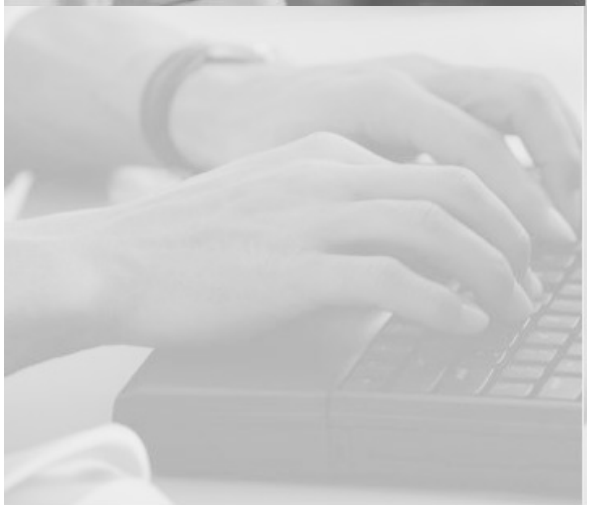
SIXTH INTERNATIONAL CONFERENCE ON QUALITY SOFTWARE



An Empirical Study on the Adoption in Practice of a Size Measurement Procedure

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- RmFFP: a measurement procedure
- The Method Evaluation Model (MAM)
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  - Validity evaluation
- Conclusions and Future work

Introduction

2004 - present

Earlier measurement of functional size using high-level specifications [Condori et al].

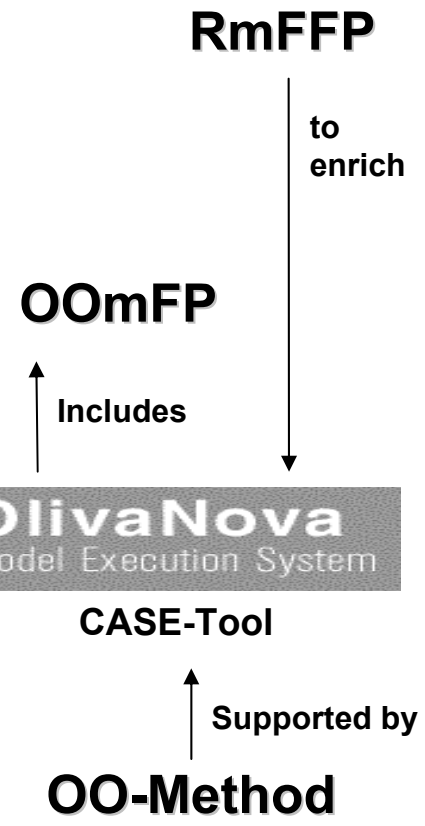
2001 - 2004

Automated module for obtaining the functional size of applications from **conceptual models** in **function points** [Abrahao et al].

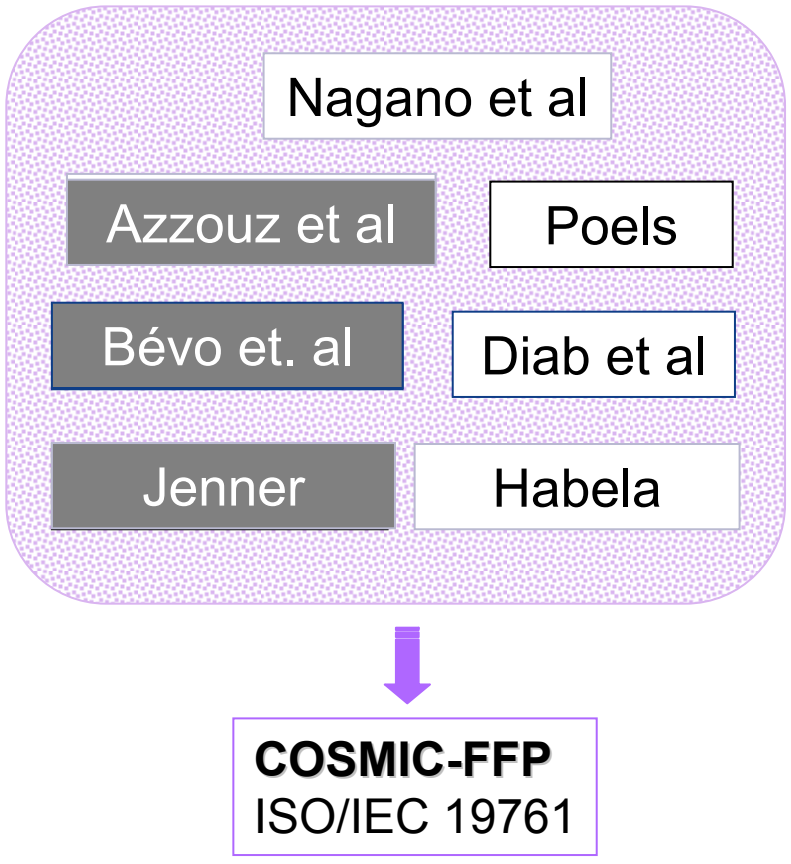
Automatic code generation tool

1996 - 2002

Method based on model transformation



Introduction



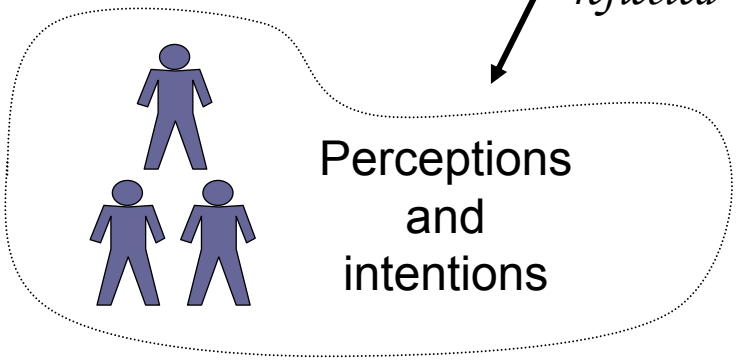
Three proposals that attempt to measure the system functionality at the **requirements level**

Introduction

- This is possible due to the code generation features of the OO-Method approach.
  - Traceability
  - Consistency

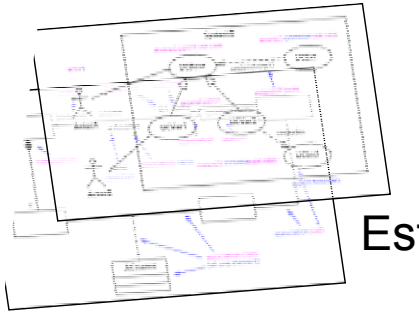
} Measurement quality

reflected



Empirical study

RmFFP



Estimated size

much closer

Actual size

of final software product

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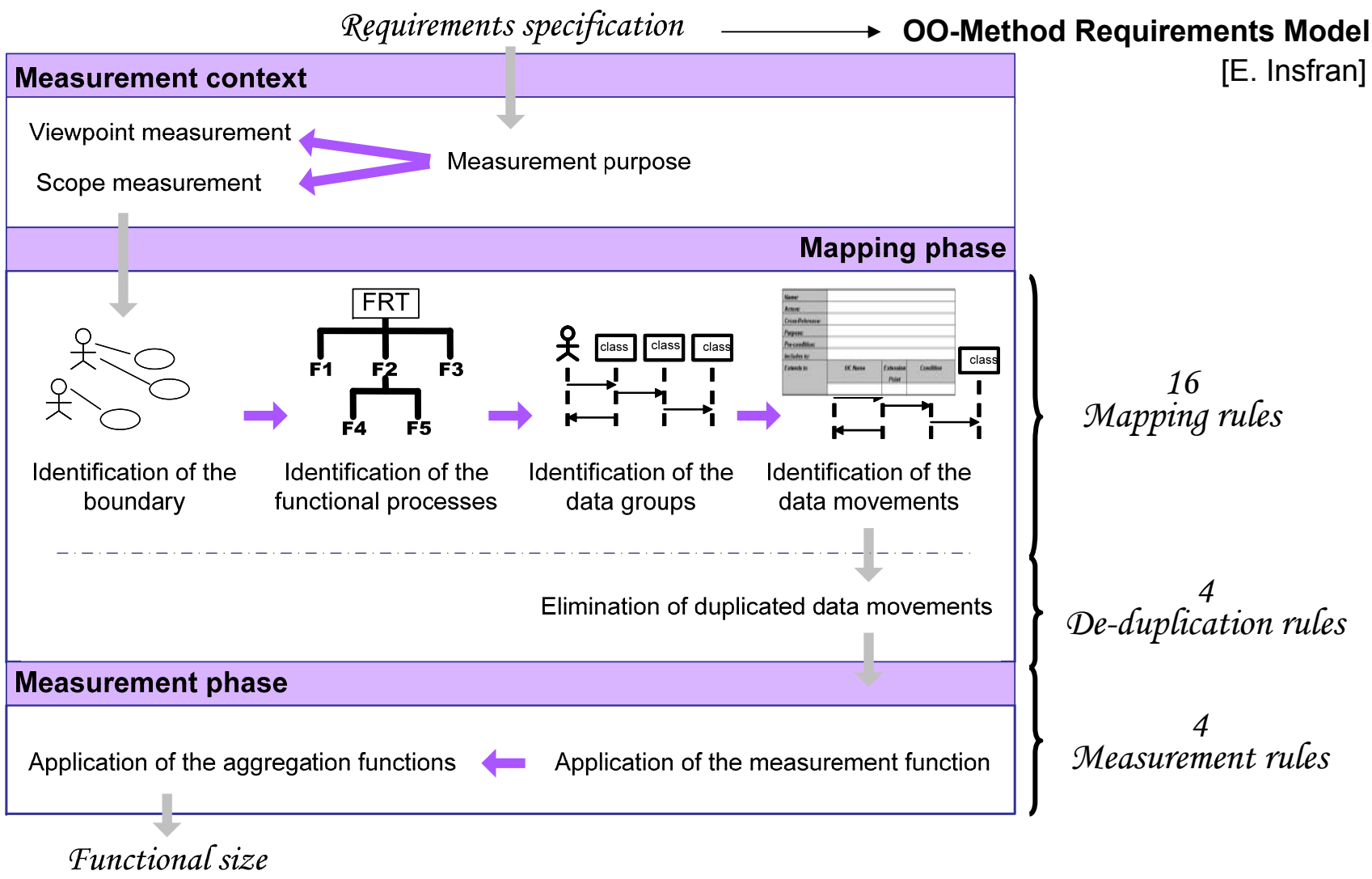
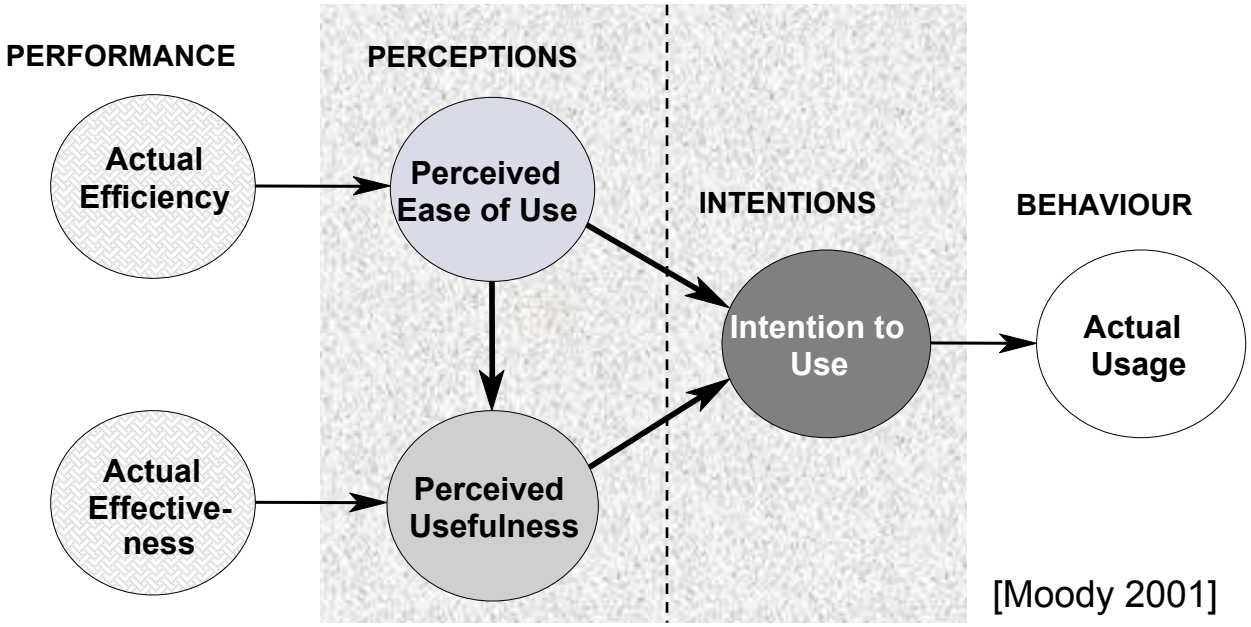
Measurement process

RmFFP: a measurement procedure



Method Evaluation Model



[Moody 2001]

This model was applied by Poels, Abrahao et al.,

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Evaluating the adoption in practice

To analyze functional size measurements

For the purpose of evaluating RmFFP

With respect to its adoption in practice

From the point of view of the researcher.

In the **context** of computer science students measuring OO-Method requirements specifications.

GQM: [Basili et al.]

RQ1: Is RmFFP perceived as easy to use and useful?

RQ2: Is there an intention to use RmFFP in the future?

RQ3: Are the perceptions really a result of actual performance using RmFFP?

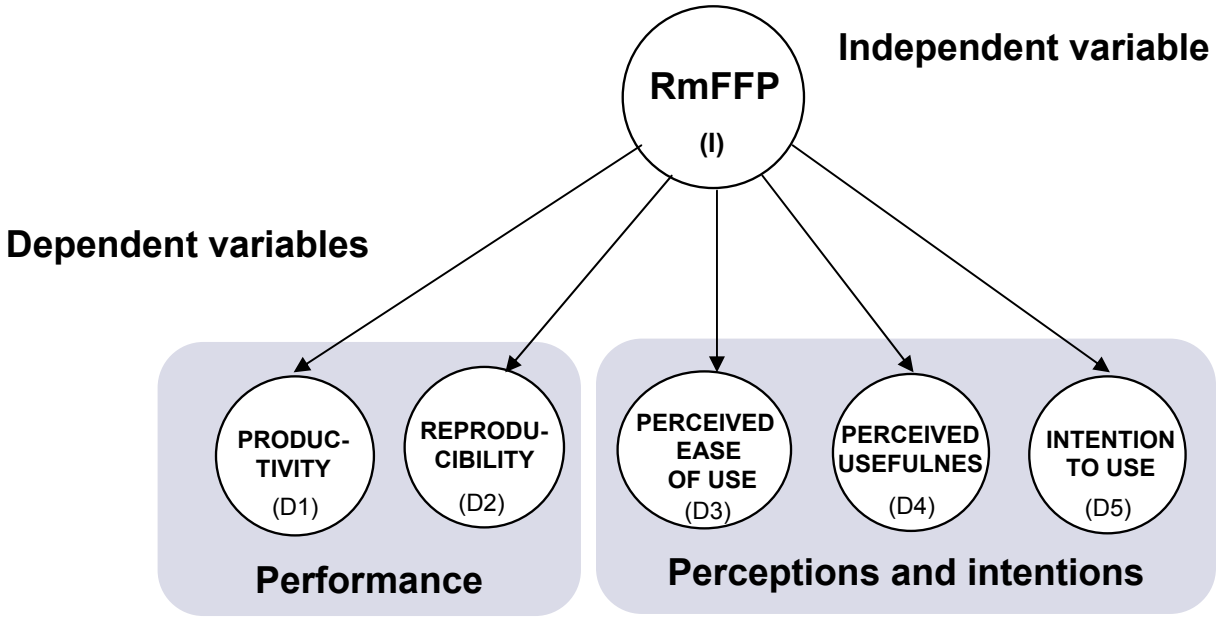
RQ4: Is the intention to use really a result of the perceptions experienced by the subjects using RmFFP?

Evaluating the adoption in practice

- **Subjects**
  - 35 computer science students at the Valencia University of Technology who had similar backgrounds in the use of the OO-Method Requirements Model.
  - These subjects were students enrolled in the “Software Development Environments” course (February until June of 2005).
- **Experimental objects**
  - Requirements specifications using OO-Method

Evaluating the adoption in practice

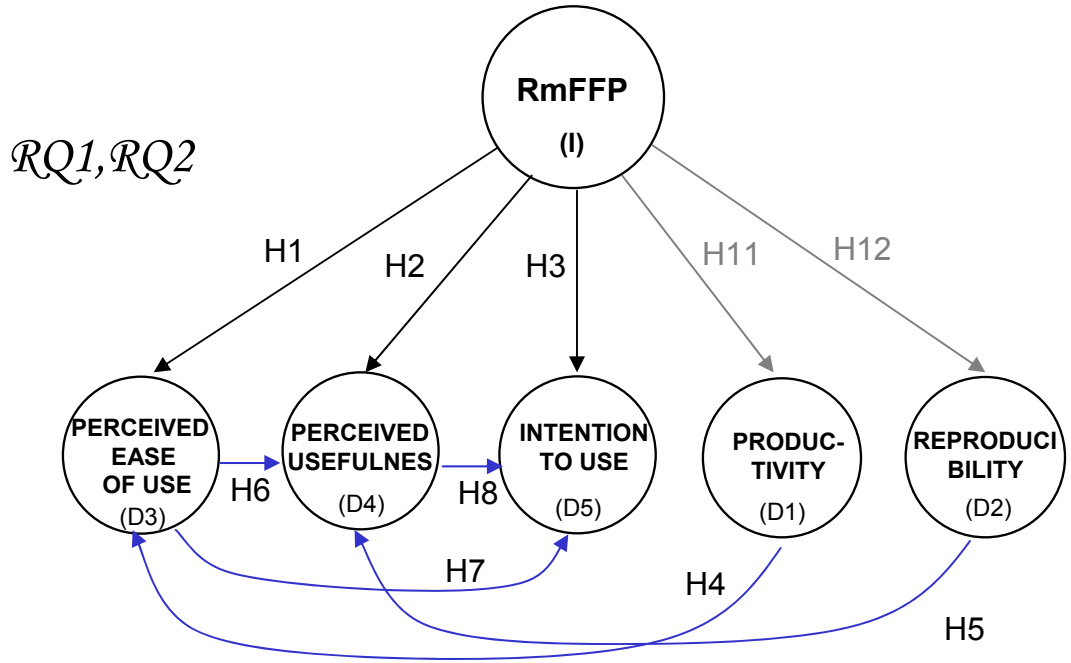
- **Selection of variables**



MEM constructs

Evaluating the adoption in practice

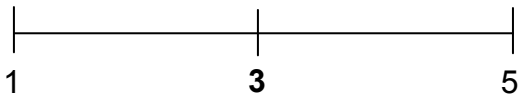
- **Identification of Hypotheses**



Evaluating the adoption in practice

- **Instrumentation**
  - **Experimental object:** requirements specification of a car rental application with thirty-five use cases.
  - **Training materials:** instructional slides on the OO-Method requirements model and the RmFFP procedure, an example of the application of RmFFP, and a measurement guide.
  - **Survey instrument:** this included thirteen closed questions adapted from Abrahao.
    - **Perceived ease of use:** 5 items (Q1,Q3,Q4,Q6,Q9)
    - **Perceived usefulness:** 5 items (Q2,Q5,Q8,Q10,Q11)
    - **Intention to use:** 3 items (Q7,Q12,Q13)

5-point Likert scale



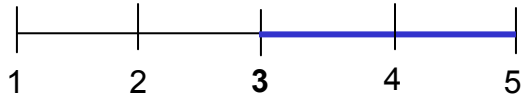
Evaluating the adoption in practice

- **Data analysis: Perceptions and Intentions**

Descriptive statistics for the MAM constructs

33 students

Statistic	PEOU	PU	ITU
Mean	4.2424	3.9394	3.8586
Standard dev.	0.5190	0.4108	0.4932
Minimum	3.20	3.00	2.67
Maximum	5.00	4.60	4.67



Testing the hypotheses H1, H2 y H3

$H_o: \mu \leq 3, \quad \alpha = 0.05$

$H_a: \mu > 3$

RQ1: Is RmFFP perceived as easy to use and useful?

RQ2: Is there an intention to use RmFFP in the future?

Evaluating the adoption in practice

- **Data analysis: Perceptions and Intentions**

One-sample t-test for the MAM constructs

Statistic	PEOU	PU	ITU
Mean Difference	1.2424	0.9394	0.8586
95% Conf. Interval for the diff.	1.0584 (lower) 1.4265 (upper)	0.7937 (lower) 1.0850 (upper)	0.6837 (lower) 1.0335 (upper)
T	13.7510	13.1380	10.0000
1-tailed p-value	0.000	0.000	0.000

p-value< 0.001

H1 H2 H3

High level significance

Evaluating the adoption in practice

- **Data analysis: MEM relationships**

RQ3: Are the perceptions really a result of actual performance using RmFFP?

H4: Productivity → Perceived ease of use

H5: Reproducibility → Perceived usefulness

RQ4: Is the intention to use really a result of the perceptions experienced by the subjects using RmFFP?

H6: Perceived ease of use → Perceived usefulness

H7: Perceived ease of use → Intention to use

H8: Perceived usefulness → Intention to use

H9: Perceived ease of use + Actual effectiveness → Perceived usefulness

H10: Perceived ease of use + Perceived usefulness → Intention to use

Evaluating the adoption in practice

- **Data analysis: MEM relationships**

Regression equation technique

MEM hypotheses	Predictive power	Significance level*	Con-firmed?
H4: D4 → D1	57%	Very high	Yes
H5: D5 → D2	9%	Low	No
H6: D1→ D2	2%	Null	No
H7: D1→ D3	10%	Low	No
H8: D2 → D3	14%	Medium	Yes
H9:D1+D5→D2	12%	Null	No
H10:D1+D2→D3	21%	Medium	Yes

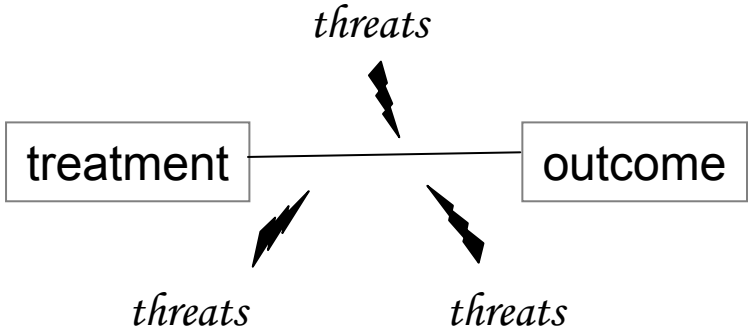
H4: Productivity → Perceived ease of use

H8: Perceived usefulness → Intention to use

H10: Perceived ease of use + Perceived usefulness → Intention to use

Evaluating the adoption in practice

- **Conclusion validity:** issues that affect the ability to draw the correct conclusion:
  - Reliability of the application of RmFFP to subjects: *following a prescribed procedure*
  - Random heterogeneity of subjects: *same level of experience working with the OO-Method Requirements Model.*



Homogeneity reduces the external validity

Evaluating the adoption in practice

- **Construct validity:** threats that concern to the generalization of the results to theory behind the experiment :
  - Constructs are not sufficiently well defined

Inter-item correlation analysis

Convergent validity (CV)
Discriminant validity (DV)

DV < CV

Results of this analysis were positive for all **PEOU, PU, and ITU** items

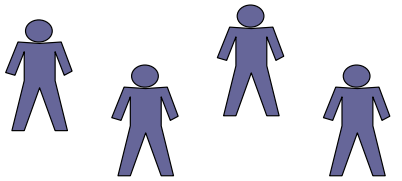
Reliability analysis

Construct	*Cronbach (α)*
Perceived ease of use	0.7
Perceived usefulness	0.5
Intention to use	0.5

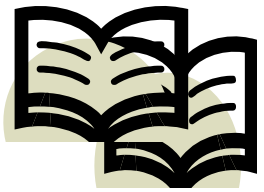
An adjustment of the questions corresponding to the constructs **PU and ITU** would be advisable

Evaluating the adoption in practice

- **External validity:** threats that concern to the generalization of the results to industrial practice.
  - Effect of no having a representative population in the experiment:
  - Effect of no having a representative material in the experiment.



*Larger number of subjects (students and **professionals**)*



Representative requirement specification

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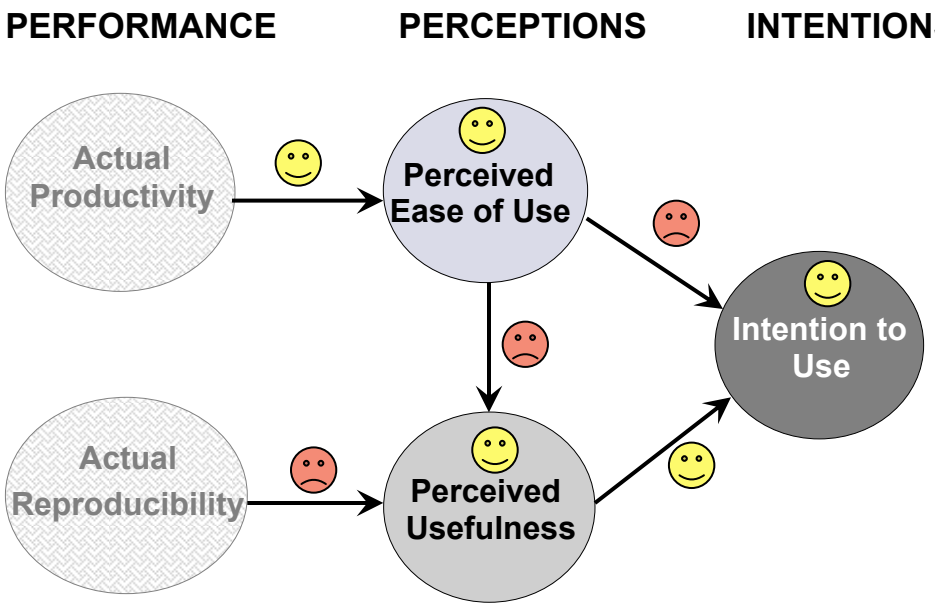
Conclusions and future work

- We have described an evaluation of the adoption in practice of a our measurement procedure (RmFFP).

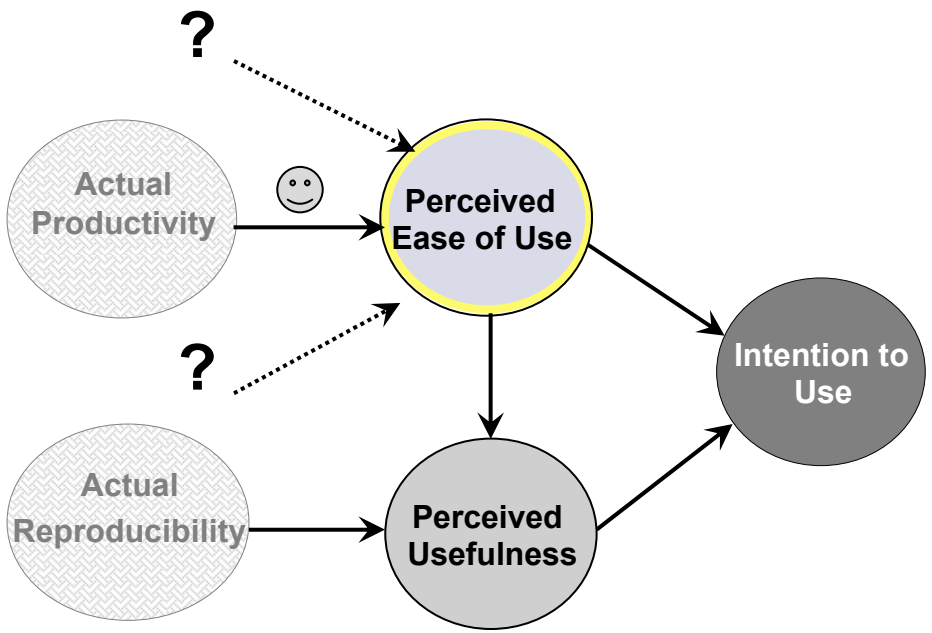
Theoretical model



Conclusions and future work

Further research

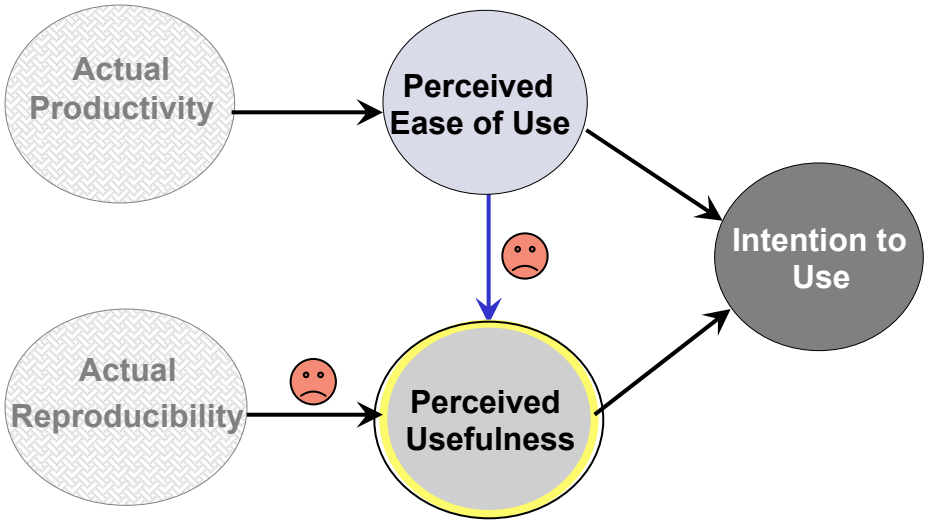
- Include other variables that contribute to determine the **perceived ease of use** when the **measurement procedure** is **automated**



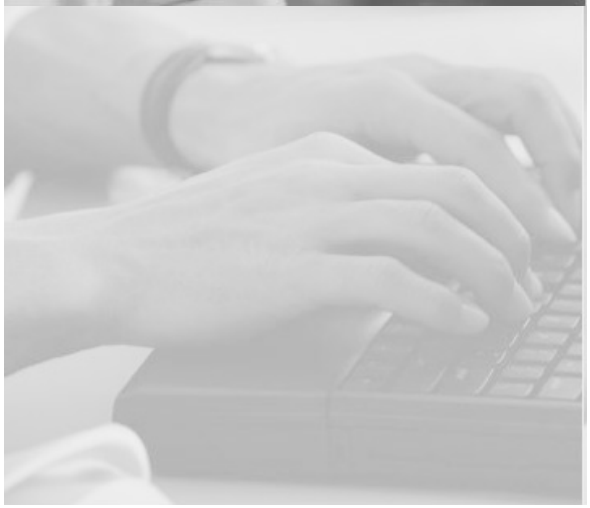
Conclusions and future work

Further research

- Identify and include other variables that contribute to determine the **perceived usefulness** in the **size measurement context**.



We plan to **adjust** the questions on the survey instrument used to replicate this empirical study .



FOR YOUR ATTENTION

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