

# Putting Software Testing Terminology to the Test

## M.A.Sc. Seminar

Samuel Crawford, B.Eng.

McMaster University  
Department of Computing and Software

Fall 2024

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## 1 Introduction

- The Need for Standardized Terminology
- The Lack of Standardized Terminology

## 2 Project

- Research Questions
- Methodology

## 3 Discrepancies

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# The Need for Standardized Terminology

- Engineering is applied science
- Scientific fields use precise terminology



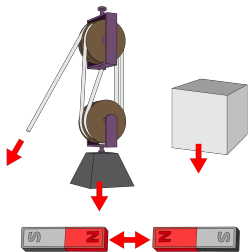
SOFTWARE  
ENGINEERING

# The Need for Standardized Terminology

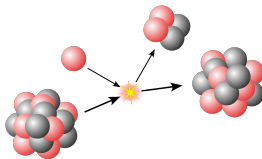
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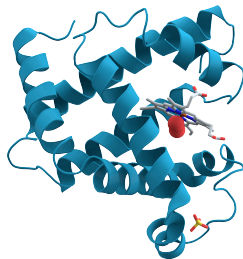
SOFTWARE  
ENGINEERING



Penubag and Ramey (2010)



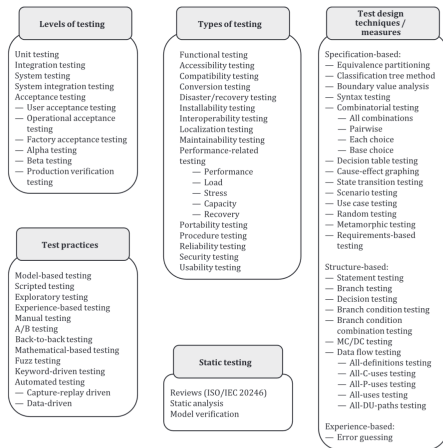
Kjerish (2016)



AzaToth (2008)

# The Lack of Standardized Terminology

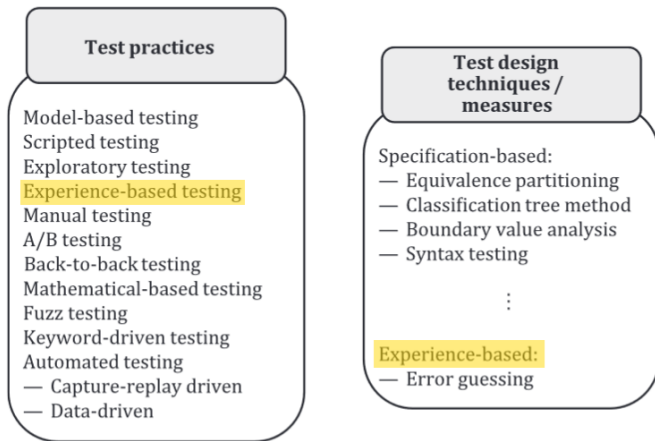
## “The Problem”



(ISO/IEC and IEEE, 2022, Fig. 2)

# The Lack of Standardized Terminology

## “The Problem”



Adapted from (ISO/IEC and IEEE, 2022, Fig. 2)

# The Lack of Standardized Terminology

## “The Problem”

ISO/IEC/IEEE 29119-4 describes the **experience-based test design technique** of error guessing. Other **experience-based test practices** include (but are not limited to) exploratory testing (see [4.4.3.3](#)), tours, attacks, and checklist-based testing.

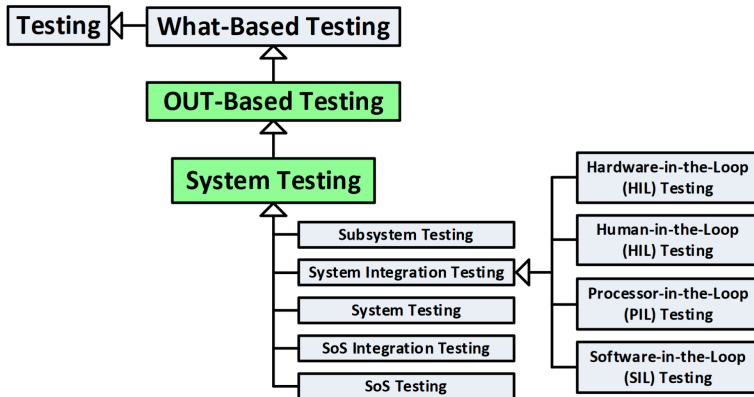
Adapted from (ISO/IEC and IEEE, 2022, p. 34)



# The Lack of Standardized Terminology

“The Problem” (cont.)

## What: by Object Under Test (OUT) – System Testing

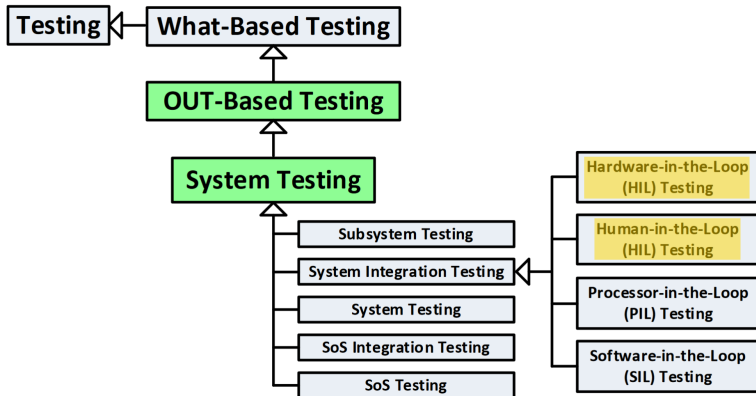


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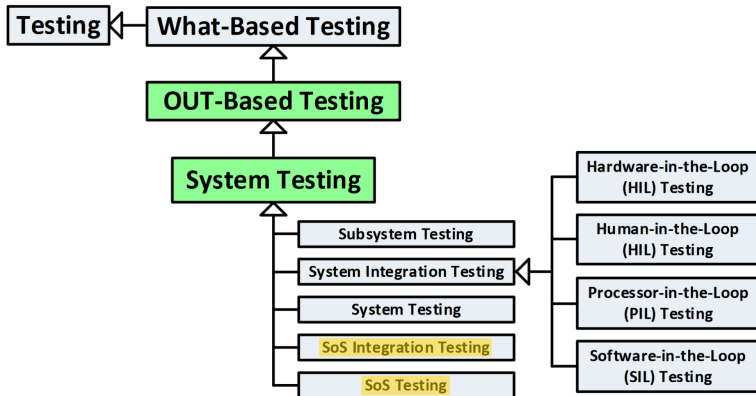


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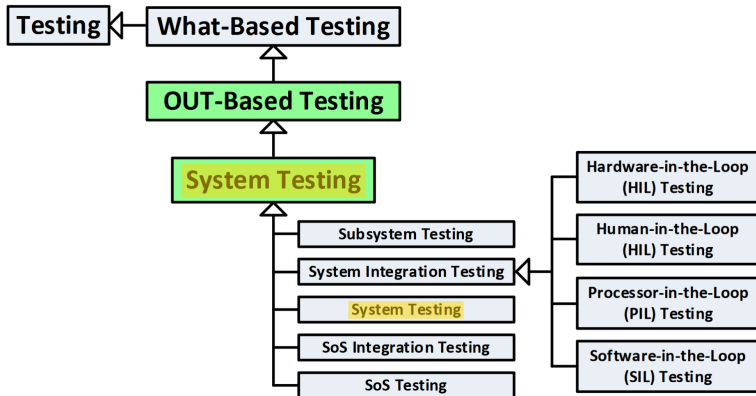


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## “The Problem” (cont.)

- Alpha testing is the “first stage of testing before a product is considered ready for commercial or operational use” (ISO/IEC and IEEE, 2017, p. 17) performed by:
  - “users within the organization developing the software” (p. 17)

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  - “a small, selected group of potential users” (Washizaki, 2024, p. 5-8)

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  - “roles outside the development organization” conducted “in the developer’s test environment” (Hamburg and Mogyorodi, 2024)

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  - “roles outside the development organization” conducted “in the developer’s test environment” (Hamburg and Mogyorodi, 2024)

“Okay testing team, we want to conduct alpha testing on our product. What’s our timeline? Budget? Sample size?”

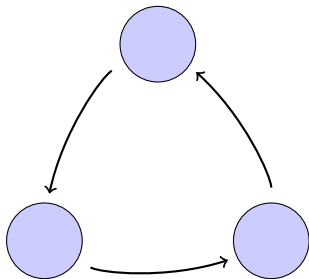


# Barriers to Effective Communication

"The Problem" (cont.)

## Interorganizational

Schools, companies, etc.

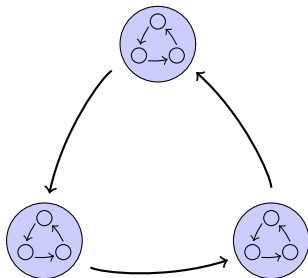


# Barriers to Effective Communication

“The Problem” (cont.)

## Interorganizational

Schools, companies, etc.



## Intraorganizational

“Complete testing” could require the tester to:

- discover every bug,
- exhaust the time allocated,
- implement every planned test,
- . . . (Kaner et al., 2011, p. 7)

# Taxonomies to the Rescue?

## “The Problem” (cont.)

- Existing software testing taxonomies:
  - Tebes et al. (2020)
  - Souza et al. (2017)
  - Unterkalmsteiner et al. (2014)

# Taxonomies to the Rescue?

## “The Problem” (cont.)

- Existing software testing taxonomies:

- Tebes et al. (2020)
- Souza et al. (2017)
- Unterkalmsteiner et al. (2014)

### Focus on:

The Testing Process  
Organizing Terminology  
Traceability between Stages

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# Research Questions

## Research Question 1

What testing approaches do the literature describe?

## Research Question 2

Are these descriptions consistent?

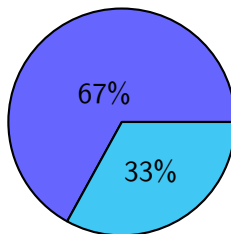
## Research Question 3

Can we systematically resolve any of these inconsistencies?

## Research Question 1

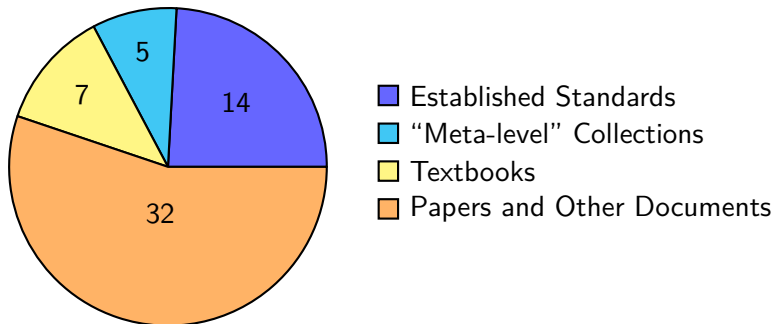
What testing approaches do the literature describe?

- 527 test approaches →
- 76 software qualities



- Defined
- Not defined

# Methodology: Sources

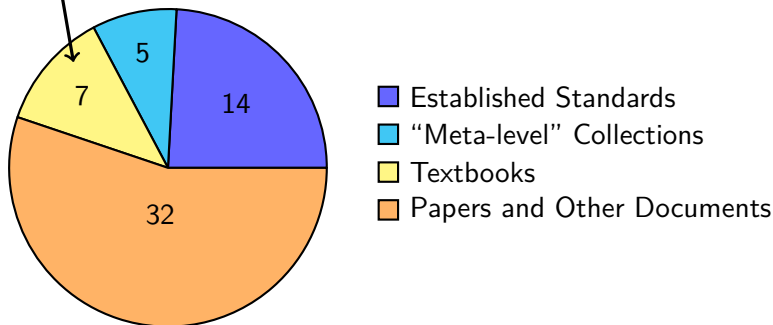


Summary of how many sources comprise each source category.



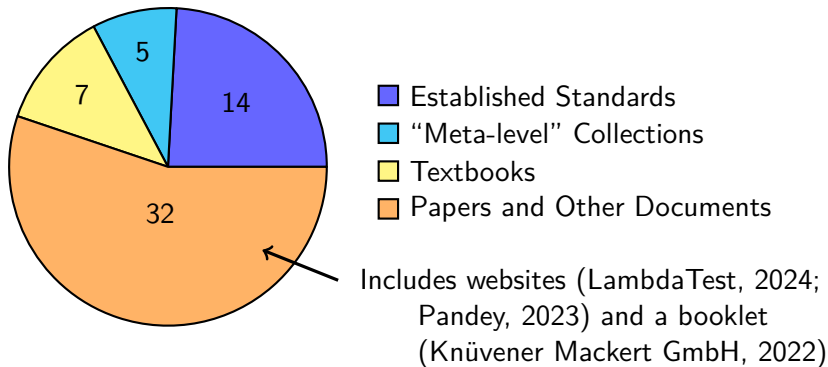
# Methodology: Sources

Textbooks trusted at McMaster were our ad hoc starting points  
(Patton, 2006; Peters and Pedrycz, 2000; van Vliet, 2000)

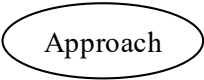


Summary of how many sources comprise each source category.

# Methodology: Sources



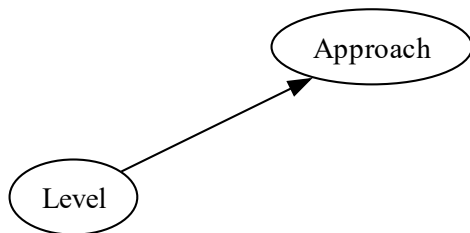
Summary of how many sources comprise each source category.



Approach

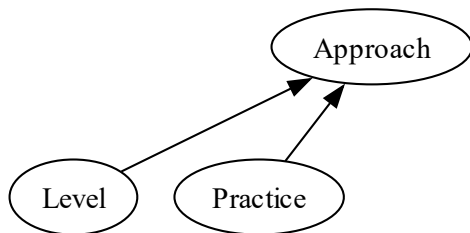
**Approach:** a “high-level test implementation choice” (ISO/IEC and IEEE, 2022, p. 10) used to “pick the particular test case values” (2017, p. 465)

# Methodology: Categories

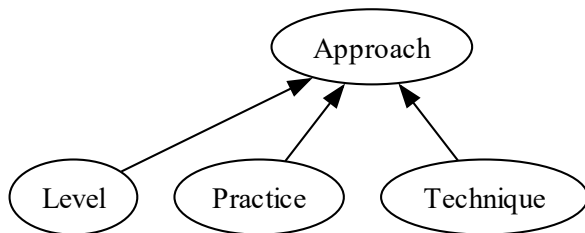


**Level:** a stage of testing with “particular objectives and ... risks”, each performed in sequence (ISO/IEC and IEEE, 2022, p. 12; 2021, p. 6)

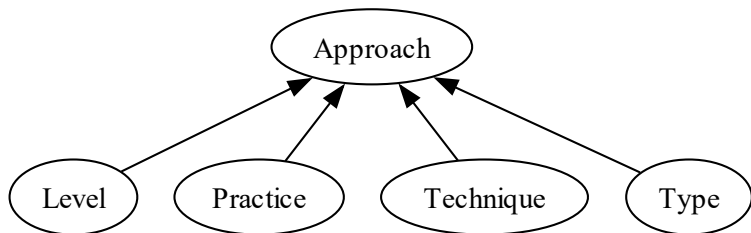
# Methodology: Categories



**Practice:** a “conceptual framework that can be applied to . . . [a] test process to facilitate testing” (ISO/IEC and IEEE, 2022, p. 14; 2017, p. 471)



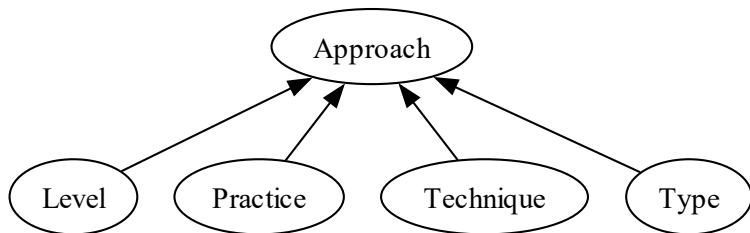
**Technique:** a “defined” and “systematic” (ISO/IEC and IEEE, 2017, p. 464) “procedure used to create or select a test model, identify test coverage items, and derive corresponding test cases” (2022, p. 11)



**Type:** “Testing that is focused on specific quality characteristics”  
(ISO/IEC and IEEE, 2022, p. 15; 2021, p. 7; 2017, p. 473)

# Methodology: Graph Notation

## Relations

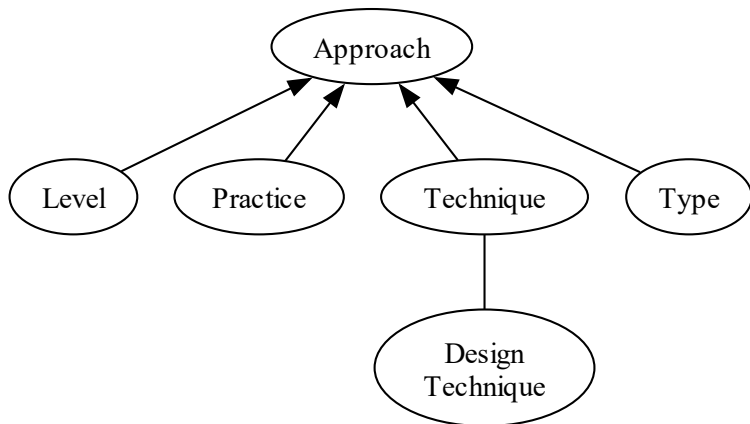


Arrows point from a *child* node to a *parent* node.



# Methodology: Graph Notation

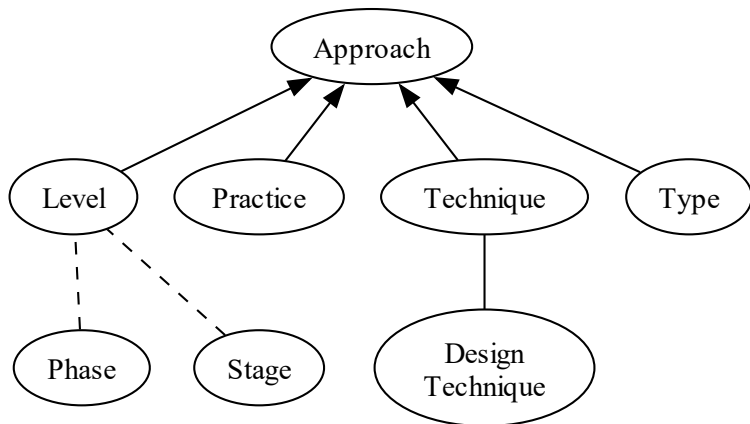
## Relations



Lines without arrowheads connect *synonyms*.

# Methodology: Graph Notation

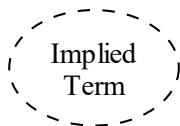
## Relations



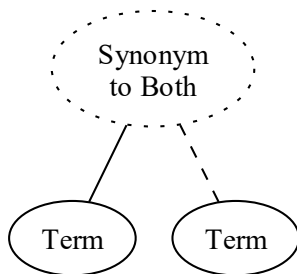
Dashed lines indicate a relationship is *implied*.

# Methodology: Graph Notation

## Terms



Dashed outlines indicate a term is *implied*.



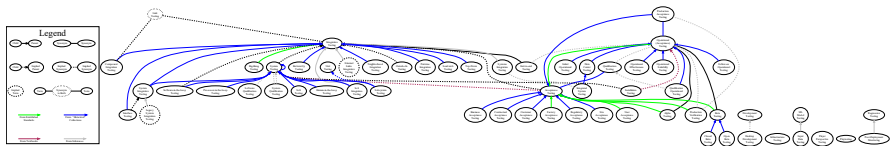
Dotted outlines indicate a term is a *synonym* to more than one term.

# Graph of Test Approaches

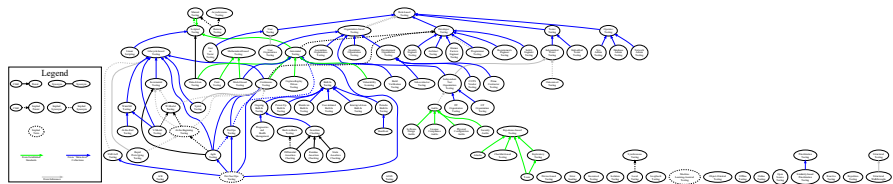
# Graph of Test Approaches

! Dimension too large.

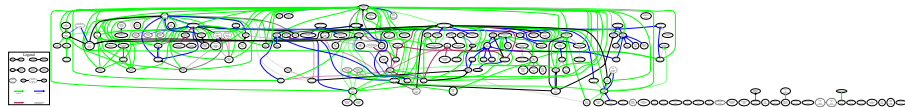
## Graph of Test Levels



## Graph of Test Practices

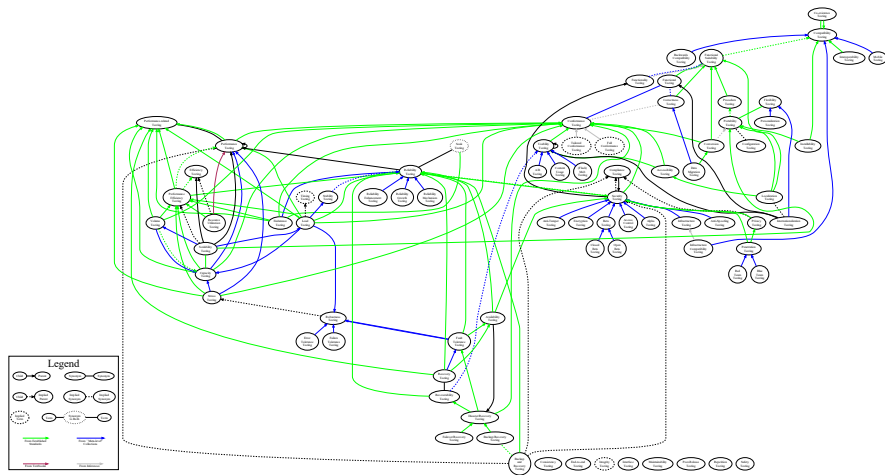


# Graph of Test Techniques



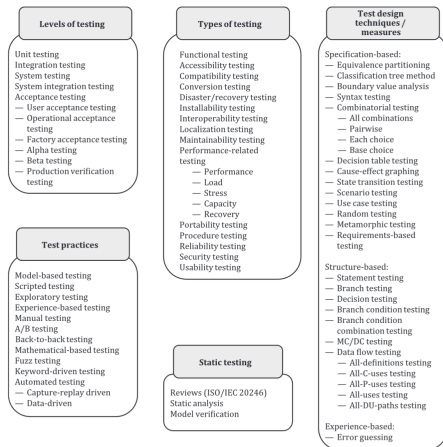


# Graph of Test Types



# Methodology: Graph Notation

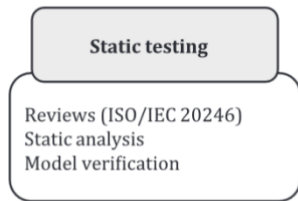
## Static Testing



Example test approach choices (ISO/IEC and IEEE, 2022, Fig. 2).

# Methodology: Graph Notation

## Static Testing

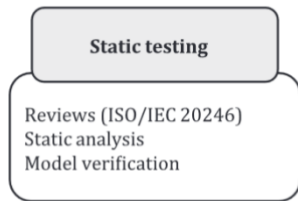


Example test approach choices.

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IEEE, 2022, Fig. 2)

# Methodology: Graph Notation

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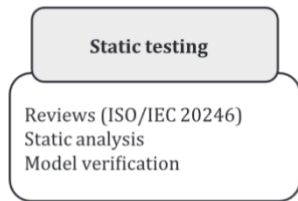


- While our focus is on dynamic testing, we include static testing in our research for completeness

Example test approach choices.  
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# Methodology: Graph Notation

## Static Testing



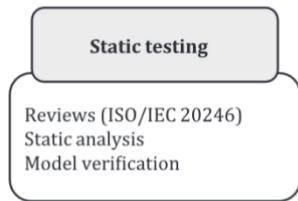
- While our focus is on dynamic testing, we include static testing in our research for completeness
- Static testing *is* quite distinct from dynamic testing, but this does not necessarily make it an orthogonal category

Example test approach choices.

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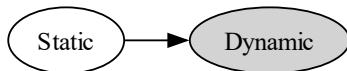
# Methodology: Graph Notation

## Static Testing

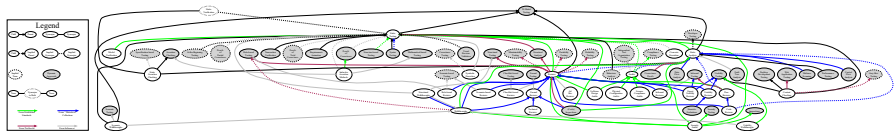


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- While our focus is on dynamic testing, we include static testing in our research for completeness
- Static testing *is* quite distinct from dynamic testing, but this does not necessarily make it an orthogonal category
- When considering static testing in isolation, terms with gray backgrounds are related *dynamic approaches*



## Graph of *Static* Test Approaches



# Methodology: Procedure

## Approaches

- A row is created for each test approach, such as the following which is based on (ISO/IEC and IEEE, 2022)

Name	Category	Definition	Parent(s)	Synonym(s)
A/B Testing	Practice (p. 22)	Testing “that allows testers to determine which of two systems or components performs better” (p. 1)	Statistical Testing (pp. 1, 35), ...	Split-Run Testing (pp. 1, 35)



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- This information is gathered from sources by looking for
  - Glossaries
  - Testing-related terms
  - Terms described *by* other approaches
  - Terms that *imply* other approaches

- It seems that the existence of a software quality implies the existence of a test type associated with it

# Methodology: Procedure

## Other Information

- It seems that the existence of a software quality implies the existence of a test type associated with it
- Some test approaches use shared or complicated terminology

# Methodology: Procedure

## Other Information

- It seems that the existence of a software quality implies the existence of a test type associated with it
- Some test approaches use shared or complicated terminology
- For each of these, we record its
  - Name
  - Definition
  - Precedence for a related test type (only for qualities)
  - Synonym(s)

# Methodology: Procedure

- Recording these data in a consistent format allows for graphs to be generated according to a certain logic

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- It also allows for subsets of discrepancies to be identified

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## Research Question 2

Are these descriptions consistent?

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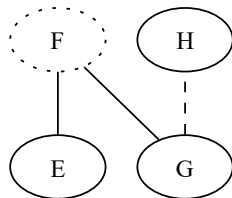
# Automated Discrepancies

- Some terms are given as a synonym to two (or more) disjoint, unrelated terms, making the relation between the given synonyms ambiguous

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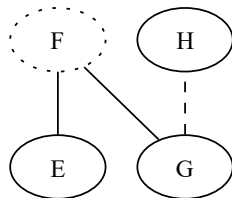
Name	Synonym(s)
E	F (Author, 0000; implied by 0001)
G	F (Author, 0002), H (implied by 0000)
H	X



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Name	Synonym(s)
E	F (Author, 0000; implied by 0001)
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H	X



- The following four are the most prominent examples of the ten identified automatically:

## ❶ Invalid Testing:

- Error Tolerance Testing (Kam, 2008, p. 45)
- Negative Testing (Hamburg and Mogyorodi, 2024; implied by ISO/IEC and IEEE, 2021, p. 10)

## ❷ Soak Testing:

- Endurance Testing (ISO/IEC and IEEE, 2021, p. 39)
- Reliability Testing (Gerrard, 2000a, Tab. 2; 2000b, Tab. 1, p. 26)

## ❸ User Scenario Testing:

- Scenario Testing (Hamburg and Mogyorodi, 2024)
- Use Case Testing (Kam, 2008, p. 48) (although “an actor can be a user or another system” (ISO/IEC and IEEE, 2021, p. 20))

## ❹ Link Testing:

- Branch Testing (implied by ISO/IEC and IEEE, 2021, p. 24)
- Component Integration Testing (Kam, 2008, p. 45)
- Integration Testing (implied by Gerrard, 2000a, p. 13)

# Acknowledgment

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- The past and current Drasil team have created a truly amazing framework!

Thank you!  
Questions?



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