Testing, the ultimate Sisiphus rock

By Bernard Stepien

University of Ottawa

Heterogeneity of testing methods

- Manual testing
- General purpose languages based testing
- Formal methods (TTCN-3)
- Model based testing

Manual testing

- Probably the most commonly used
- Based on subjective test plans
- No strong typing
- No guaranty of completness

General purpose languages based testing

- No abstraction
- Test events are mixed with data retrieval operations
- Test verification is performed at the atomic level

Formal methods (TTCN-3)

- Separation of concerns between
  - Abstract test behavior
  - Concrete level for encoding and decoding messages
- Concept of template which is another separation between test behavior and conditions governing behavior
- Extensive re-usability of templates

Model based testing

- So far all methods involve manual coding of test suites
- A model can be verified before automatically generating a test suite

Software Development Visualization

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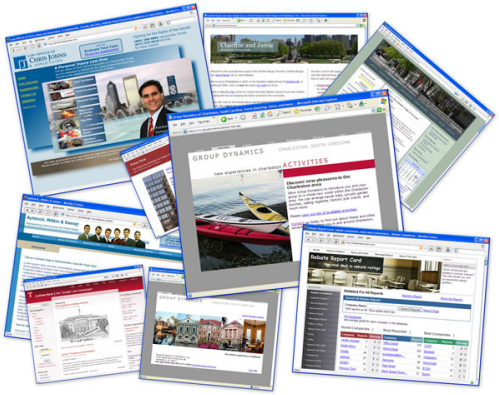


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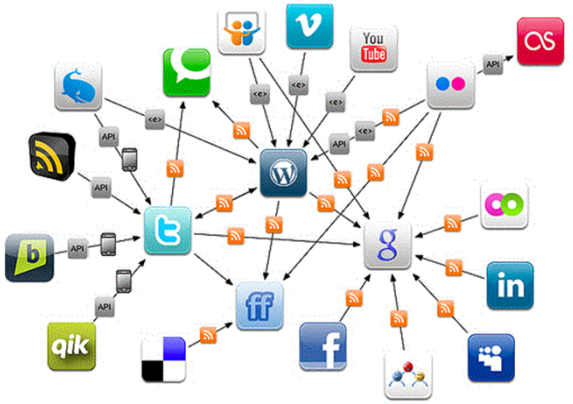
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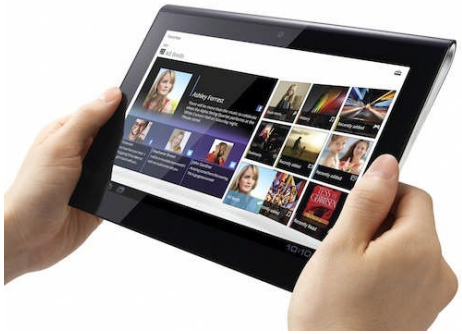
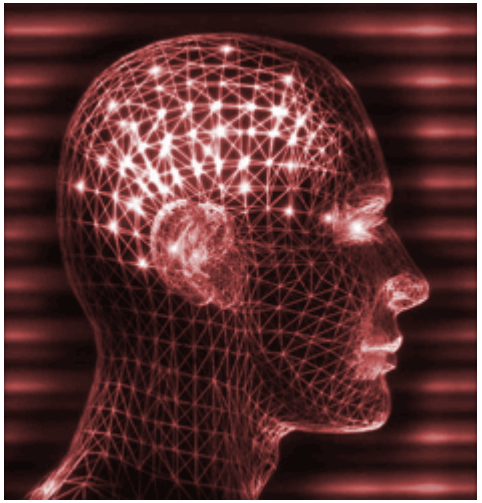


Data is difficult to manage

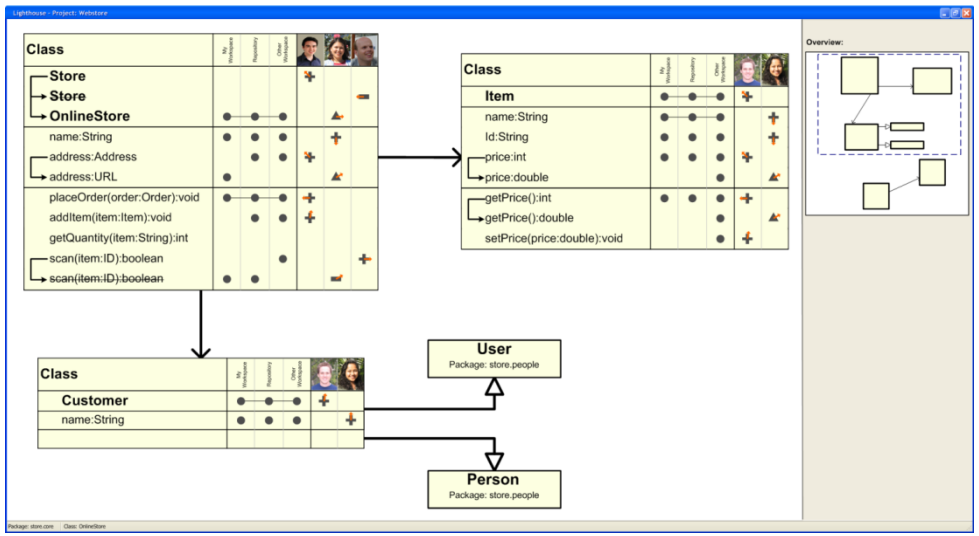

Books/Booklets
Q&A
Manuals
Issue Trackers
Documentation
E-mail Lists
Android Programming Tutorials
Tutorials
Software Development Scenario
Code Repositories & VCSs
Scientific Publications
Discussion Forums
Development Environments


How to
deal with
this?

Awareness



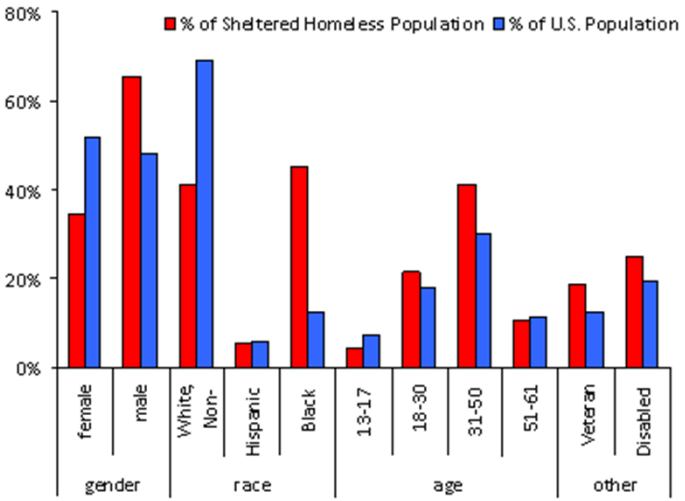
cognitive reactions to a condition/event
(being aware of it)



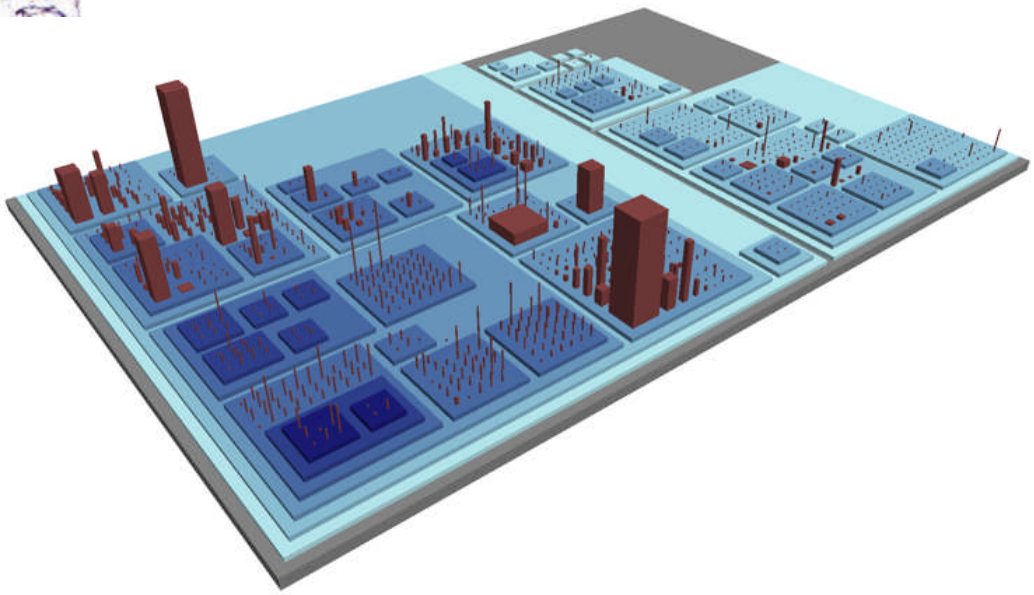
allows software development stakeholders to **be percipient of what goes on** in the development scenario

Comprehension

assimilation of knowledge
(understanding a fact)



Visualization support



represent software through **metaphors**, from a particular **point of view**, helping **stakeholders** to **focus** on the kind of **task** being performed

General Comprehension/Awareness Challenges

Use software tools to seamlessly ***collect rich data sets on software comprehension*** *activities*

Build ***specialized, personalized visualizations*** *according to the* ***comprehension needs***

Identification and development of ***suitable mechanisms*** *and* ***adequate abstractions***

Strengthen and increase *the group of* ***researchers*** *interested in* ***software visualization, awareness, and related areas***

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JÜLICH
FORSCHUNGSZENTRUM

Big Data and Machine Learning to Democratize Software Development?

February 25, 2020 | Jędrzej Rybicki

Software/Solution Development

Software Engineering:

- *“systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software"* (IEEE)
- requirement engineering
- design
- testing

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Machine Learning:

- data-driven algorithm creation

$\Rightarrow$ function approximation (solution creation)

- can be done almost automatically: AutoML
- data, frameworks and resource access proliferation

JÜLICH FORSCHUNGSZENTRUM

Motivation: ML

```
1  from sklearn.model_selection import train_test_split
2  from sklearn.ensemble import RandomForestRegressor
3  import pandas as pd
4
5  lr =  RandomForestRegressor(n_estimators=100)
6  df = pd.read_csv('https://...')
7  X_train, X_test, y_train, y_test = train_test_split(
8          df['X'], df['y'], test_size=0.33, random_state=42)
9
10 lr.fit(X_train, y_train)
11
12 pred = lr.predict(X_test)
13 print(f'Score {lr.score(y_test, pred)}')
```

Motivation: Web Development

```
1  #!/usr/bin/env python
2  from flask import Flask
3
4  app = Flask(__name__)
5
6  @app.route('/')
7  def index():
8      return 'It works!'
9
10 app.run(port=8081)
```

Summary

Democratization:

- ML is dramatically lowering the “Barriers to Entry”
- factors: data, resources, frameworks
- everyone can do it now (not in terms of Software Engineer)

but...

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but...ML is high-interest credit on technical debt:

- hard to understand & interpret
- hard to extend & hard to incorporate knowledge
- limited testing capabilities: Unit Tests, Integration Tests,...

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Democratization...really?

- do you have data?
- do you have GPU cluster?