Advances in the Characterization of Cognitive Support for Unit Testing:

The Bug-Hunting Game and the Visualization Arsenal

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Human Aspects in Software Testing

... a hunting metaphor

Testers

=

Hunters

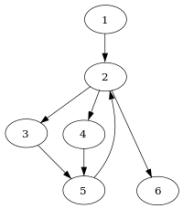
=

Game Animals

Tools

=

Snares



Techniques

=

Tactics

Human Aspects in Software Testing

... a hunting metaphor


Testers

=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=


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Human Aspects in Software Testing

... a hunting metaphor

Testers =

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=

Game Animals

Tools =

Snares

Techniques =

Tactics

Shots are the test cases

The quality of the hunter's shot determines if the target is hit or not

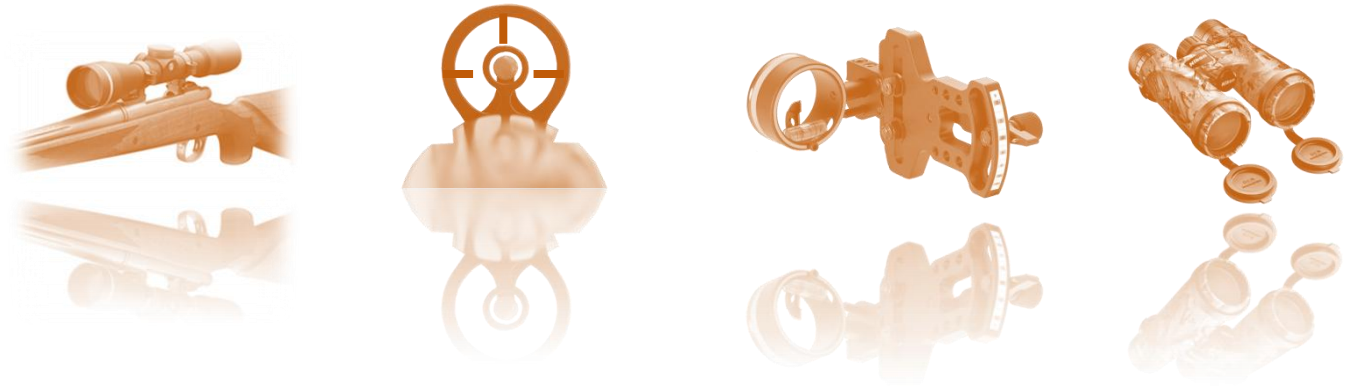
Test case: embodies tester's intention

Another factors

- **Issues possibly related to lack of <u>cognitive support</u>**
- **Proposition of a framework**

In this paper:

- **Current unit testing tool**
- **Focus on visualization "arsenal"**



Background in Visualization

Expressiveness
The capacity to transmit all – and only -- information of interest

Effectiveness
How clearly the user understands the information

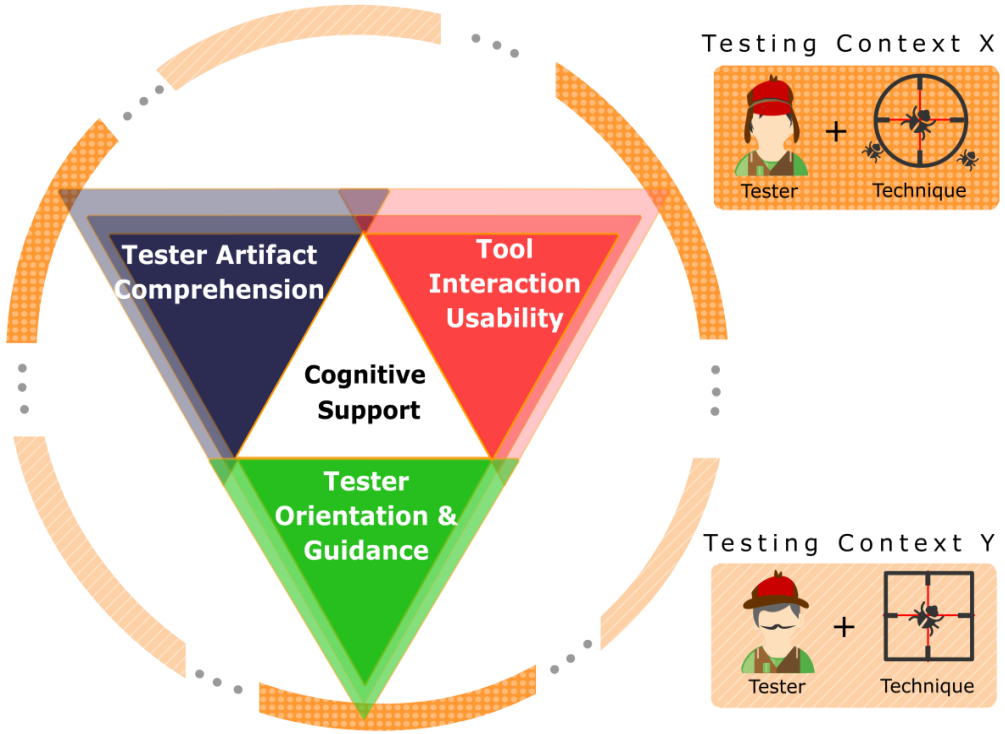
Background in Visualization

Expressiveness
The capacity to transmit all – and only -- information of interest

Effectiveness
How clearly the user understands the information

Regardless the visualization's purpose

Activity Specifics



Framework with three dimensions

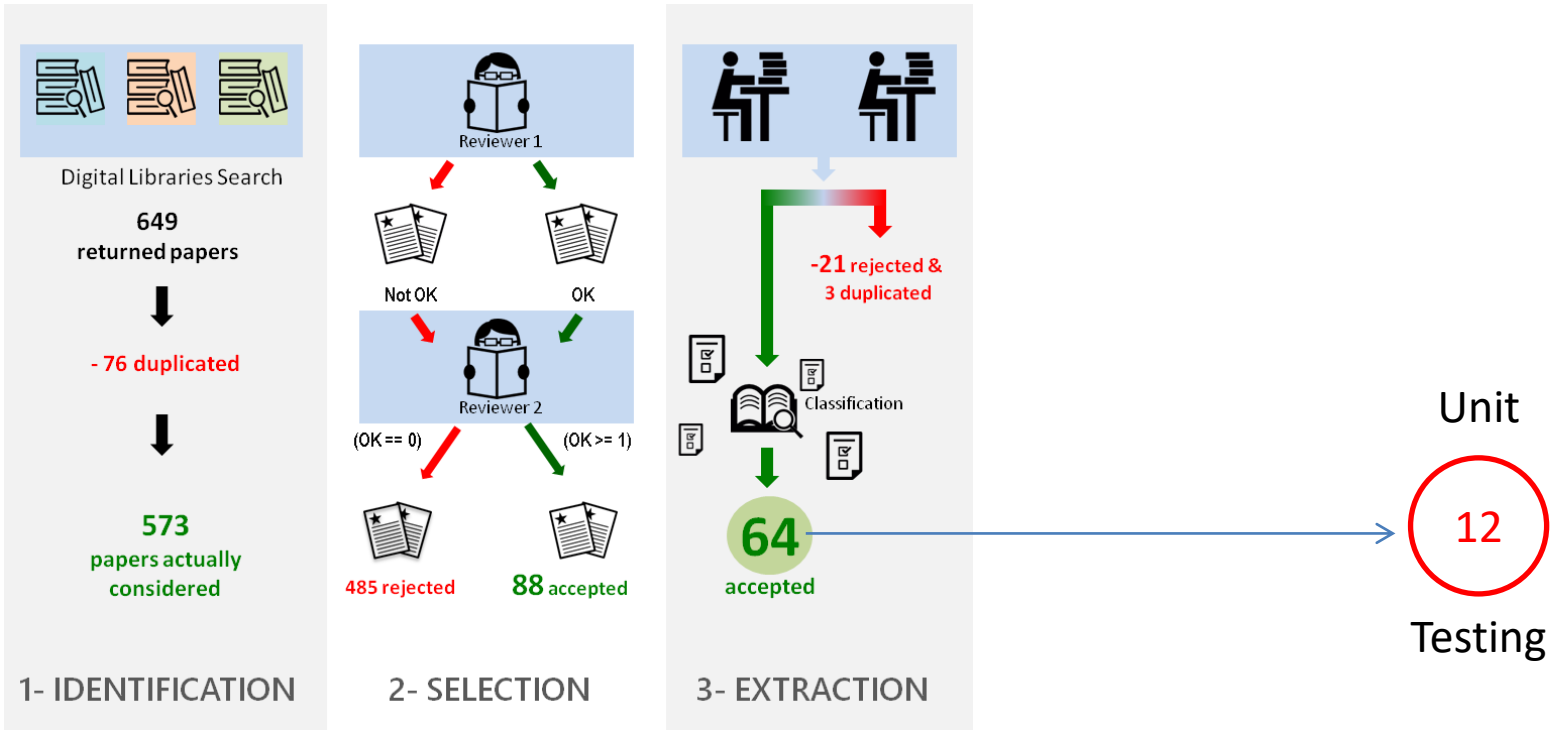
Strategy of the study

1. Visualization to Soft. testing in general → unit testing

2. Read, analyse and interrelate proposal's aspects

3. Cog. support gaps & opportunities

Previous S.M. Study (quick view)



Analysis

Research Questions:

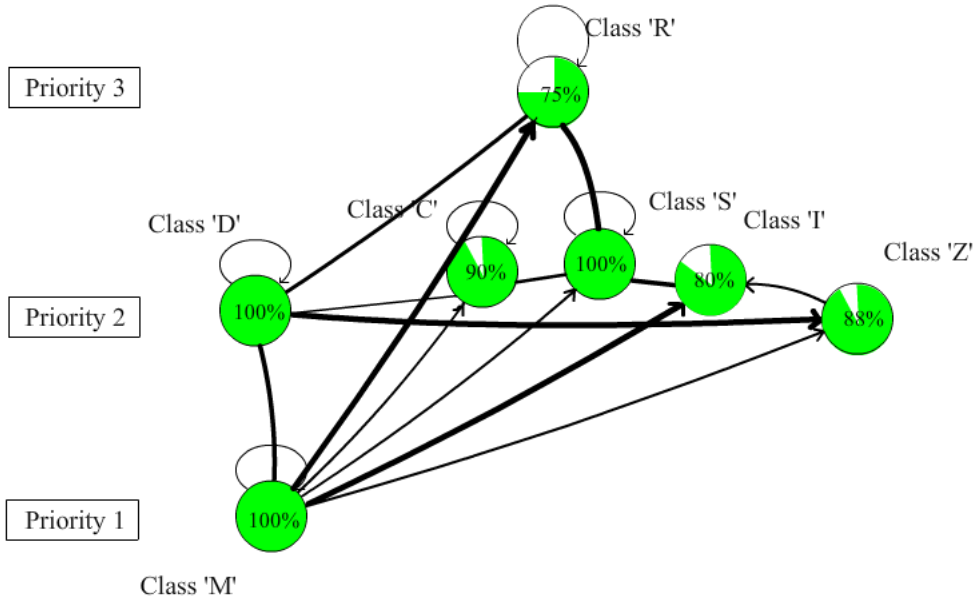
RQ1.: How the visualization address the problem of reformulating unit testing artifacts to facilitate their comprehension?

RQ2.: How the visualization addresses the problem of orienting tester on unit testing tasks?

RQ3.: How usability issues are addresses in the visualization tool?

Results and Analysis

- **Muto et al. [7]**



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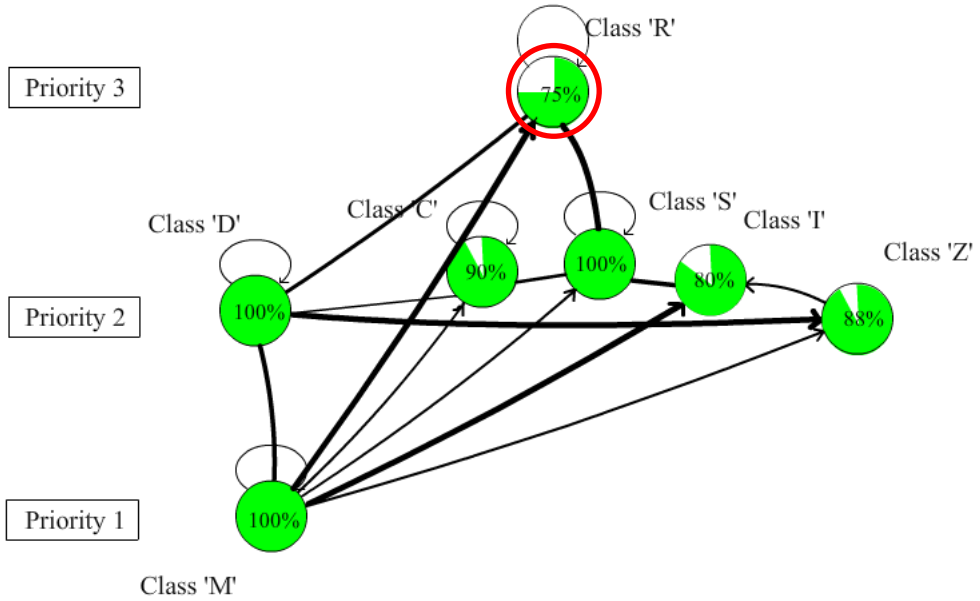

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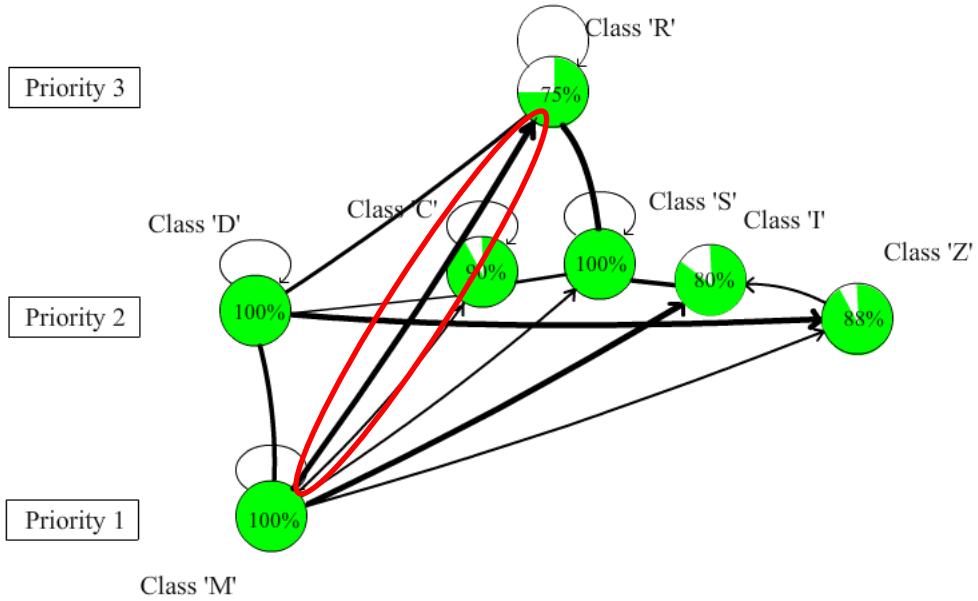

Results and Analysis

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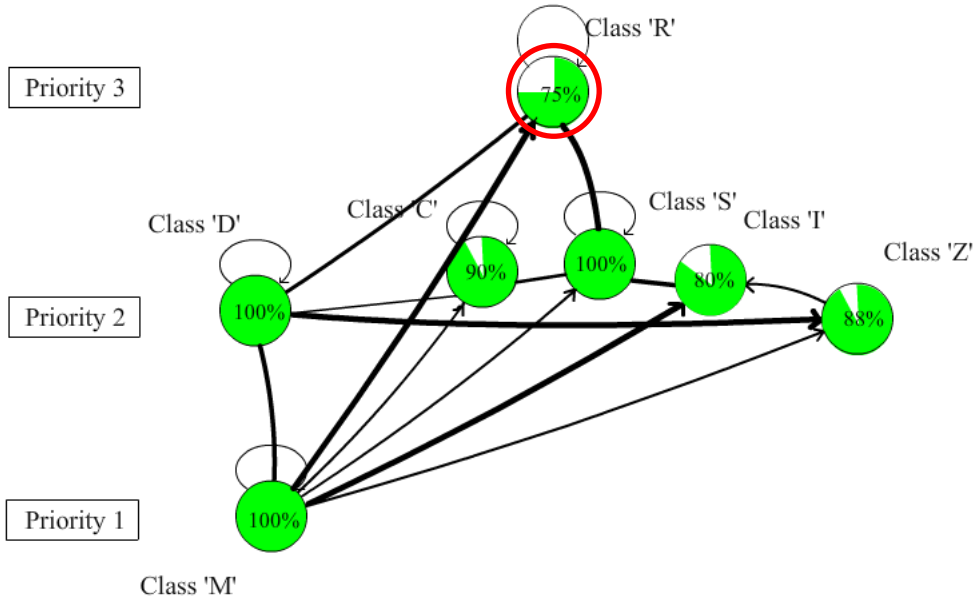
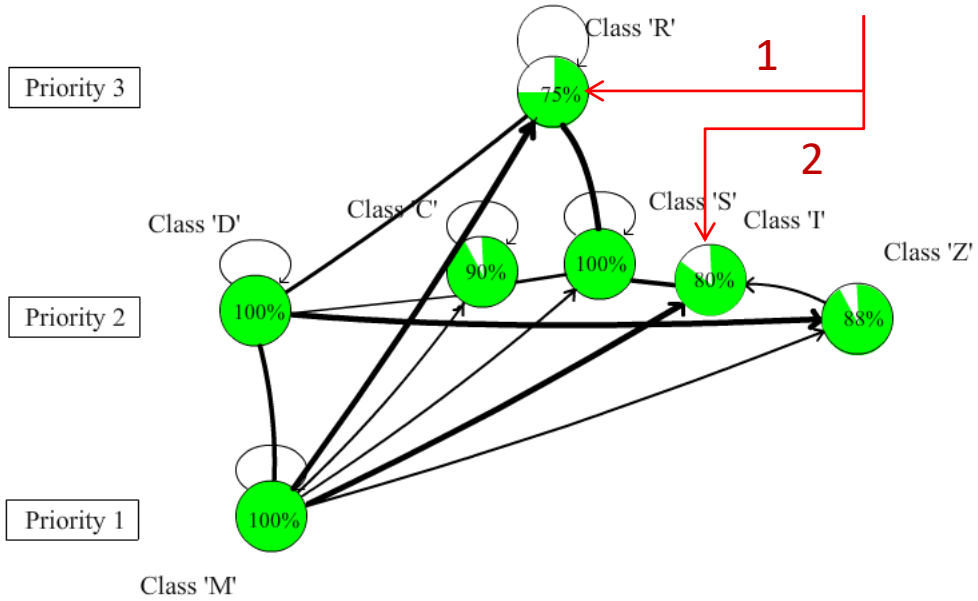


Results and Analysis

- **Muto et al. [7]**

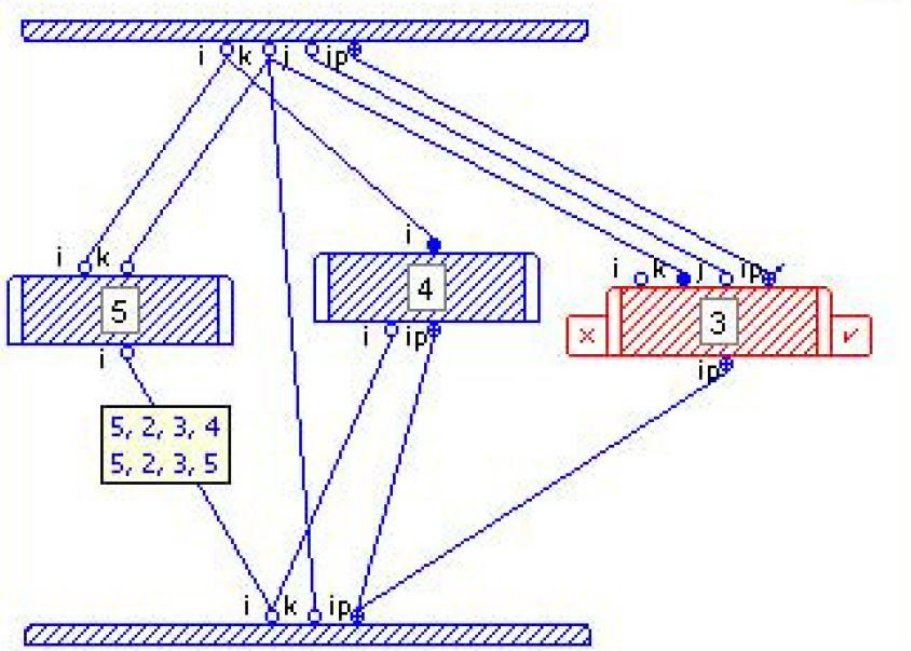
- Restrict user's scope to classes to be prioritized

- Usability aspects not addressed



Results and Analysis

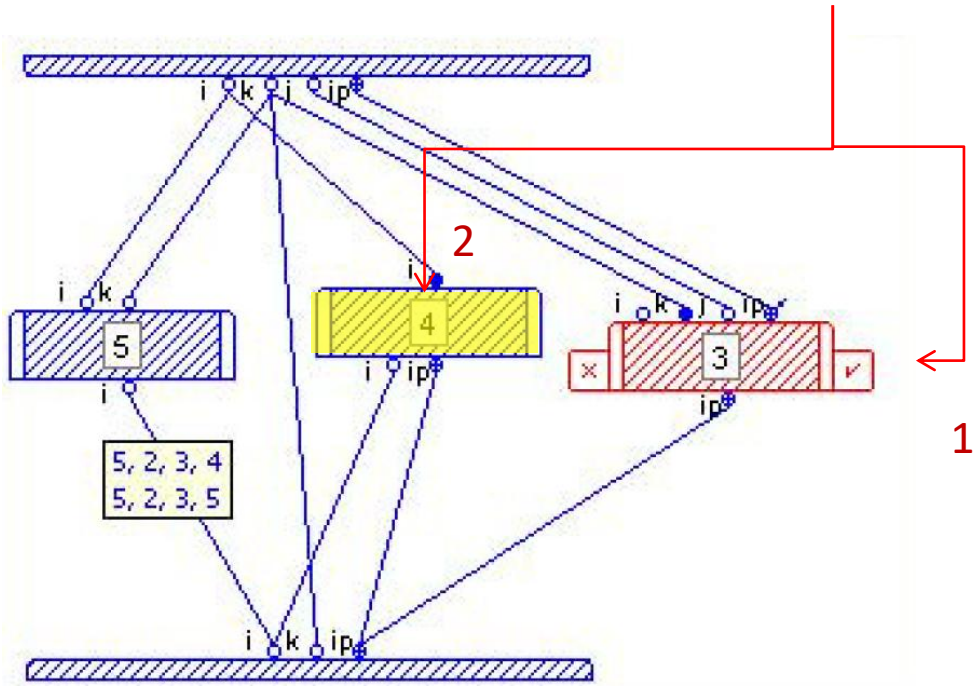
- **Karan and Abdallah [12]**



Results and Analysis

- **Karan and Abdallah [12]**

  - CFG and DFG
  - Coloring tries to restrict the scope of the user
  - Does not address usability aspects



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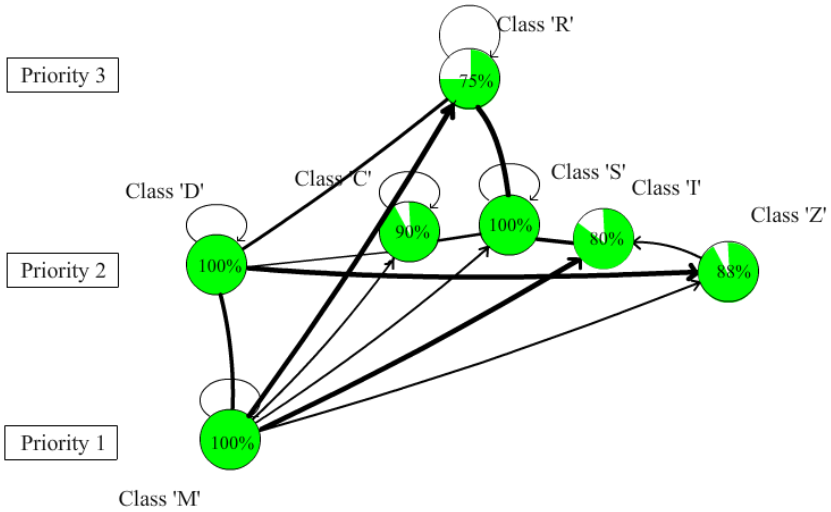

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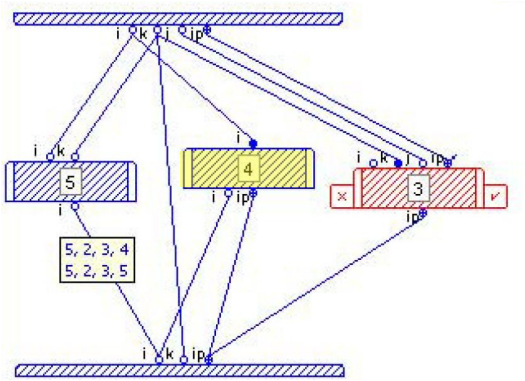

Expressiveness problems

Results and Analysis

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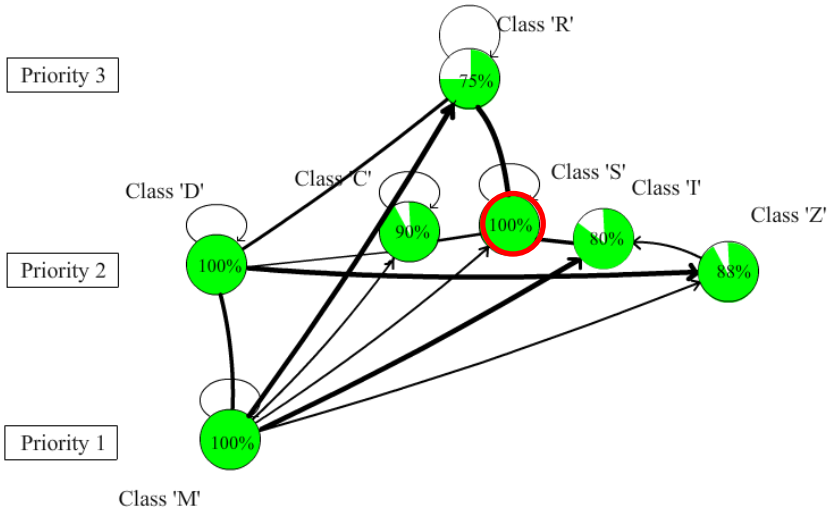

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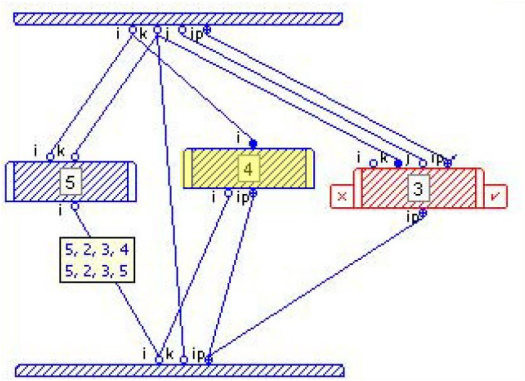

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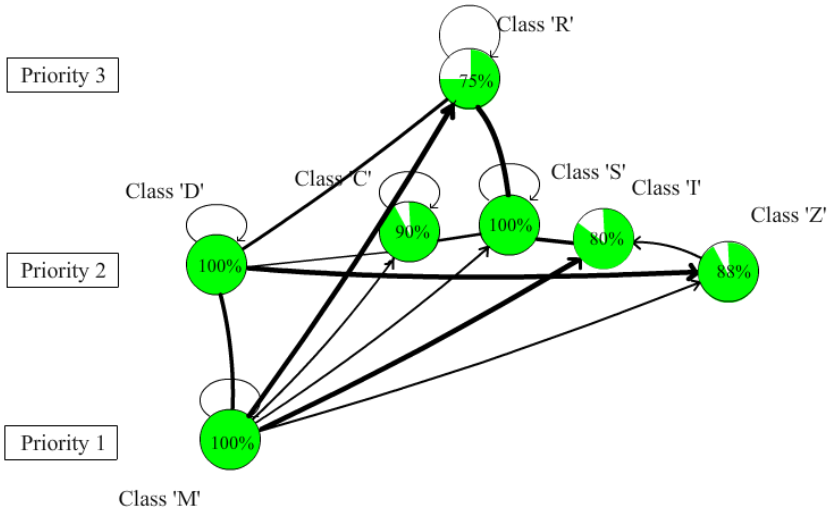

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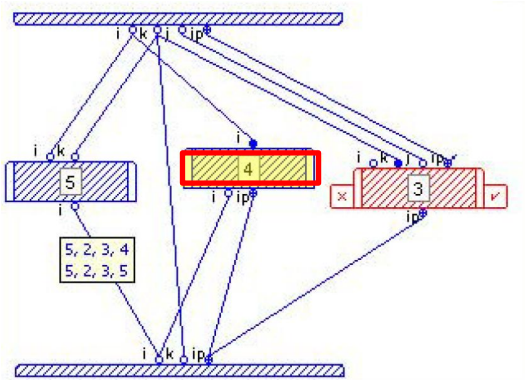


Expressiveness problems

Results and Analysis

Intention to restrict user's focus → **"Elimination by Aspects"** heuristic [16]

- Great number of choices
- All aspects at once → One attribute/time
- Iteratively exclude options

Results and Analysis

Limited info regarding users participation... To ensure adequate cog. support it would be important:

- Prior user studies
- Which outcomes motivated visualization specifics?
- Decision-making motivations

Results and Analysis

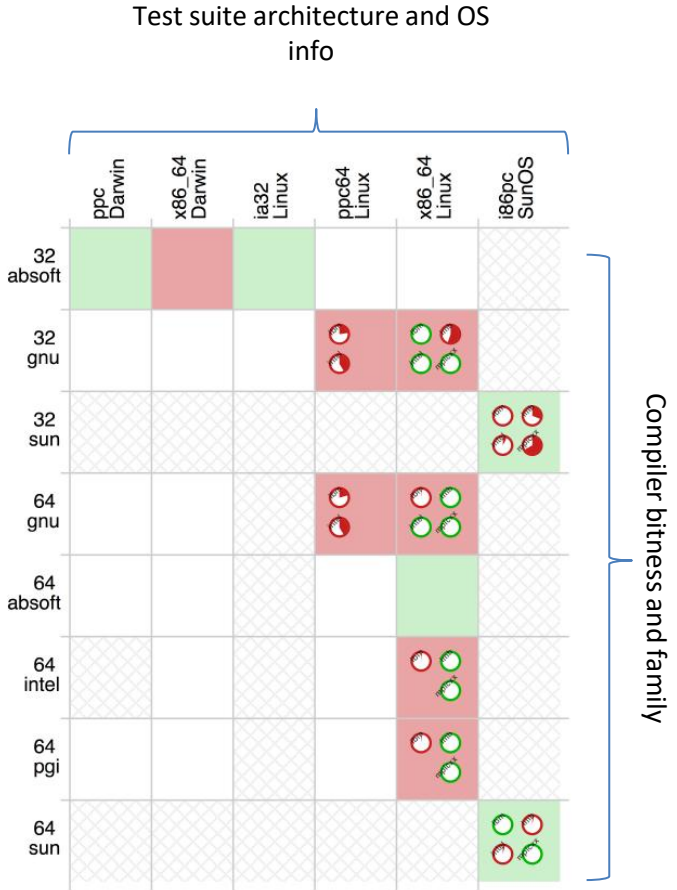
Lawrence et al. [19]: visualization's effect over user's behavior

- Number of faults: no significant differences
- Number of test cases: variability in the treatment group
- Overestimation of the tests effectiveness in the treatment group
- Visualization benefits?

Results and Analysis

Cottam et al. [23]

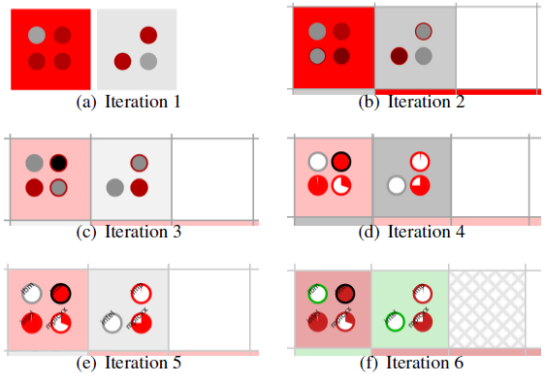
- Unit testing results to MPI testing tool (MTT)
- N-dimensional space to 2-dimensional grid (customizable)
- Background: state of the trivial test suite
- Foreground glyphs: each test suite



Results and Analysis

Cottam et al. [23]

- Target users: since the initial stages
  - How info came from data
  - Stratifying groups
  - Understanding group's needs
- User's opinion → choices
  - Vis. Metaphor and colors applied
  - Double encoding
- Evaluated effectiveness and expressiveness



Conclusion

Several aspects covered:

- Lack of user's participation
- Decision-making strategies
- No info regarding usability of the tools
- Expressiveness risk
- Human involvement needs to be transversal

Questions?

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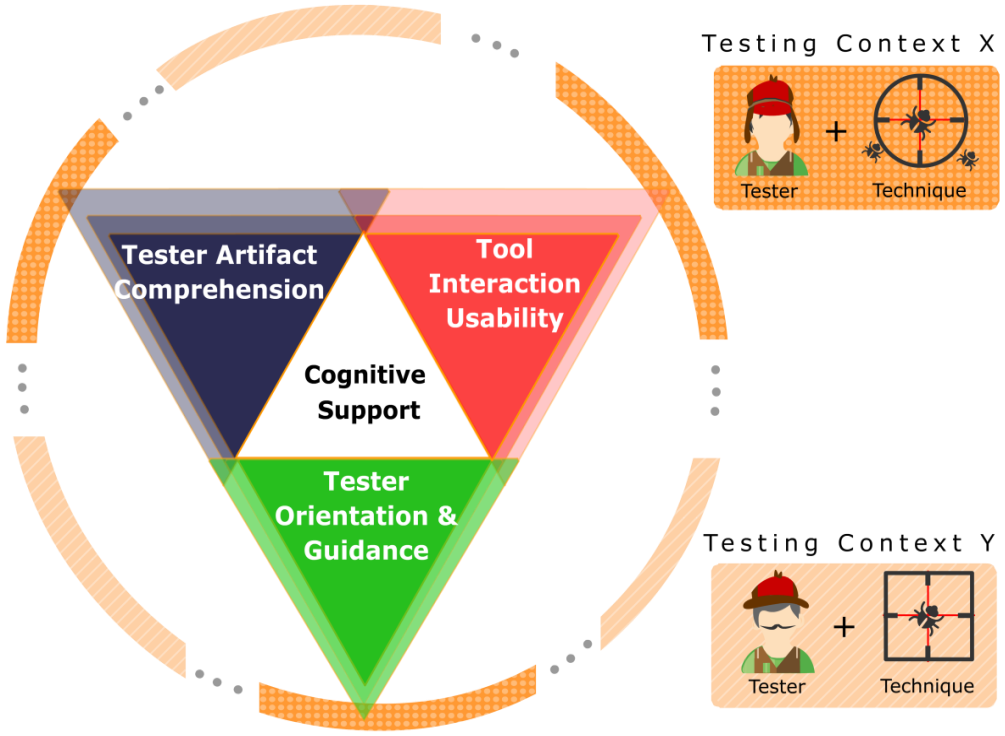
Fundação de Amparo à Pesquisa do Estado de Goiás

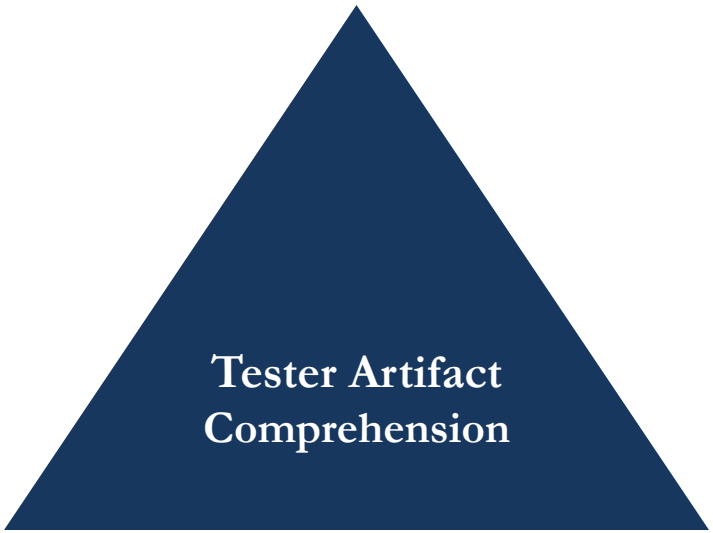
Turning Hunter Needs into a "Research Compass"



Framework with three cognitive dimensions

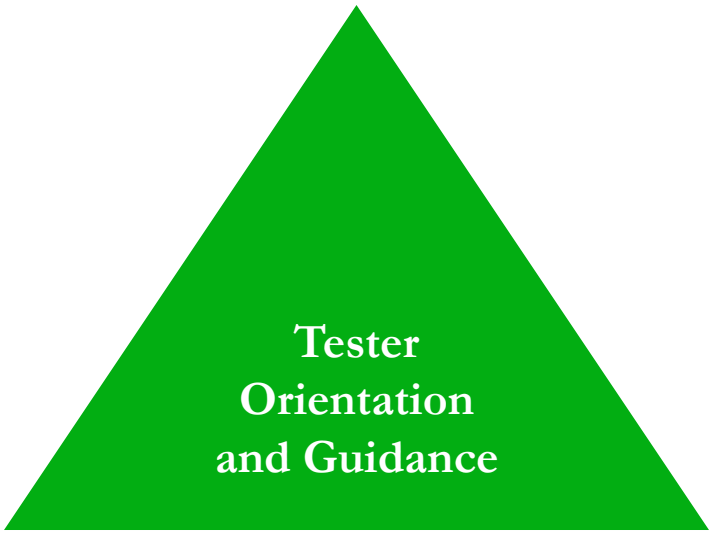
Turning Hunter Needs into a "Research Compass"

Reformulating artifact information to improve comprehension.



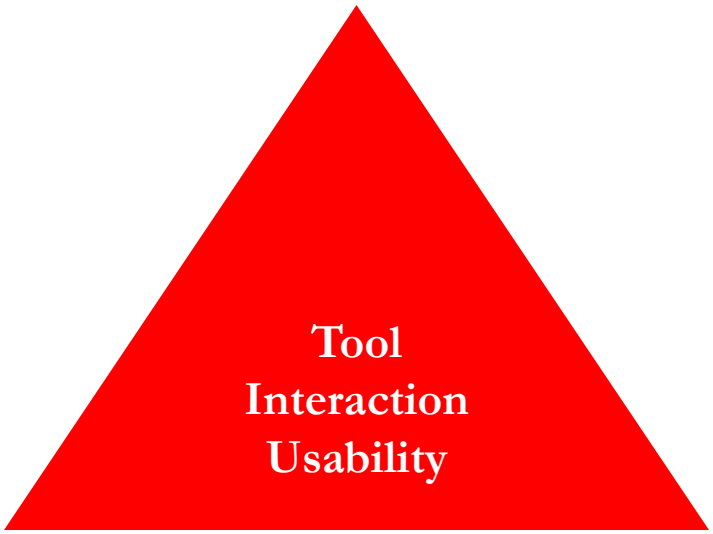
Turning Hunter Needs into a "Research Compass"

Testers may experience disorientation, confusion → Guidance, reference, restrictiveness



Turning Hunter Needs into a "Research Compass"

Issues to set up and operate → visibility of operations, clear feedback.



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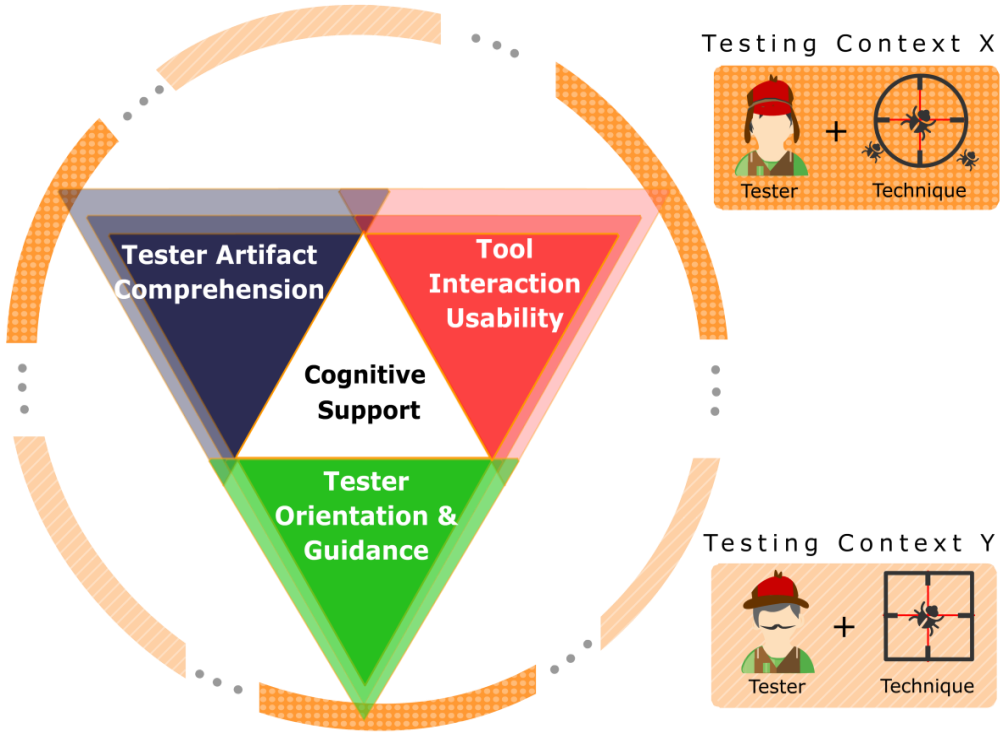

Framework with three cognitive dimensions

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Problem

Unit Testing Literature

Evidence of cognitive issues in practice

e.g. False-Positive (F.P.) test cases

Goals

- Getting insight of F.P.'s detection current practice.
- Understanding the role of test case's misjudgement in F.P.'s detection.
- Improvement of tools' GUI interaction during unit testing practice.

Approach

Survey with real practitioners

***Mixed format (open-ended and closed question)**

***Total of 11 questions (approx. 30 min.)**

***Requirements: Experience with unit testing and Black-box technique**