

# Putting Software Testing Terminology to the Test

## M.A.Sc. Seminar

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Fall 2024

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

## 2 Project

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## 3 Discrepancies

# The Need for Standardized Terminology

- Engineering is applied science
- Scientific fields use precise terminology



SOFTWARE  
ENGINEERING

# The Need for Standardized Terminology

- Engineering is applied science
- Scientific fields use precise terminology



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



(Firesmith, 2015, p. 23)

# The Lack of Standardized Terminology

“The Problem” (cont.)

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# The Lack of Standardized Terminology

“The Problem” (cont.)



Adapted from (Hamburg and Mogyorodi, 2024)

Adapted from (Firesmith, 2015, p. 23)

# The Lack of Standardized Terminology

“The Problem” (cont.)



# The Lack of Standardized Terminology

## "The Problem" (cont.)

"Alpha testing is done by 'users within the organization developing the software'."

(ISO/IEC and IEEE, 2017, p. 17)



# The Lack of Standardized Terminology

## "The Problem" (cont.)



# The Lack of Standardized Terminology

## "The Problem" (cont.)



# The Lack of Standardized Terminology

“The Problem” (cont.)



# The Lack of Standardized Terminology

“The Problem” (cont.)



# The Lack of Standardized Terminology

“The Problem” (cont.)

“How? Alpha testing is performed  
‘in the developer’s test environment’,  
but you didn’t bring anyone in.”

(Hamburg and Mogyorodi, 2024)



# 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)
  - Firesmith (2015)
  - Unterkalmsteiner et al. (2014)

# Taxonomies to the Rescue?

## "The Problem" (cont.)

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Focus on:

The Testing Process  
Organizing Terminology  
Relations between Approaches  
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?

# Methodology

## Overview

### Research Question 1

What testing approaches do the literature describe?

- ① Identify authoritative sources
- ② Identify software testing terminology from each source, focusing on test approaches and software qualities
- ③ For each test approach, record its:
  - ① Name
  - ② Category
  - ③ Definition
  - ④ Synonyms
  - ⑤ Parents
  - ⑥ Other relevant notes
- ④ Repeat steps 1 to 3 for any missing or unclear terminology

# Methodology

## Overview

### Research Question 2

Are these descriptions consistent?

⑤ Analyze these data for discrepancies

- ① Record discrepancies as they arise during data collection
- ② Generate relation graphs
- ③ Automatically detect certain classes of discrepancies
- ④ Automatically analyze manually recorded discrepancies from step 1

⑥ Report results of discrepancy analysis

### Research Question 3

Can we systematically resolve any of these inconsistencies?

⑦ Seek to resolve these discrepancies

# Methodology

## Procedure

- A row is created for each test approach

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)

Information from (ISO/IEC and IEEE, 2022)

# Methodology

## Procedure

- A row is created for each test approach

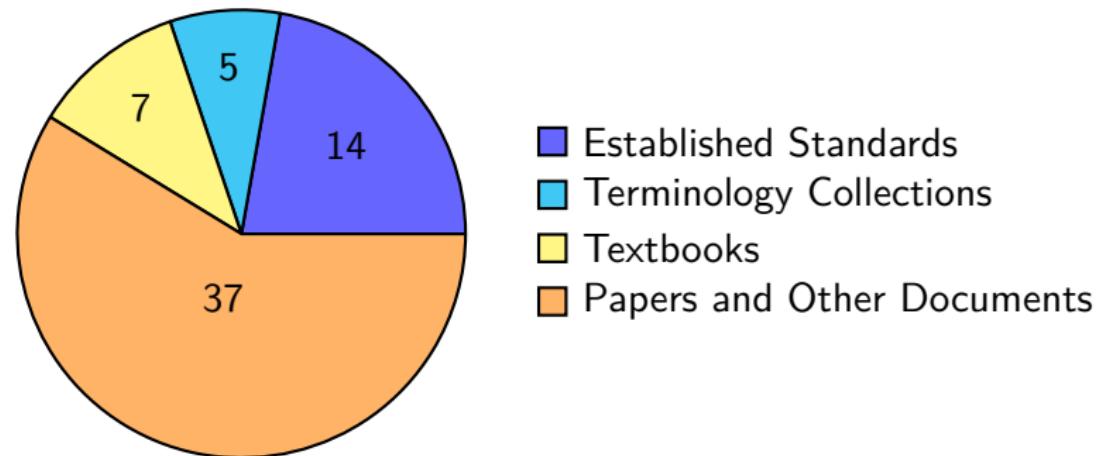
Name	Category	Definition	Parent(s)	Synonym(s)
A/B Testing	Practice (p. 22)	Testing “that allows testers to determine which of two systems or components performs better” (p. 1)	Statistical Testing (pp. 1, 35), ...	Split-Run Testing (pp. 1, 35)

Information from (ISO/IEC and IEEE, 2022)

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

# Methodology

## Sources

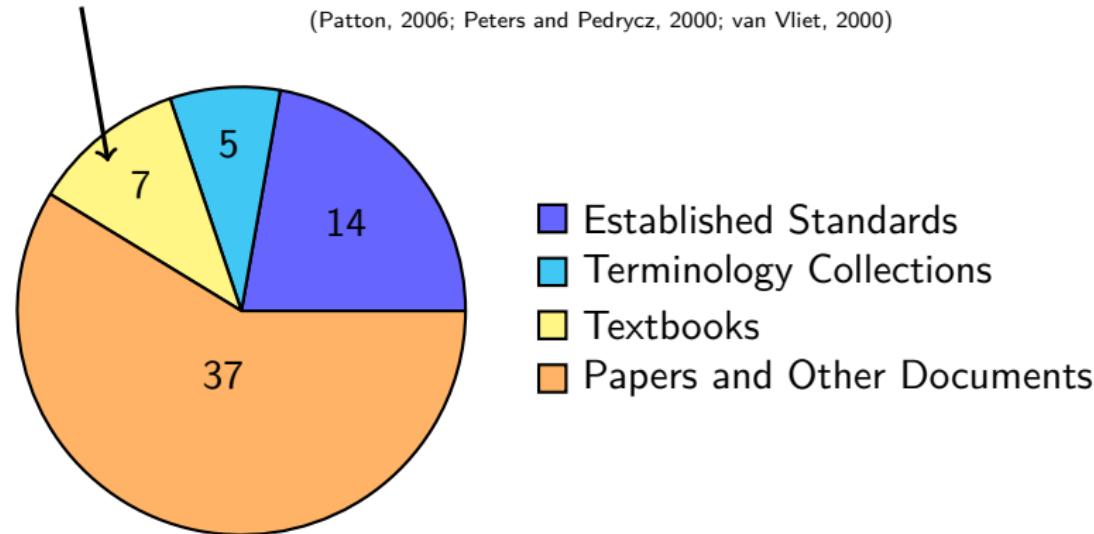


# Methodology

## Sources

Textbooks trusted at McMaster were our ad hoc starting points

(Patton, 2006; Peters and Pedrycz, 2000; van Vliet, 2000)



# Methodology

## Categories

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)

# Methodology

## Categories



**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)

# Methodology

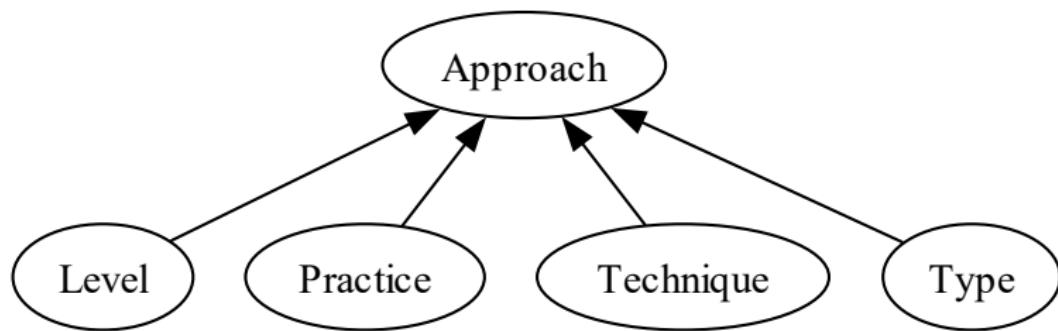
## Categories



**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



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

# Methodology

## Graph Notation



Lines without arrowheads connect *synonyms*.

# Methodology

## Graph Notation



Dashed lines indicate a relationship is *implicit*.

# Methodology

## Graph Notation



Dashed outlines indicate a term is *implied*.

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

# Graph of Test Approaches

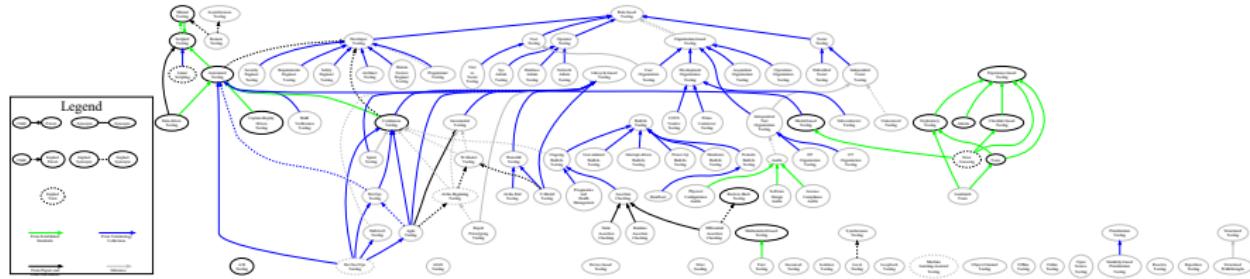
# Graph of Test Approaches

! Dimension too large.

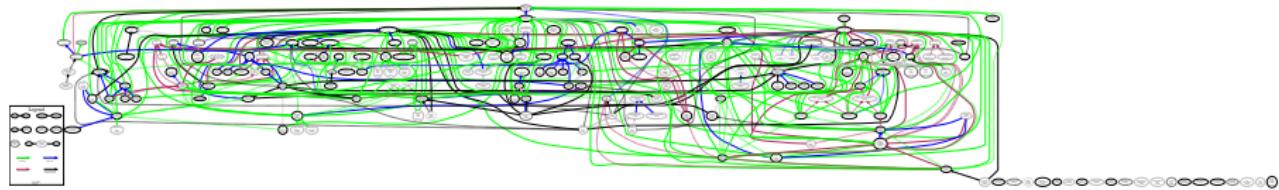
# Graph of Test Levels



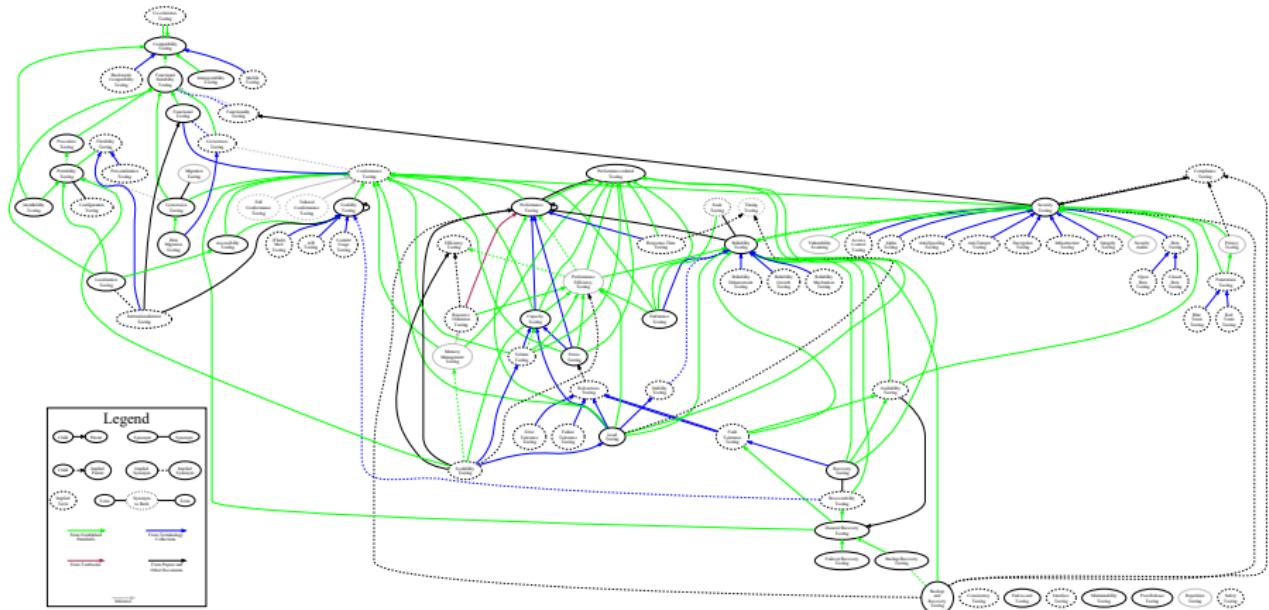
# Graph of Test Practices



# Graph of Test Techniques



# Graph of Test Types



# Methodology

## Graph Notation



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

# Methodology

## Graph Notation



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

# Methodology

## Graph Notation

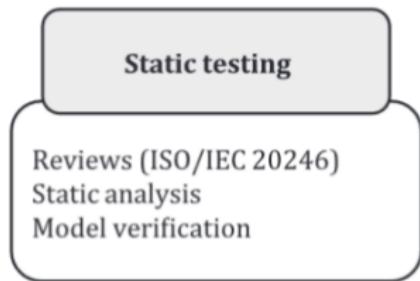


- Quite distinct but not necessarily orthogonal

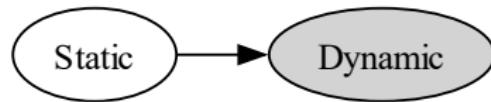
Adapted from (ISO/IEC and IEEE, 2022, Fig. 2)

# Methodology

## Graph Notation

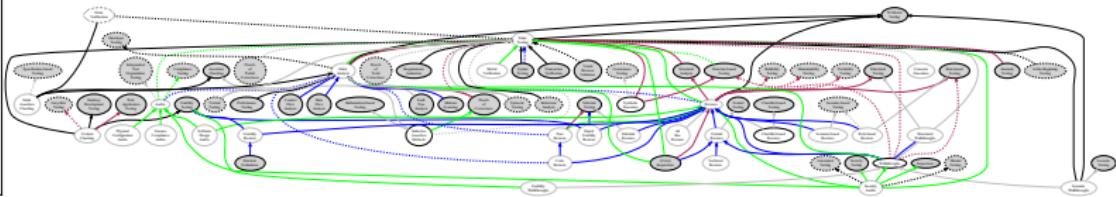
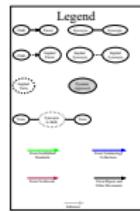


- Quite distinct but not necessarily orthogonal
- When considering static testing in isolation, related *dynamic approaches* have grey backgrounds



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

# Graph of *Static* Test Approaches



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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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- These are included in generated graphs automatically

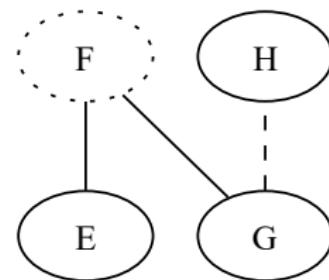
Name	Synonym(s)
E	F (Author, 0000; implied by 0001)
G	F (Author, 0002), H (implied by 0000)
H	X



# Automated Discrepancies

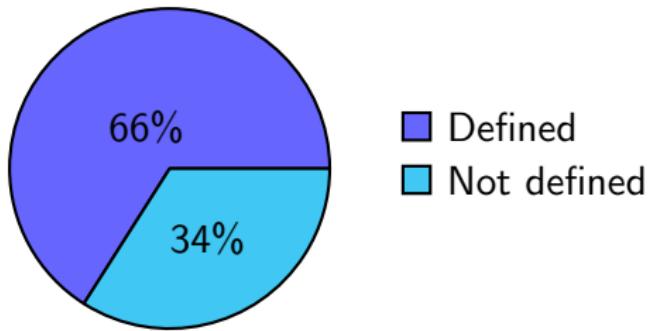
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Name	Synonym(s)
E	F (Author, 0000; implied by 0001)
G	F (Author, 0002), H (implied by 0000)
H	X



# Results

- 557 test approaches →
- 76 software qualities  
(may imply test approaches)



# Automated Discrepancies

Prominent examples of these “multi-synonyms”:

① Invalid Testing:	Source(s)
• Error Tolerance Testing	(Kam, 2008, p. 45)
• Negative Testing	(Hamburg and Mogyorodi, 2024)

# Automated Discrepancies

Prominent examples of these “multi-synonyms”:

- |   |   |
|---|---|
| <p><b>① Invalid Testing:</b></p> <ul style="list-style-type: none"><li>• Error Tolerance Testing</li><li>• Negative Testing</li></ul> <p><b>② Soak Testing:</b></p> <ul style="list-style-type: none"><li>• Endurance Testing</li><li>• Reliability Testing</li></ul> | <p><b>Source(s)</b></p> <p>(Kam, 2008, p. 45)<br/>(Hamburg and Mogyorodi, 2024)</p> <p>(ISO/IEC and IEEE, 2021, p. 39)<br/>(Gerrard, 2000a, Tab. 2; 2000b, Tab. 1, p. 26)</p> |
|---|---|

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|--|---|

# Acknowledgment

- Drs. Spencer Smith and Jacques Carette have been great supervisors in the past and have, both then and now, provided me with valuable guidance and feedback
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- The past and current Drasil team have created a truly amazing framework!

Thank you!  
Questions?

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