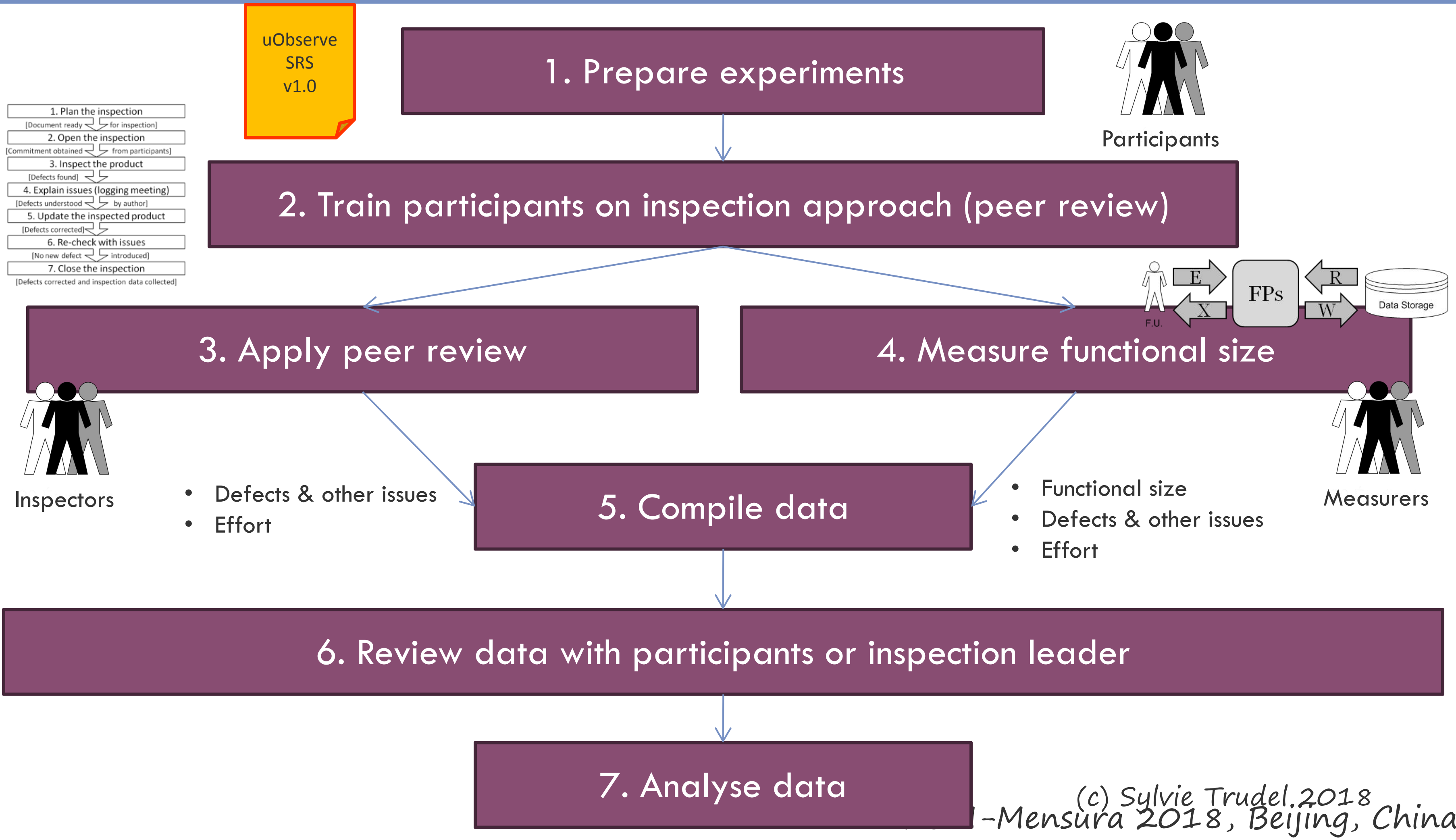
- Effectiveness (unit cost) = (minutes/defect) $\frac{\text{Effort}}{\text{\# defects found}}$

- Efficiency (%) = $\frac{\text{\# defects found}}{\text{Total \# of defects}}$

- Only consider Critical, Major and Minor defects
  - Drop spelling & syntax errors and other issues (improvement suggestions & questions)

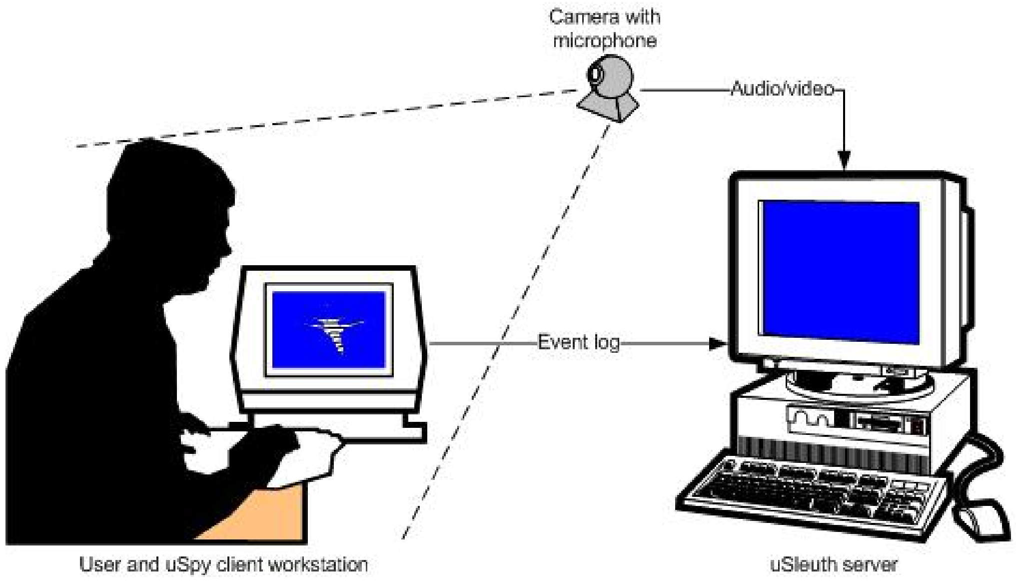
Source: (Weigers 2002)

Experiment protocol overview

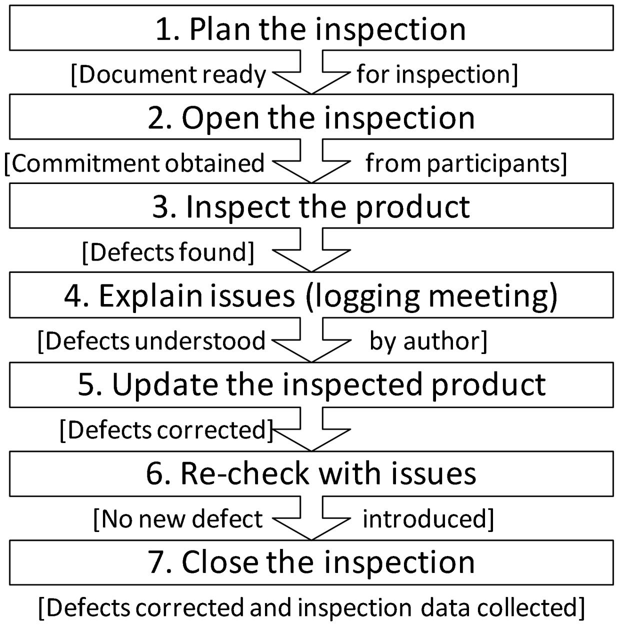


Prepare experiments: select material and methods

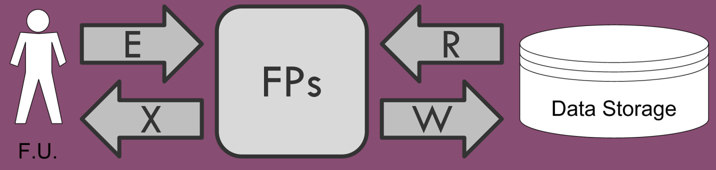
uObserve SRS



Inspection method from CRIM (adapted from Gilb & Graham)



The COSMIC Method



The uObserve SRS

uObserve
SRS
v0.1

1. Peer reviewed
2. Defects fixed
3. Software developed ~~successfully~~
4. SRS reviewed by industry expert
5. Defects fixed

uObserve
SRS
v1.0

Event-based system

2 software boundaries

2900 words

10 use cases

Compliant w/ UML 2.0

Compliant w/IEEE Std 830

1st phase of experiments

Research objectives

1) Determine **effectiveness** (unit cost), when allotted **limited effort** as applied in the industry

2) Determine **efficiency**

3) Determine whether it is advantageous to include a measurer role in a peer review team

Phase 1: Compare efficiency and effectiveness (unit cost) of COSMIC and an inspection approach

Expert practitioners experiment

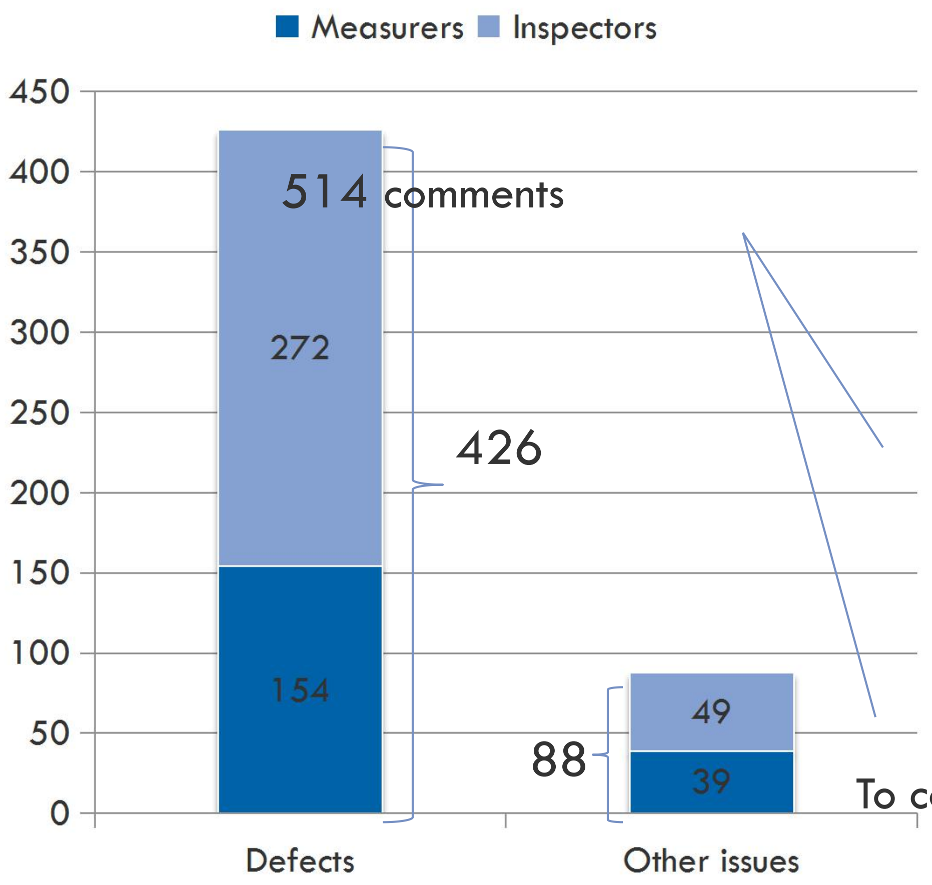
Practitioners with limited experience experiments

17 Inspectors

18 Measurers

35 participants!

Defects & other issues: Raw Data



426 Defects
-153 **Duplicates**
-30 **Rejected**
-58 **Non Functional** defects
-31 **Spelling** or **syntax** defects

154 Unique functional defects, major & minor

= **100%**
To compute efficiency

Defect analysis

- Inspectors and measurers find defects of different nature
- Measurers find more defects of a higher severity than inspectors
- Defects affecting functional size:
  - Ambiguous functional descriptions
  - Missing functional processes
  - Missing error handling
  - Ambiguous data groups
  - Ambiguities due to multiple occurences

What if ... a measurer replaces an inspector

Efficiency

- Average efficiency with 2 to 4 inspectors = 19.2%
- Adding an inspector = 23.6%
- Adding a measurer = 22.4% (↓1.2%)

→ But: measurers find higher severity defects!

Effectiveness

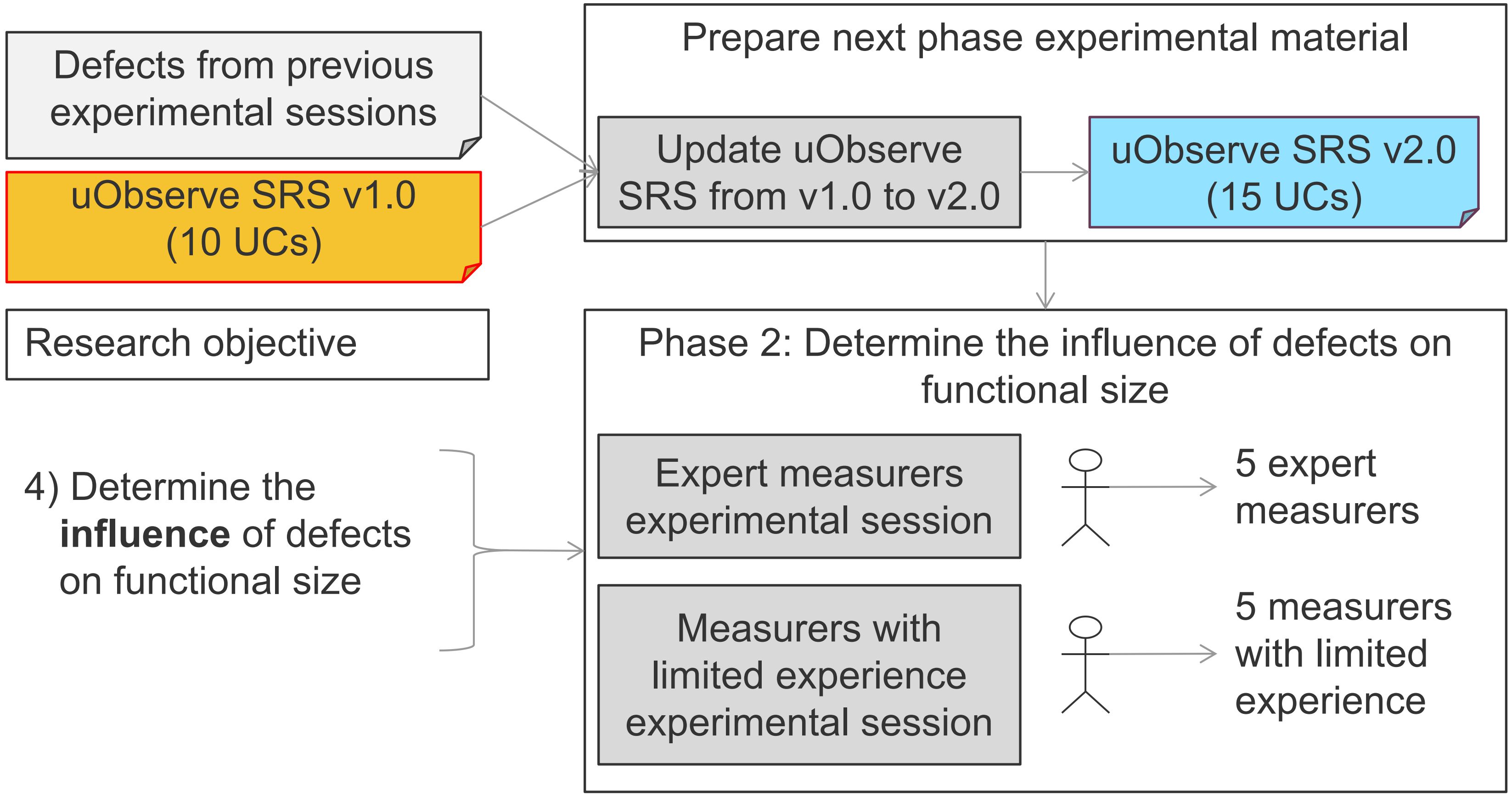
- Average effectiveness with 2 to 4 inspectors = 49.6 min/defect
- Adding an inspector = 32.4 min/defect **Better**
- Adding a measurer = 28.0 min/defect **Best!**

→ Plus: you get the size measured!

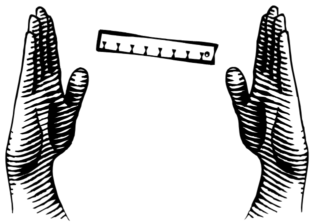
Requirement defects vs. Functional size

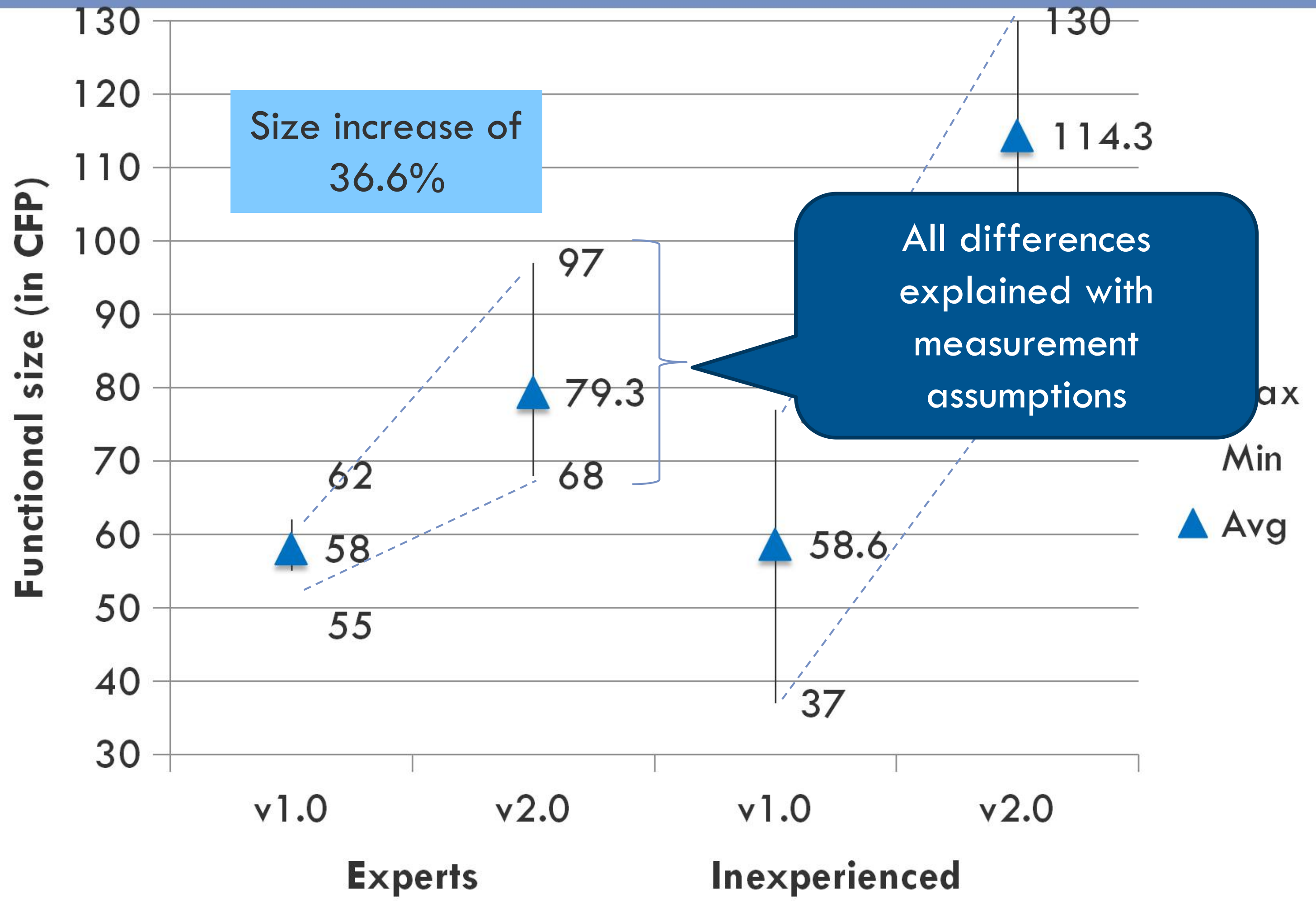
Exploring the consequences experimentally

2nd phase of experiments



Functional size: comparing results





Data analysis summary

Objective: Determine the influence of defects on functional size

- Defects in requirements influence the functional size: Up to 39%
- Important decrease of new defects identified: -86%
  - However, some measurers said they would have found more defects if they had more time
- All differences among individual results were explained through 20 written measurement:
  - Level of decomposition
  - Identified boundaries
  - Identified functional users
  - Identified functional processes
  - Absence of a data model

Discussion

And future work

Discussion

- Exploration of the value-added of having a measurer as part of an inspection team
- Relation between requirements defects and functional size
- Practical new usage of the COSMIC method
- Shifting of the measurement cost from management cost (indirect) to software engineering cost (direct)

Future work

- Process residual defects into uObserve SRS v3.0
  - Include a verified measurement case study

COSMIC

www.cosmic-sizing.org

