

# Bridging the gap - state-of-the-art testing research, Explanea, and why you should care

Robert Feldt  
Blekinge Institute of Technology &  
Chalmers



All animations have been excluded in this pdf version!

# Bridging the gap - state-of-the-art testing research, Explanea, and why you should care

Robert Feldt  
Blekinge Institute of Technology &  
Chalmers



@drfeldt



All animations have been excluded in this pdf version!

# Bridging the gap - state-of-the-art testing research, Explanea, and why you should care

**Dan** Robert Feldt  
Blekinge Institute of Technology &  
Chalmers



@drfeldt



All animations have been excluded in this pdf version!





# We are also humans!



# Your Use of Research

- New/Better/Alternative Ideas (N)
- Strengthen/Confirm/Refine Beliefs (S)
- Contradict Beliefs (X)
- Point to Future/New/Missed Areas (F)
- Extend/Move Ideas to Your/Other Area (E)
- Attracting personnel

IEEE TRANSACTIONS ON  
**SOFTWARE  
ENGINEERING**

*A publication of the IEEE Computer Society*

NOVEMBER 2004

VOLUME 30

NUMBER 11

IESEDJ

(ISSN 0098-5589)

---

*Editorial: New AE Introduction*

J. Knight

713

**PAPERS**

*Analysis and Visualization of Predicate Dependence on Formal Parameters and Global Variables*

D. Binkley and M. Harman

715

*Enhancing Structured Review with Model-Based Verification*

I. Traoré and D.B. Aredo

736

*Evaluating Web Software Reliability Based on Workload and Failure Data Extracted from Server Logs*

J. Tian, S. Rudraraju, and Z. Li

754

*Assessing and Improving State-Based Class Testing: A Series of Experiments*

L.C. Briand, M. Di Penta, and Y. Labiche

770

*Contract-Checking Wrappers for C++ Classes*

S.H. Edwards, M. Sitaraman, B.W. Weide, and J. Hollingsworth

794

*A Cognitive-Based Mechanism for Constructing Software Inspection Teams*

J. Miller and Z. Yin

811

---

**SHORT PAPERS**

*Improving Cohesion Metrics for Classes by Considering Dependent Instance Variables*

H.S. Chae, Y.R. Kwon, and D.H. Bae

826

  
IEEE  
COMPUTER  
SOCIETY  
<http://www.computer.org>  
[tse@computer.org](mailto:tse@computer.org)

 IEEE



IEEE TRANSACTIONS ON  
**SOFTWARE  
ENGINEERING**

*A publication of the IEEE Computer Society*

NOVEMBER 2004

VOLUME 30

NUMBER 11

IESEDJ

(ISSN 0098-5589)

*Editorial: New AE Introduction*

J. Knight

713

**PAPERS**

*Analysis and Visualization of Predicate Dependence on Formal Parameters and Global Variables*

D. Binkley and M. Harman

715

*Enhancing Structured Review with Model-Based Verification*

I. Traoré and D.B. Aredo

736

*Evaluating Web Software Reliability Based on Workload and Failure Data Extracted from Server Logs*

J. Tian, S. Rudraraju, and Z. Li

754

*Assessing and Improving State-Based Class Testing: A Series of Experiments*

L.C. Briand, M. Di Penta, and Y. Labiche

770

*Contract-Checking Wrappers for C++ Classes*

S.H. Edwards, M. Sitaraman, B.W. Weide, and J. Hollingsworth

794

*A Cognitive-Based Mechanism for Constructing Software Inspection Teams*

J. Miller and Z. Yin

811

**SHORT PAPERS**

*Improving Cohesion Metrics for Classes by Considering Dependent Instance Variables*

H.S. Chae, Y.R. Kwon, and D.H. Lee

826

We're dead  
serious!

IEEE  
COMPUTER  
SOCIETY  
<http://www.computer.org>  
[tse@computer.org](mailto:tse@computer.org)

IEEE

IEEE TRANSACTIONS ON  
**SOFTWARE  
ENGINEERING**

*A publication of the IEEE Computer Society*

NOVEMBER 2004

VOLUME 30

NUMBER 11

IESEDJ

(ISSN 0098-5589)

No Fancy  
Pics!

*Editorial: New AE Introduction*

J. Knight

713

**PAPERS**

*Analysis and Visualization of Predicate Dependence on Formal Parameters and Global Variables*

D. Binkley and M. Harman

715

*Enhancing Structured Review with Model-Based Verification*

I. Traoré and D.B. Aredo

736

*Evaluating Web Software Reliability Based on Workload and Failure Data Extracted from Server Logs*

J. Tian, S. Rudraraju, and Z. Li

754

*Assessing and Improving State-Based Class Testing: A Series of Experiments*

L.C. Briand, M. Di Penta, and Y. Labiche

770

*Contract-Checking Wrappers for C++ Classes*

S.H. Edwards, M. Sitaraman, B.W. Weide, and J. Hollingsworth

794

*A Cognitive-Based Mechanism for Constructing Software Inspection Teams*

J. Miller and Z. Yin

811

**SHORT PAPERS**

*Improving Cohesion Metrics for Classes by Considering Dependent Instance Variables*

H.S. Chae, Y.R. Kwon, and D.H. Lee

826

We're dead  
serious!

IEEE  
COMPUTER  
SOCIETY  
<http://www.computer.org>  
[tse@computer.org](mailto:tse@computer.org)

IEEE

IEEE TRANSACTIONS ON  
**SOFTWARE  
ENGINEERING**

*A publication of the IEEE Computer Society*

NOVEMBER 2004

VOLUME 30

NUMBER 11

IESEDJ

(ISSN 0098-5589)

No Fancy  
Pics!

Intentionally left blank!  
Mysterious...

*Editorial: New AE Introduction*

J. Knight

713

**PAPERS**

*Analysis and Visualization of Predicate Dependence on Formal Parameters and Global Variables*

D. Binkley and M. Harman

715

*Enhancing Structured Review with Model-Based Verification*

I. Traoré and D.B. Aredo

736

*Evaluating Web Software Reliability Based on Workload and Failure Data Extracted from Server Logs*

J. Tian, S. Rudraraju, and Z. Li

754

*Assessing and Improving State-Based Class Testing: A Series of Experiments*

L.C. Briand, M. Di Penta, and Y. Labiche

770

*Contract-Checking Wrappers for C++ Classes*

S.H. Edwards, M. Sitaraman, B.W. Weide, and J. Hollingsworth

794

*A Cognitive-Based Mechanism for Constructing Software Inspection Teams*

J. Miller and Z. Yin

811

**SHORT PAPERS**

*Improving Cohesion Metrics for Classes by Considering Dependent Instance Variables*

H.S. Chae, Y.R. Kwon, and D.H. Lee

826

We're dead  
serious!

IEEE  
COMPUTER  
SOCIETY  
<http://www.computer.org>  
[tse@computer.org](mailto:tse@computer.org)

IEEE

Intentionally left blank!  
Mysterious...

No Fancy  
Pics!

<i>Editorial: New AE Introduction</i> J. Knight .....	713
<b>PAPERS</b>	
<i>Analysis and Visualization of Predicate Dependence on Formal Parameters and Global Variables</i> D. Binkley and M. Harman .....	715
<i>Enhancing Structured Review with Model-Based Verification</i> I. Traoré and D.B. Aredo .....	736
<i>Evaluating Web Software Reliability Based on Workload and Failure Data Extracted from Server Logs</i> J. Tian, S. Rudraraju, and Z. Li .....	754
<i>Assessing and Improving State-Based Class Testing: A Series of Experiments</i> L.C. Briand, M. Di Penta, and Y. Labiche .....	770
<i>Contract-Checking Wrappers for C++ Classes</i> S.H. Edwards, M. Sitaraman, B.W. Weide, and J. Hollingsworth .....	794
<i>A Cognitive-Based Mechanism for Constructing Software Inspection Teams</i> J. Miller and Z. Yin .....	811
<b>SHORT PAPERS</b>	
<i>Improving Cohesion Metrics for Classes by Considering Dependent Instance Variables</i> H.S. Chae, Y.R. Kwon, and D.H. Lee .....	826

Short papers  
are for  
wimps!

We're dead  
serious!

Intentionally left blank!  
Mysterious...

No Fancy  
Pics!

<i>Editorial: New AE Introduction</i> J. Knight .....	713
<b>PAPERS</b>	
<i>Analysis and Visualization of Predicate Dependence on Formal Parameters and Global Variables</i> D. Binkley and M. Harman .....	715
<i>Enhancing Structured Review with Model-Based Verification</i> I. Traoré and D.B. Aredo .....	736
<i>Evaluating Web Software Reliability Based on Workload and Failure Data Extracted from Server Logs</i> J. Tian, S. Rudraraju, and Z. Li .....	754
<i>Assessing and Improving State-Based Class Testing: A Series of Experiments</i> L.C. Briand, M. Di Penta, and Y. Labiche .....	770
<i>Contract-Checking Wrappers for C++ Classes</i> S.H. Edwards, M. Sitaraman, B.W. Weide, and J. Hollingsworth .....	794
<i>A Cognitive-Based Mechanism for Constructing Software Inspection Teams</i> J. Miller and Z. Yin .....	811
<b>SHORT PAPERS</b>	
<i>Improving Cohesion Metrics for Classes by Considering Dependent Instance Variables</i> H.S. Chae, Y.R. Kwon, and D.H. Lee .....	826

At least 20  
pages!

Short papers  
are for  
wimps!

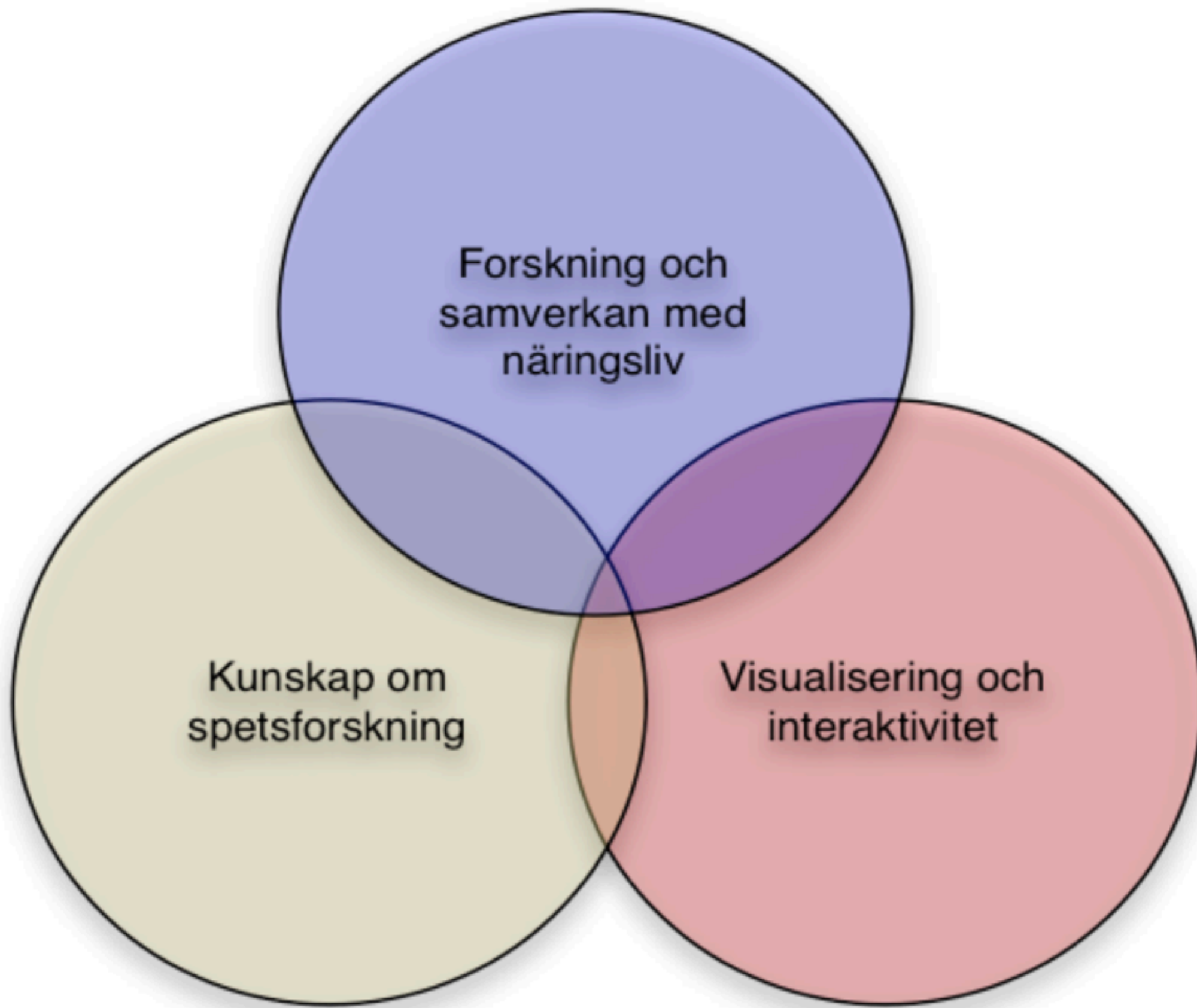
We're dead  
serious!



# TIES och Explanea

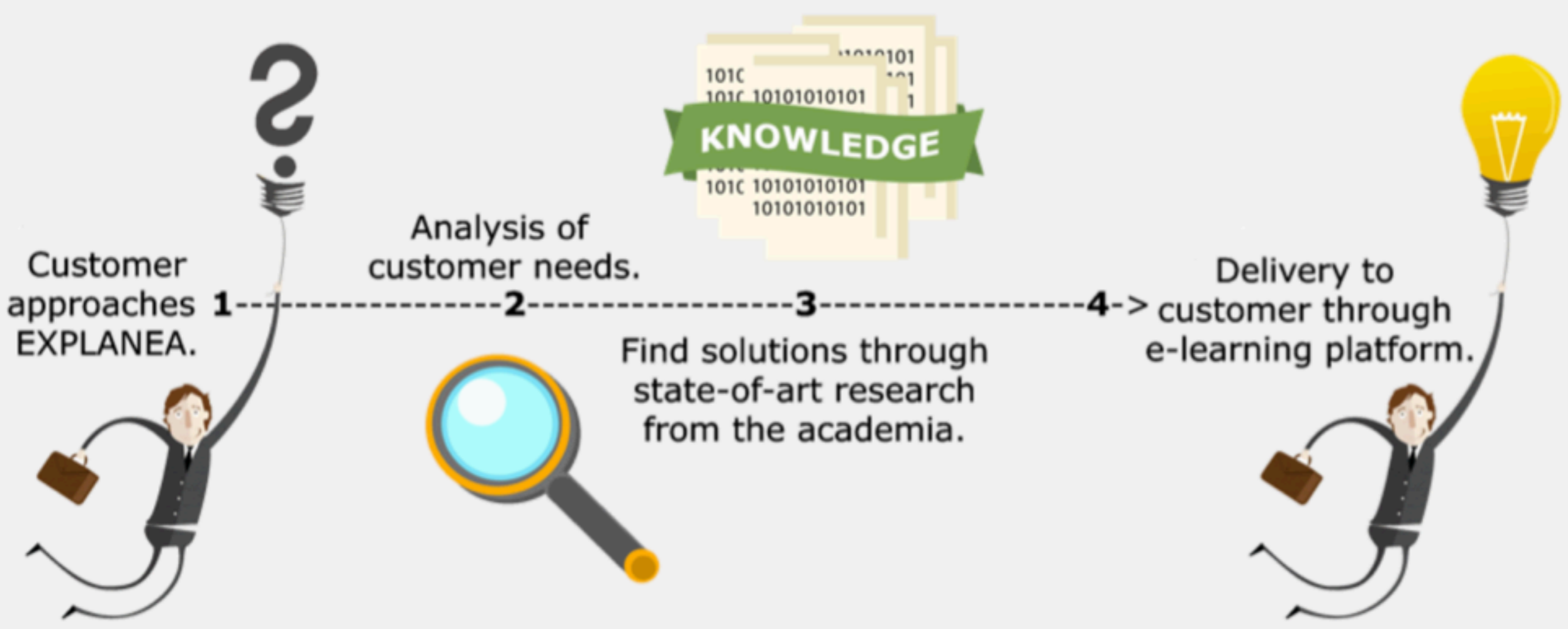
Innovation Partner







# EXPLANEA



# Öka innovationshöjden

- Få ut forskningsresultat snabbare till näringslivet
- Arbeta närmare varandra
  - Lära av varandra: Tvåvägs utbyte
- Kvantifiera förändringsarbetet (statistik)
  - Räkna kronor/kvalitet - inte gå på magkänsla
- Hitta rätt personer som har mandat att förändra

# Exempel på ny forskning

- Fem enkla mallar räcker för att förbättra kravarbetet
- Granskning är bättre än TDD (lite dyrare, men hittar fler & viktigare problem)
- Kanban är bättre än Scrum (50% kortare ledtider och 10% färre fel)
- Visuella GUI Tester kan automatisera systemtest

# Exempel på ny forskning

- Exploratory testing är i många fall bättre än traditionell testning
- Metod för test design är generellt sett irrelevant – testaren är viktigare...
- Enkla modeller predikterar vart fel kommer upptäckas nästan lika bra som avancerade modeller
  - Enkla modeller kan appliceras nästan överallt

Data

+

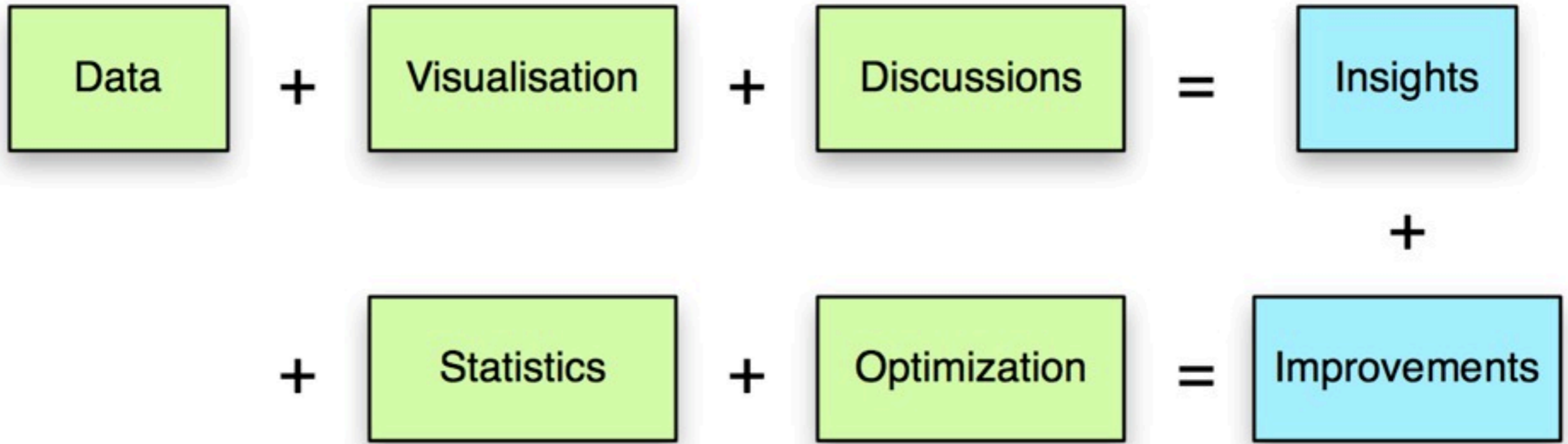
Visualisation

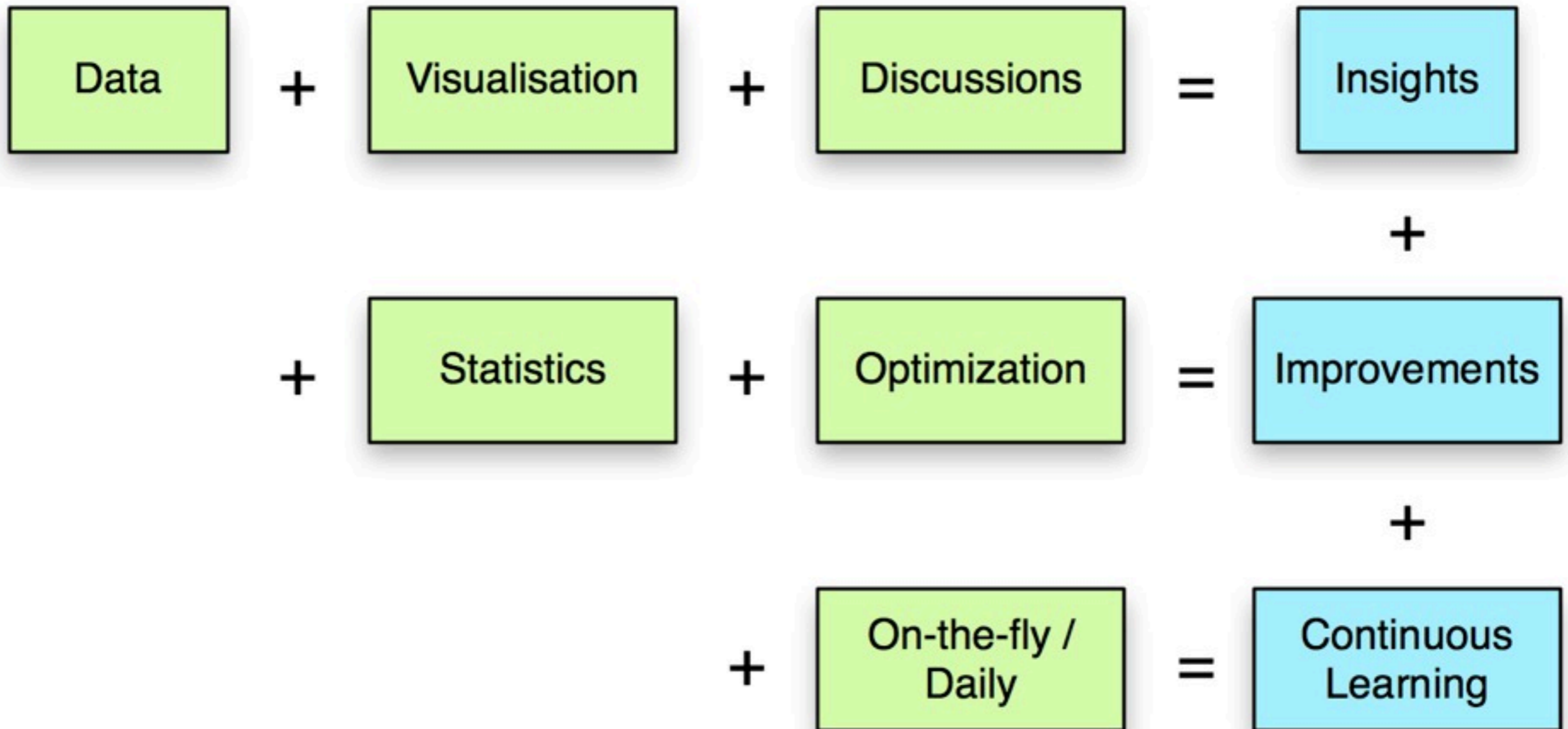
+

Discussions

=

Insights





TEST START TIME

TEST CASE

SYSTEM VERSION

OUTCOME

2013-09-04 04:17:12

Login non existing user

1.32 - Build 3476



2013-09-04 04:17:12

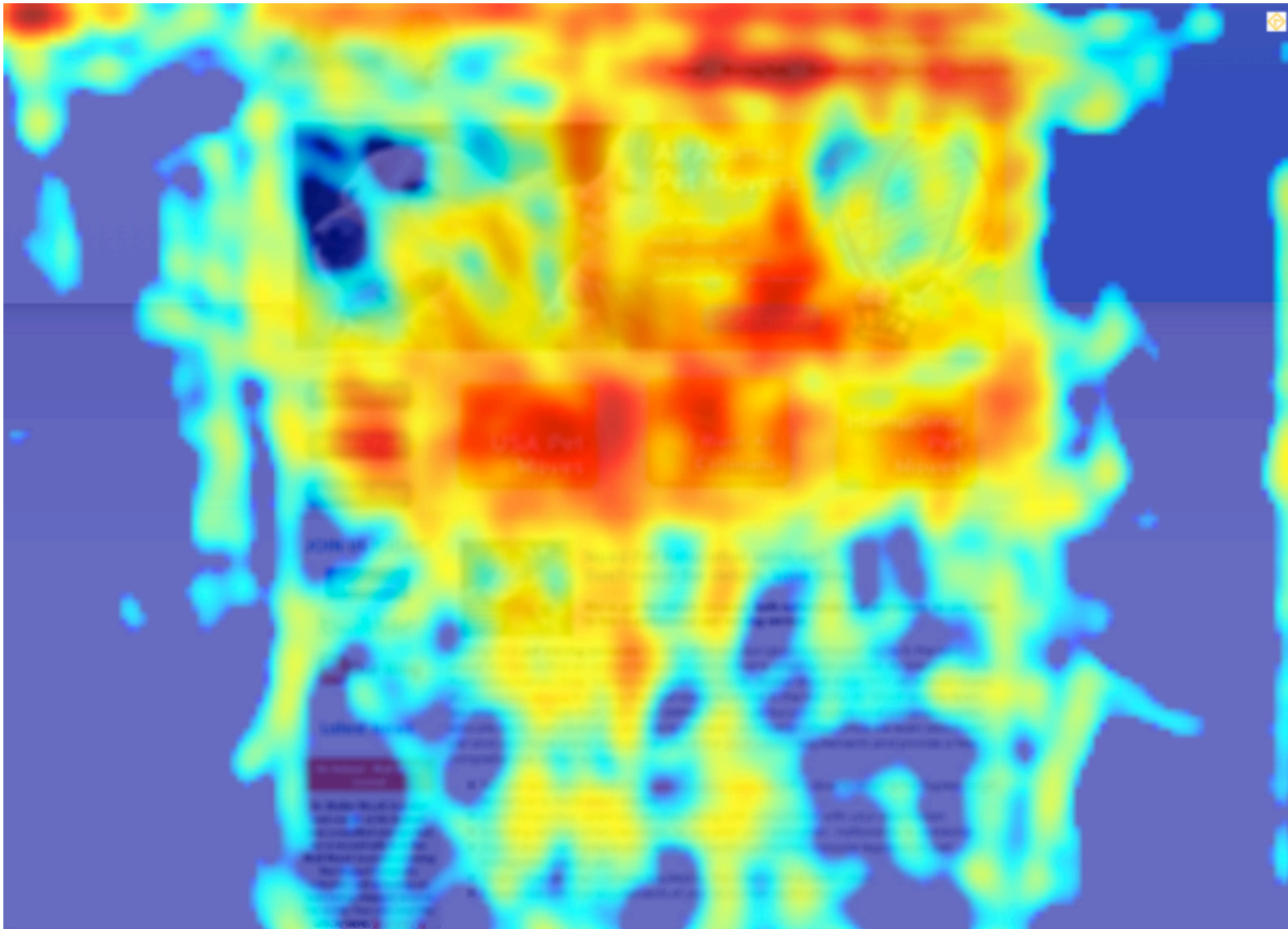
Login existing user

1.32 - Build 3476



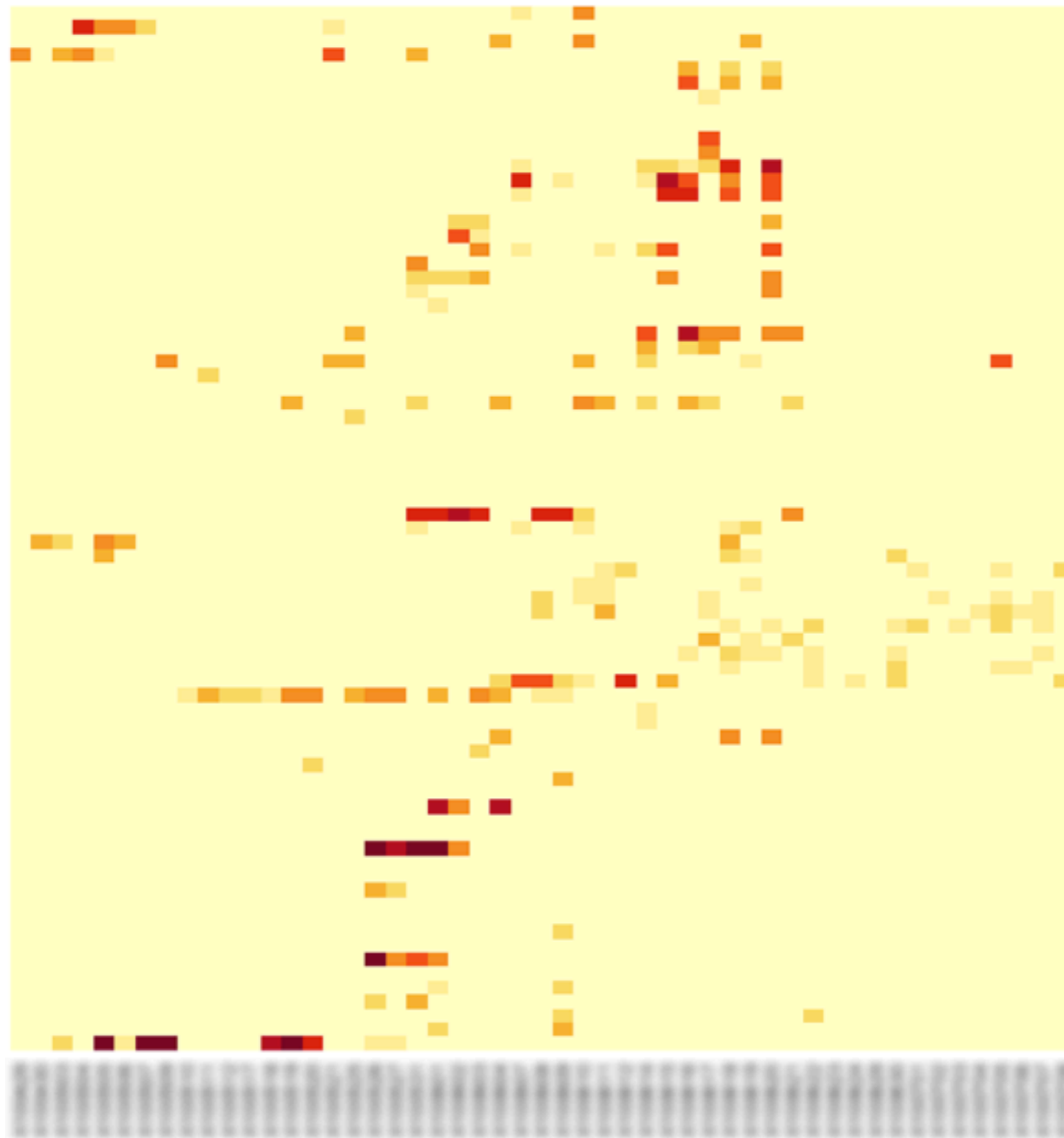


# Heatmaps shows “raw” data and reveals patterns

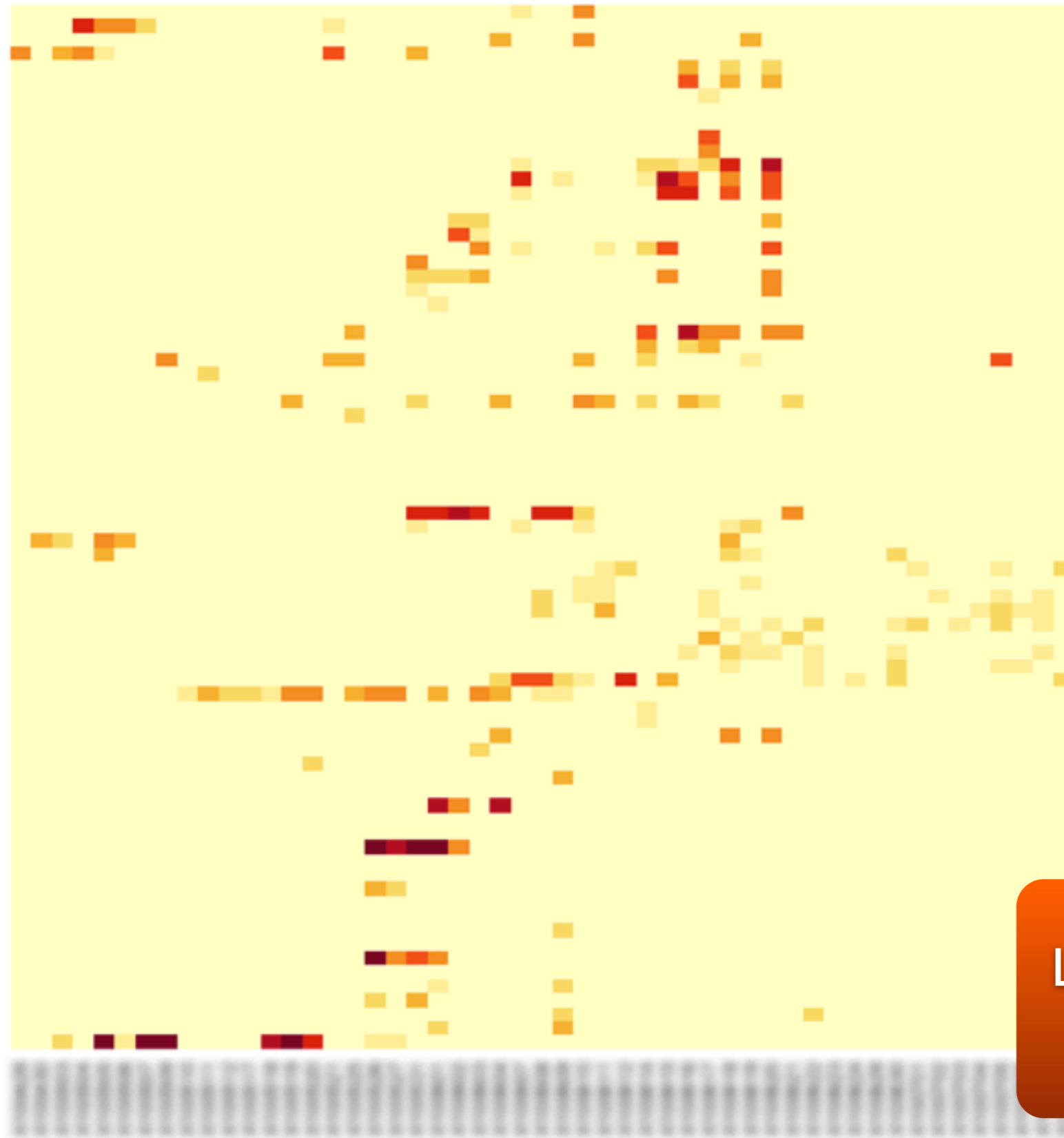




# Test failures

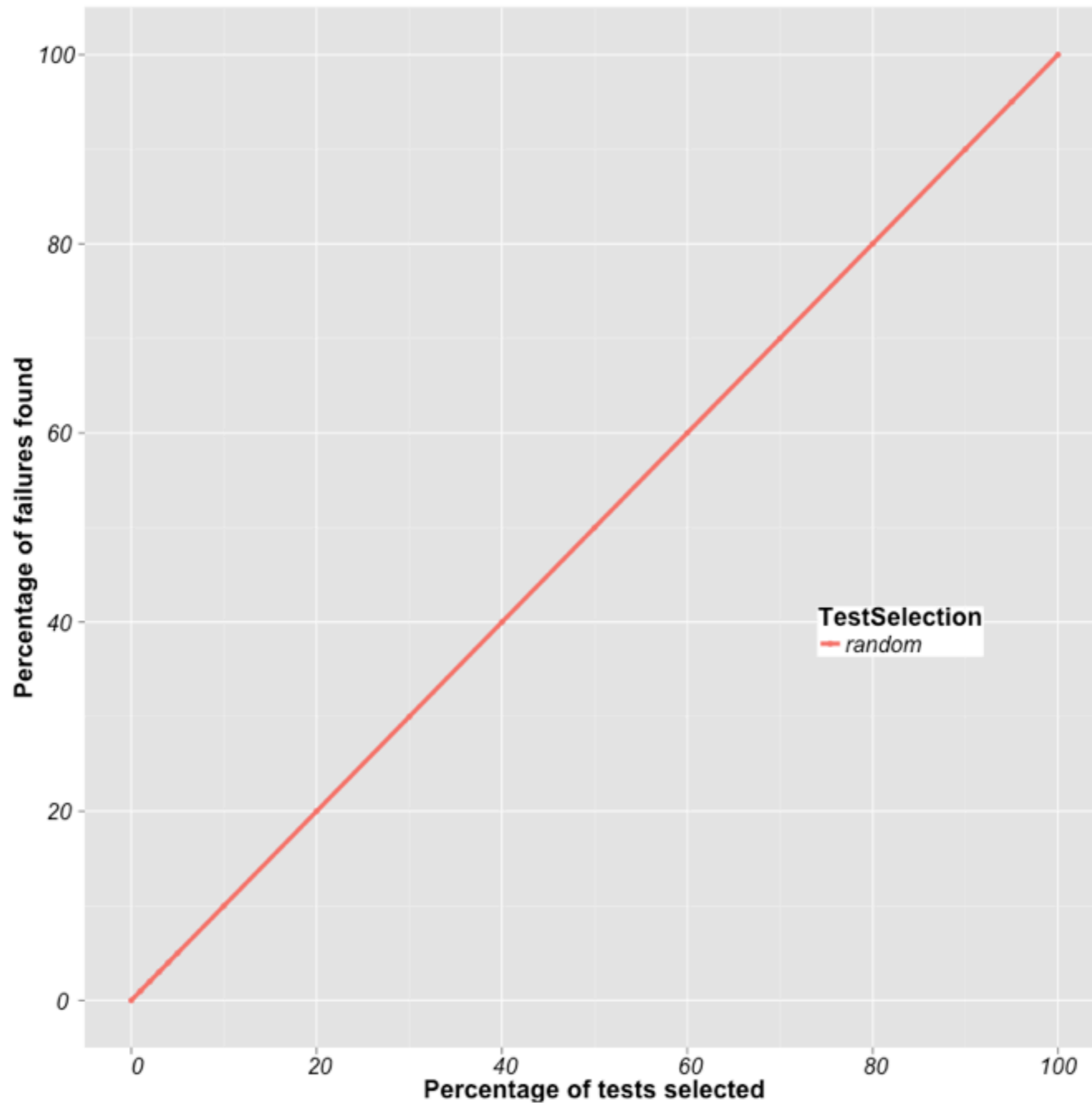


# Test failures

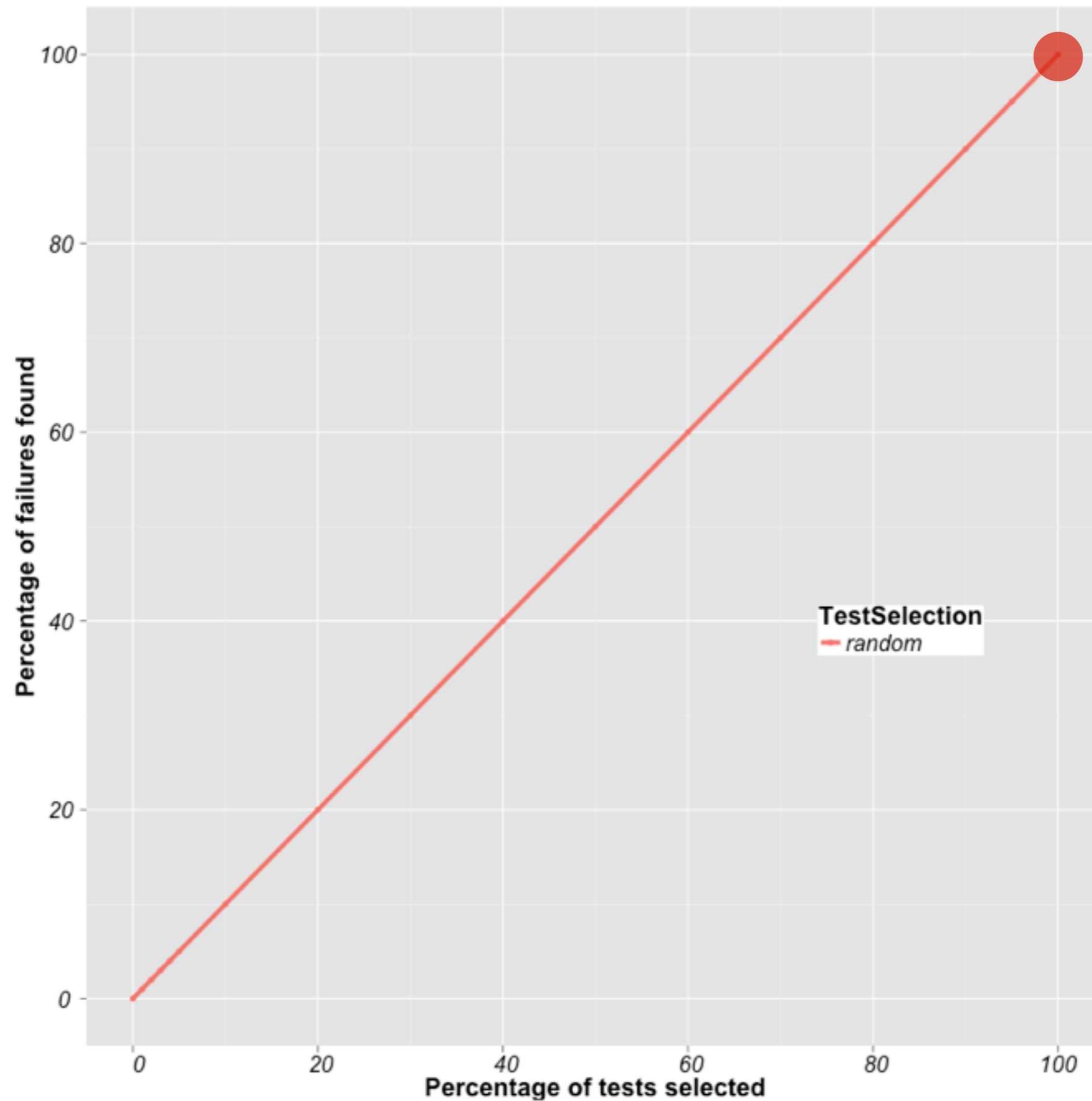


Lack of integration traces!

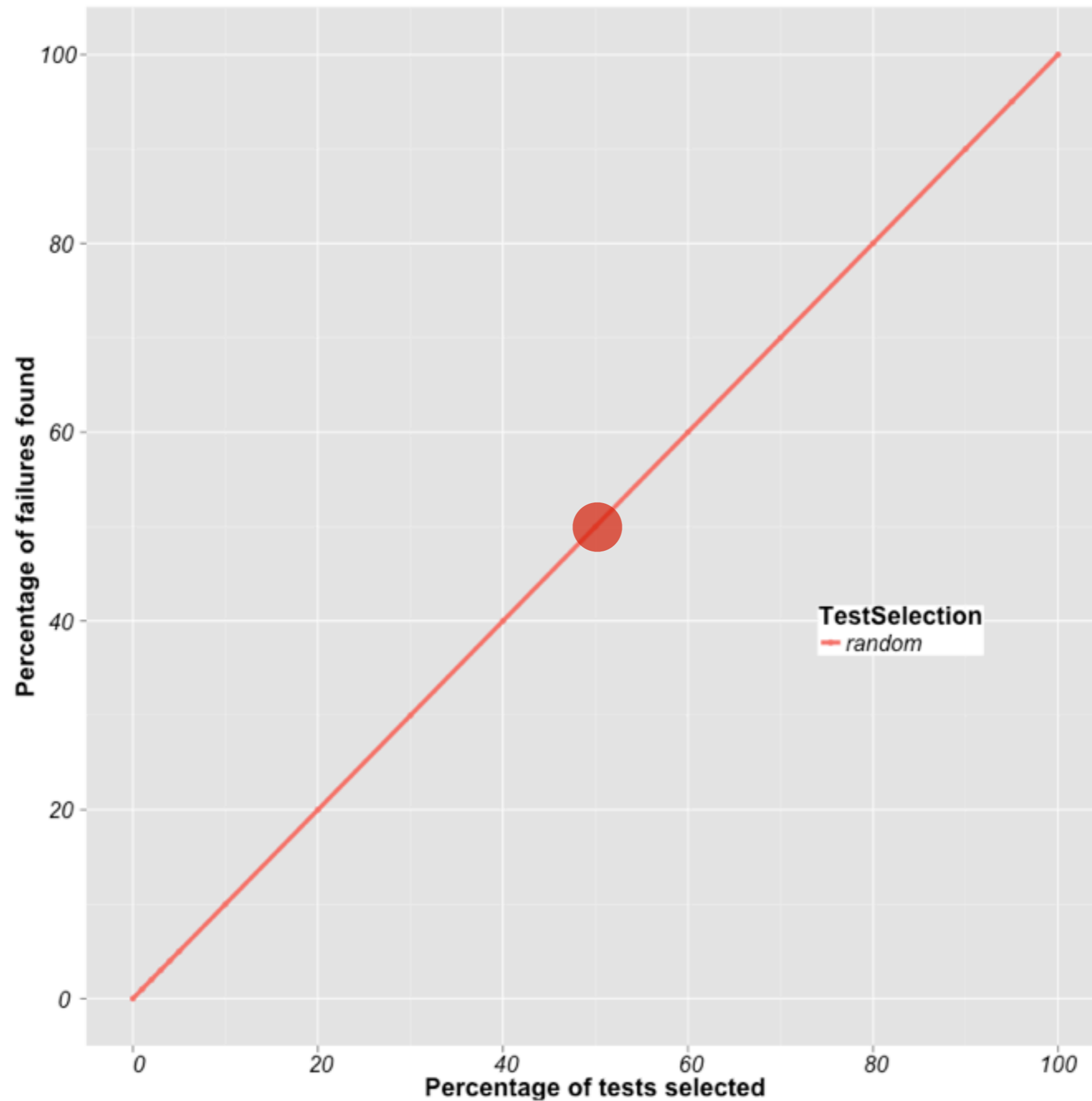
# Testing only what is likely to fail



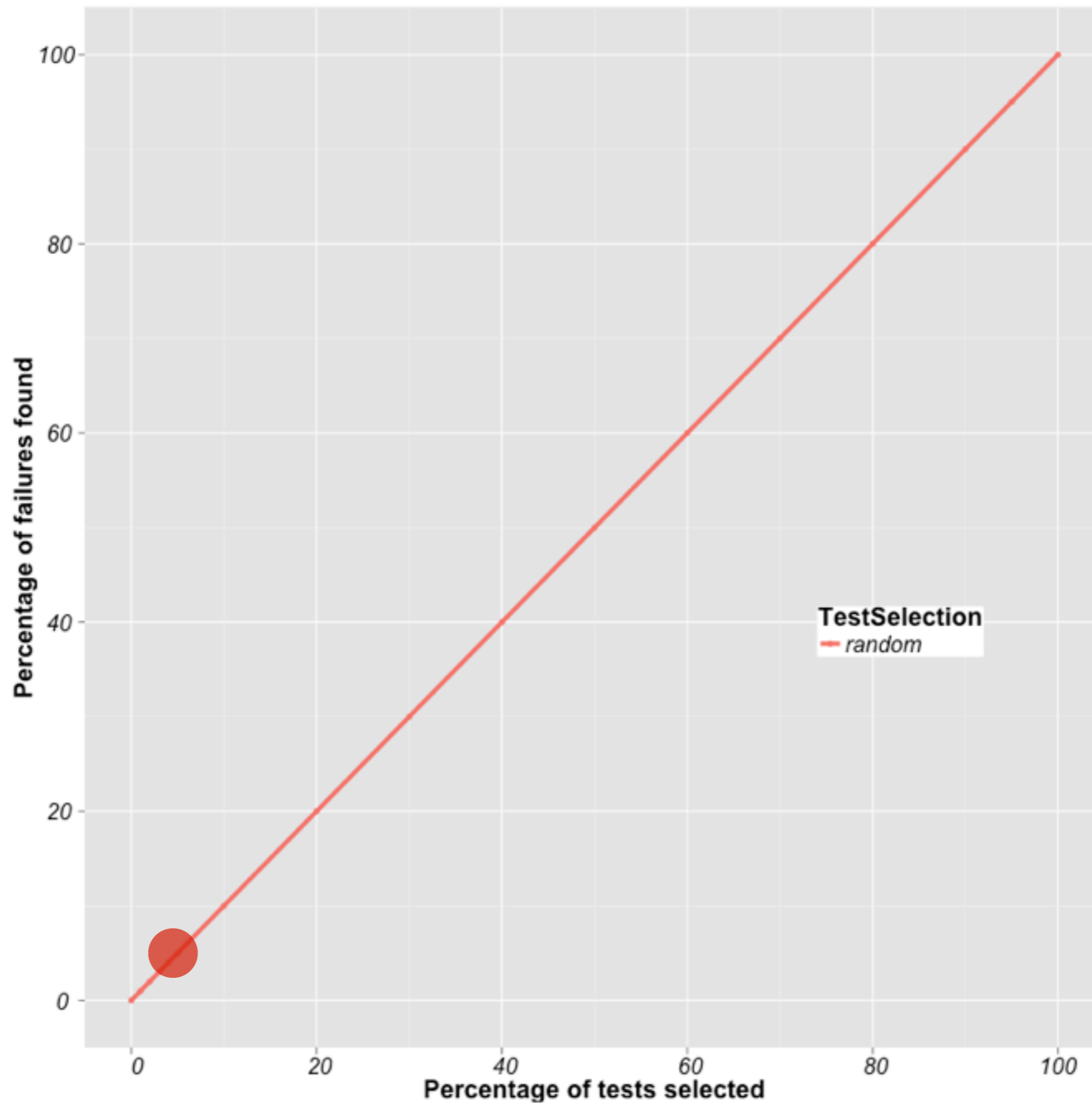
# Testing only what is likely to fail



# Testing only what is likely to fail

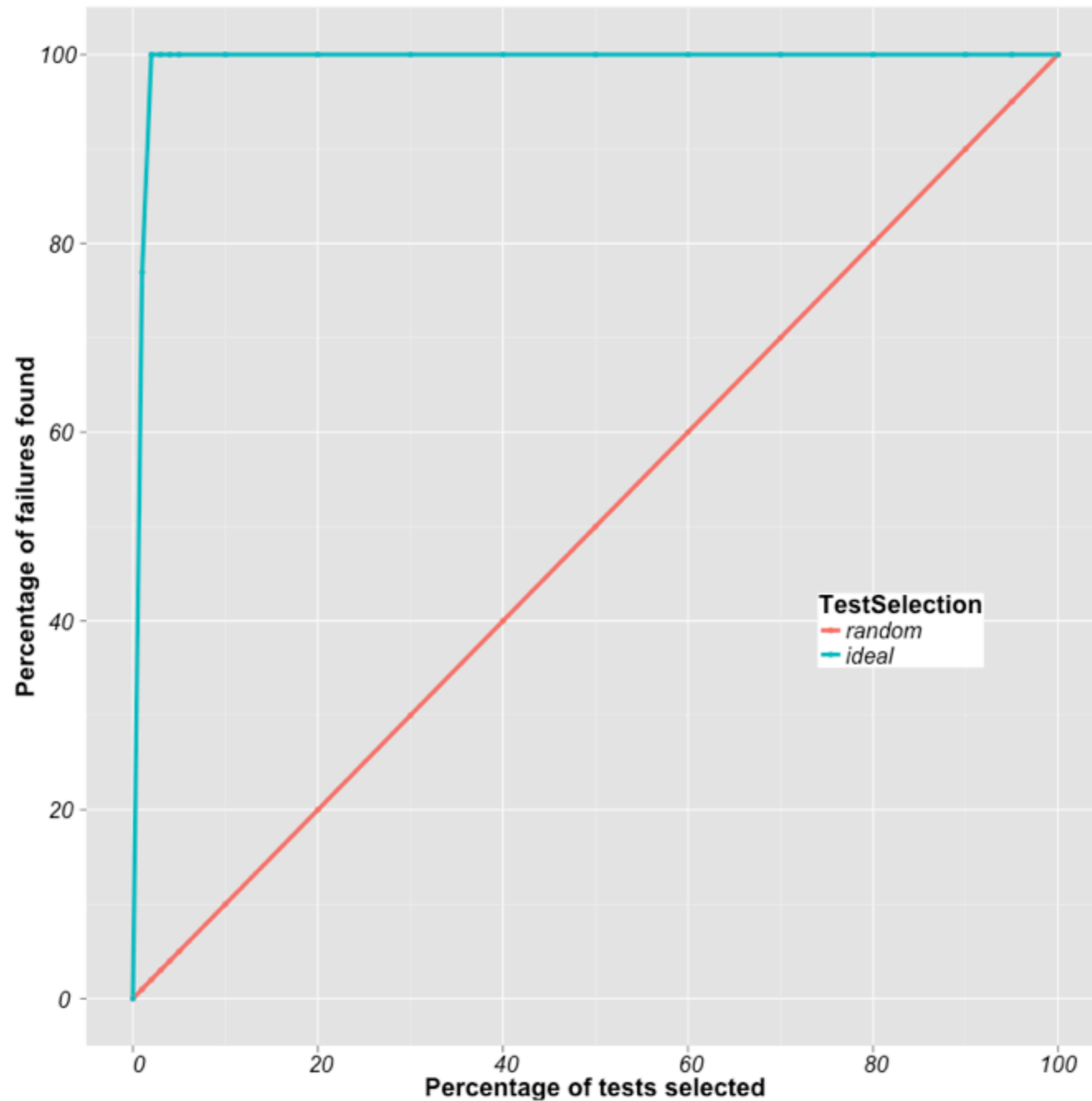


# Testing only what is likely to fail

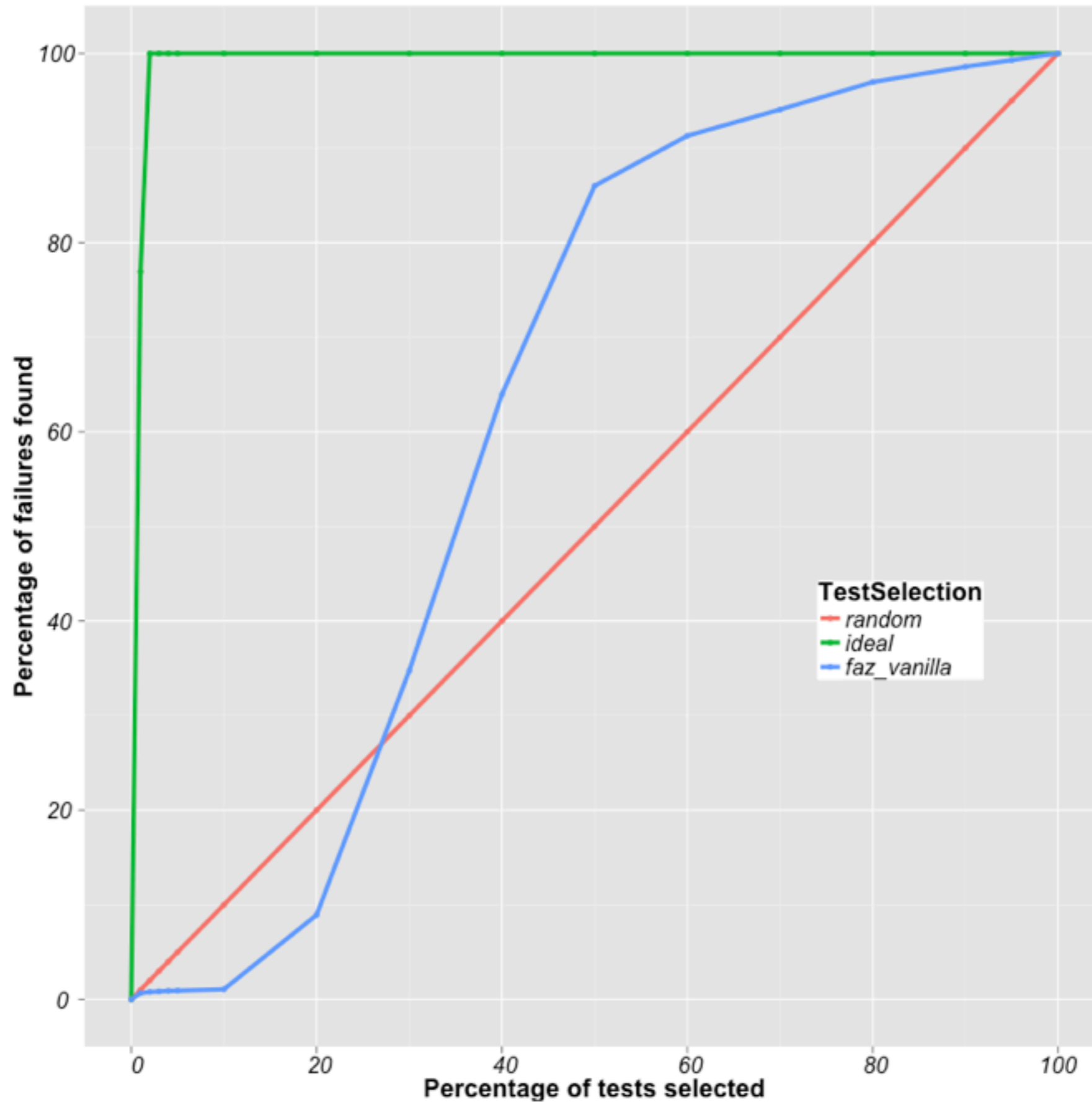




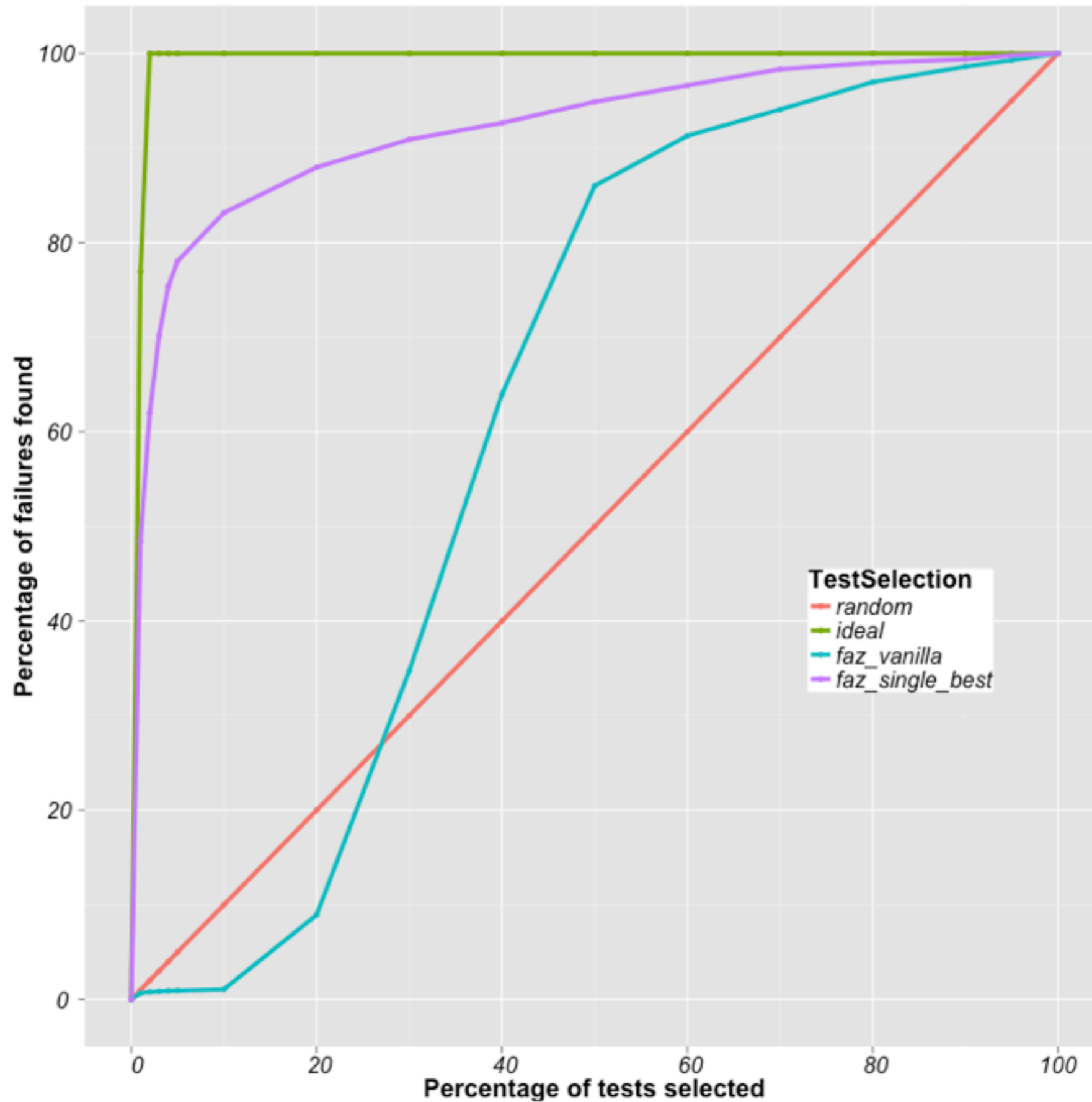
# Testing only what is likely to fail



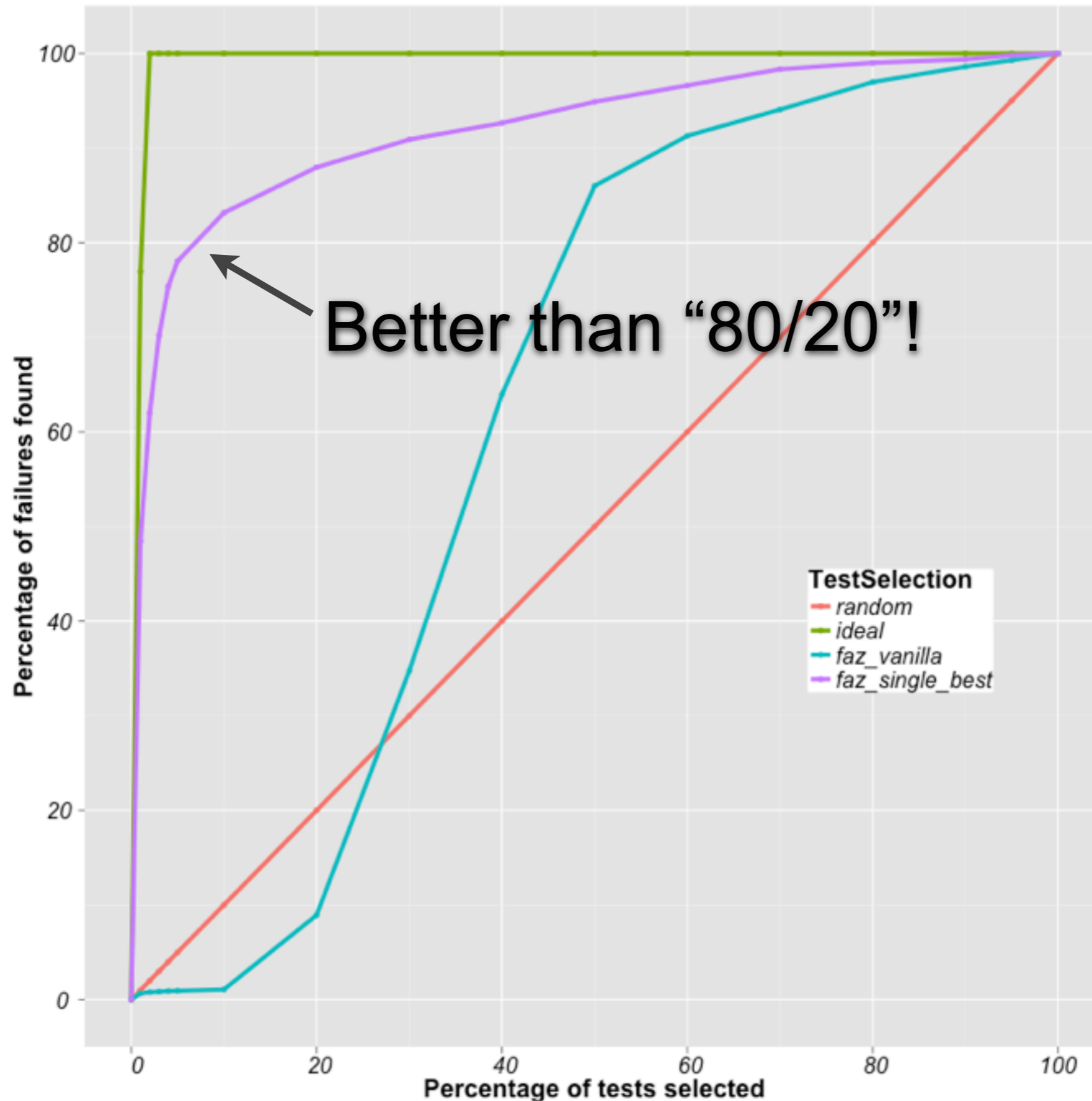
# Testing only what is likely to fail

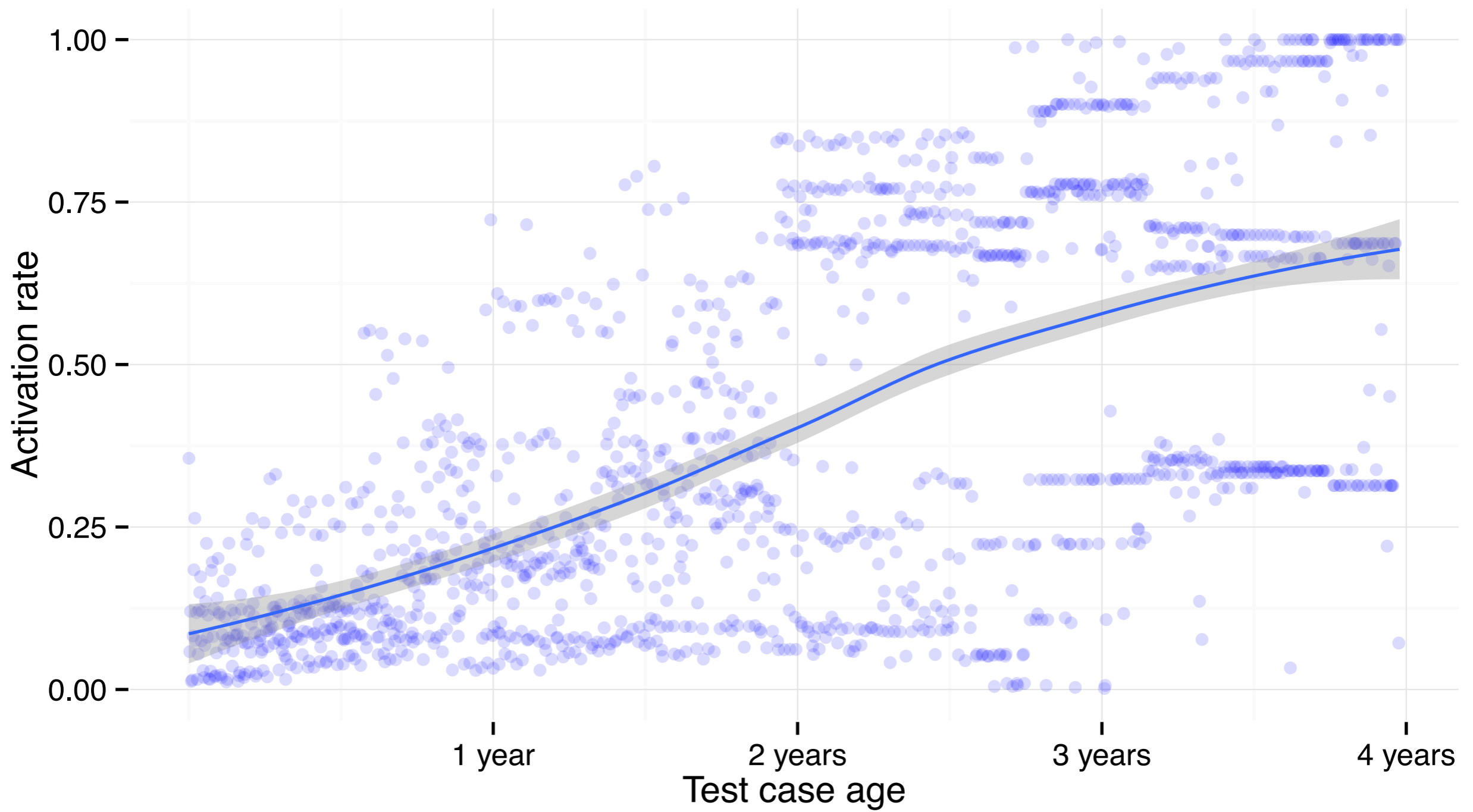


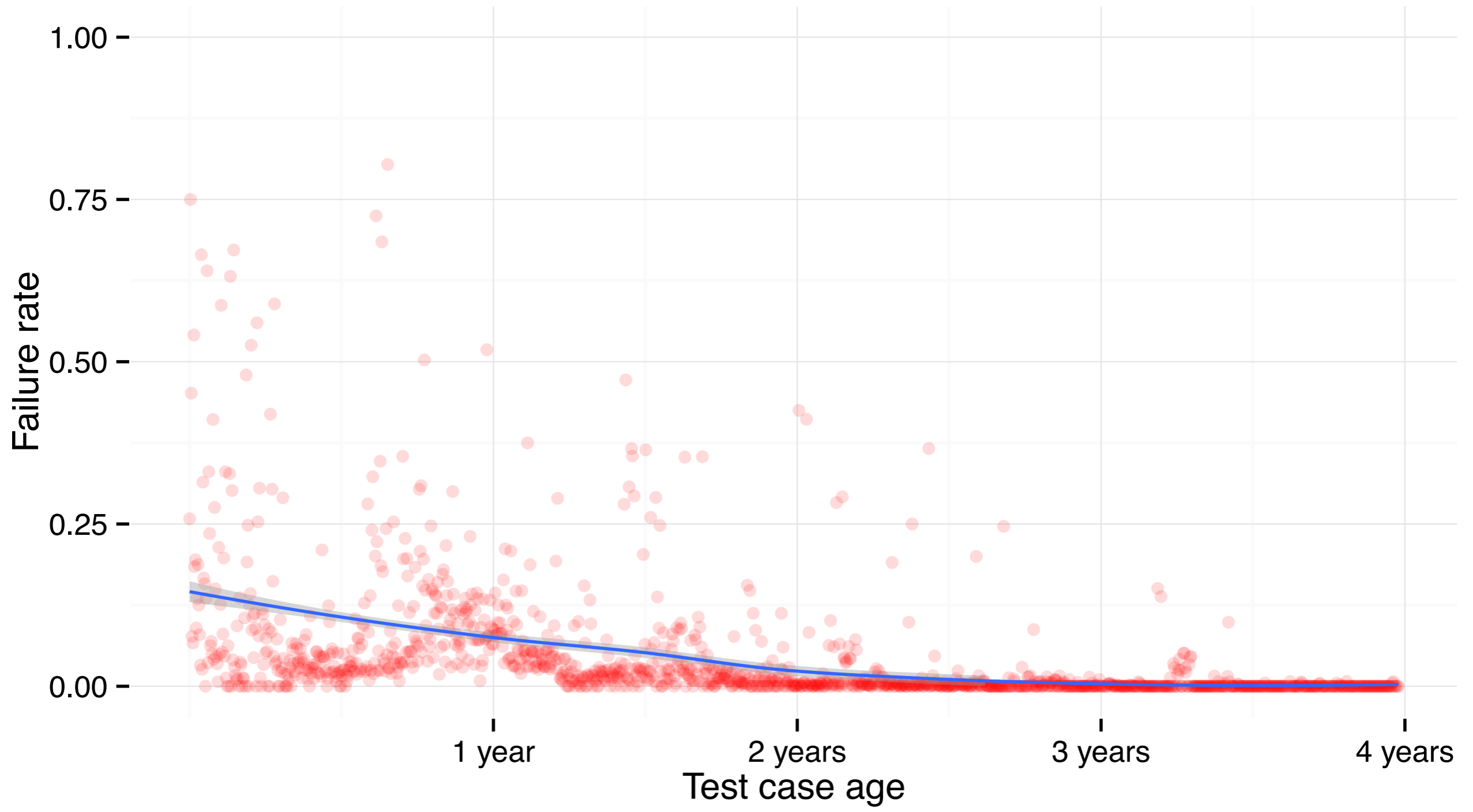
# Testing only what is likely to fail



# Testing only what is likely to fail

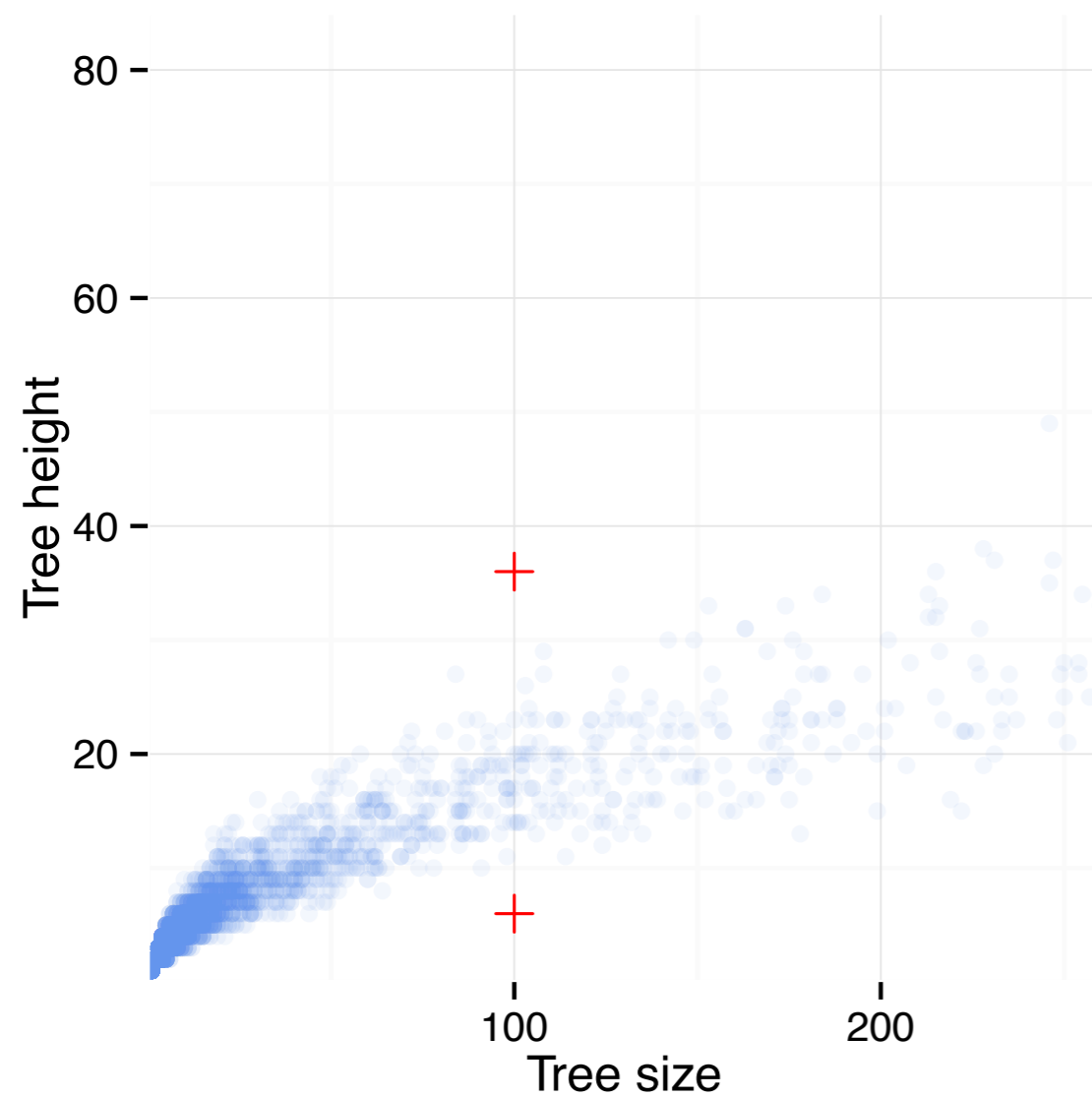




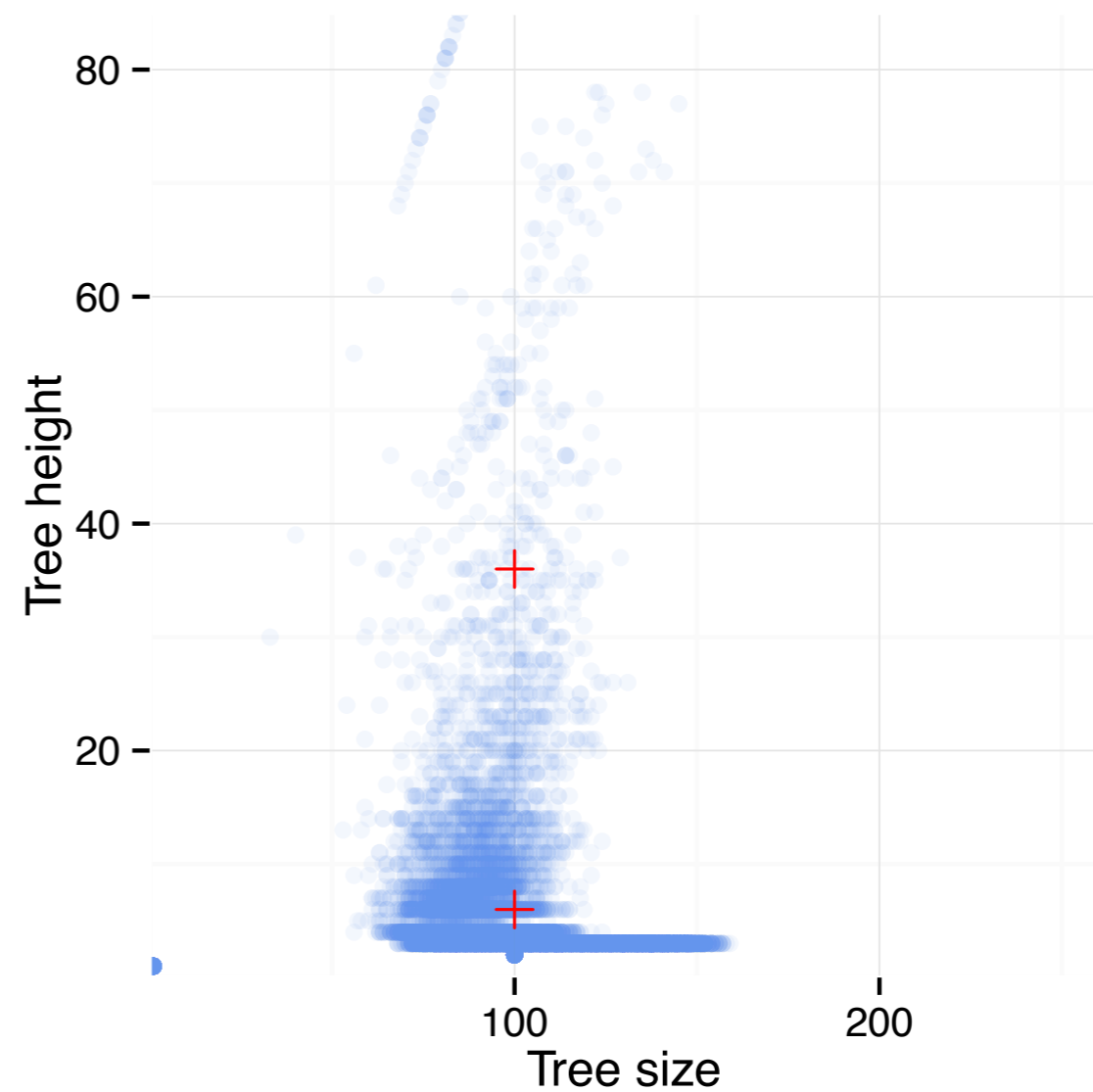


# Results

Scatter plots show the distribution of tree sizes and heights; target bias objectives are indicated by crosses



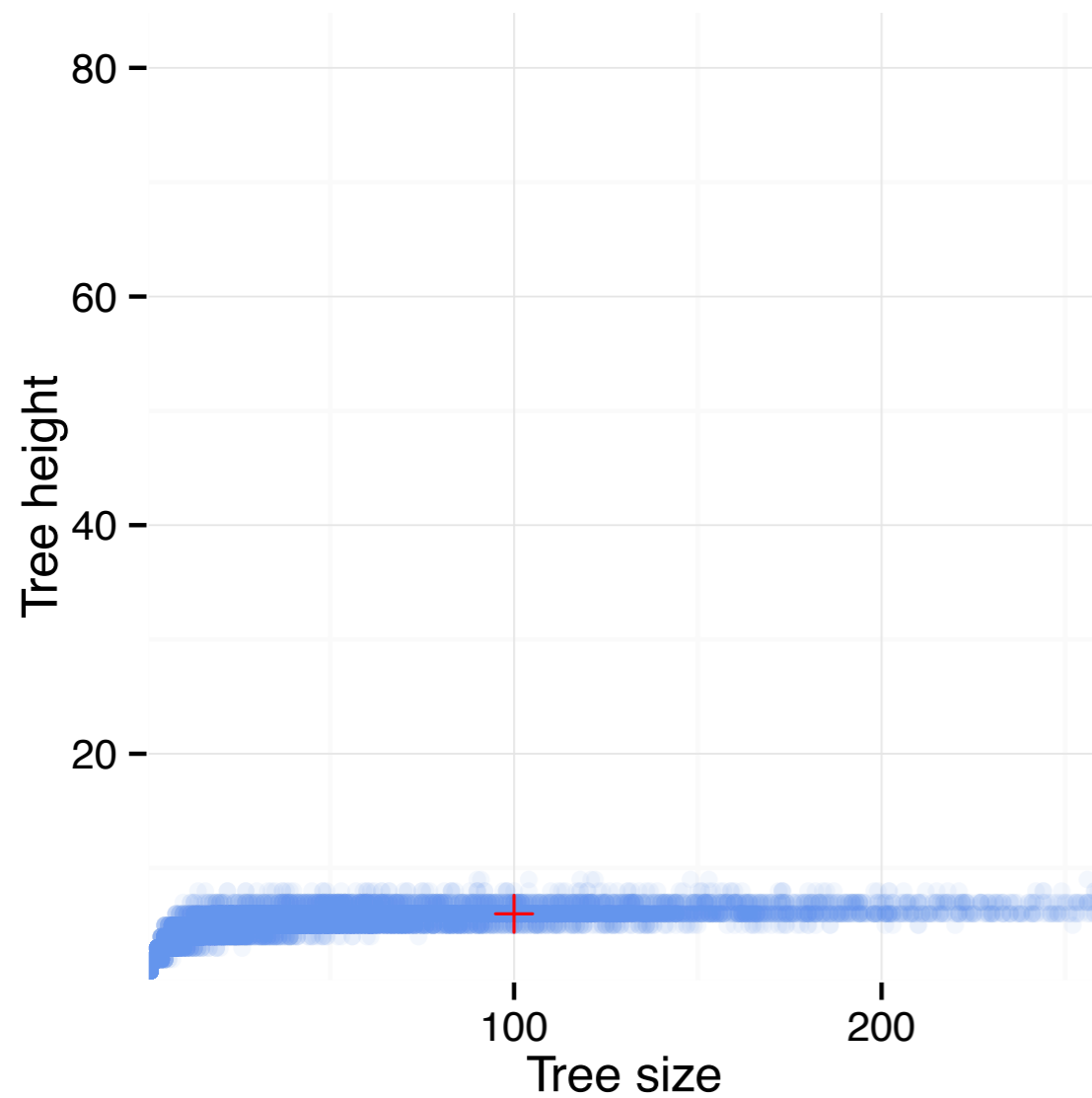
**Boltzmann Sampler**



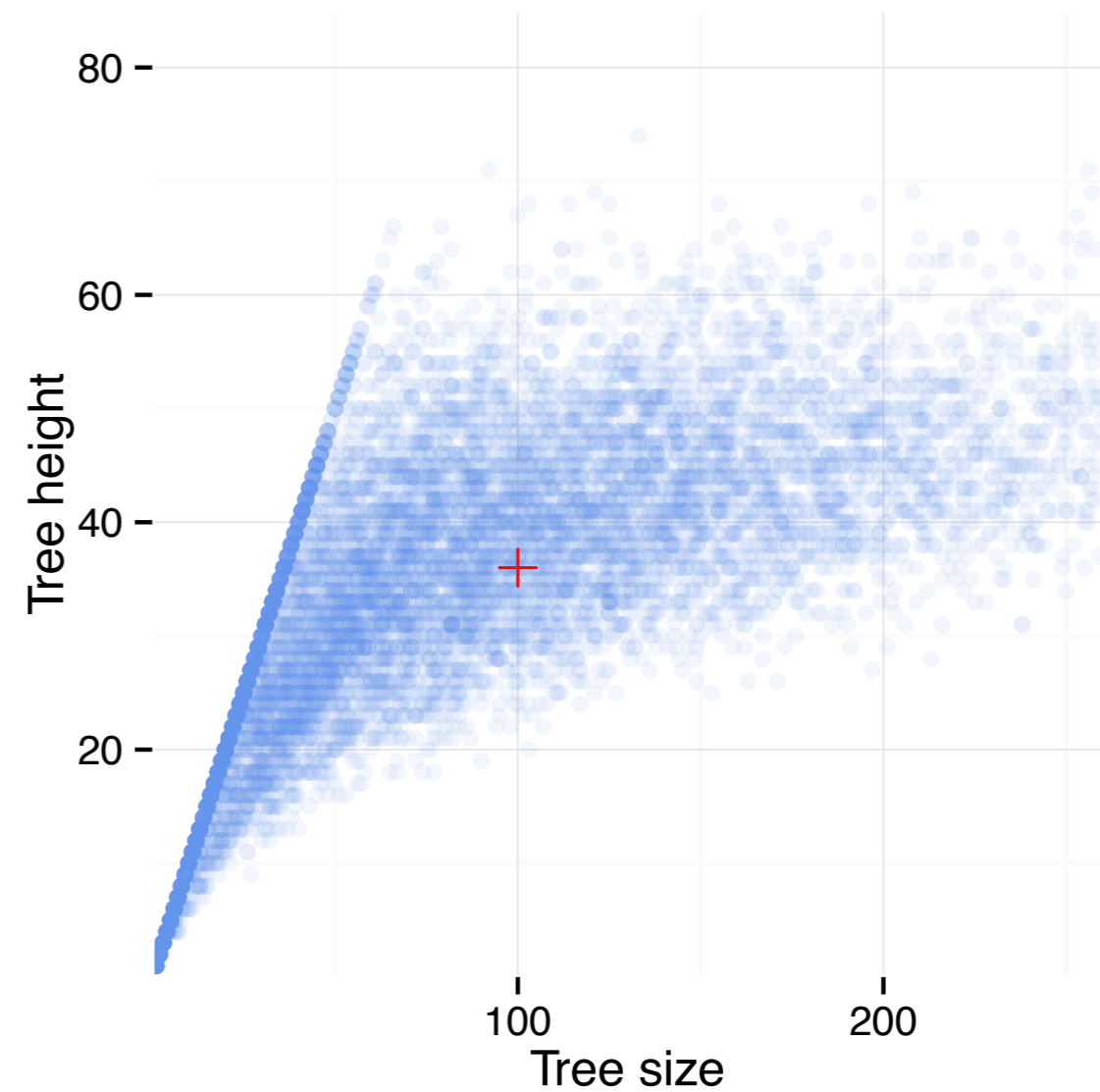
**QuickCheck**

# Results

Scatter plots show the distribution of tree sizes and heights; target bias objectives are indicated by crosses



**GödelTest  
(Decay Distribution)**



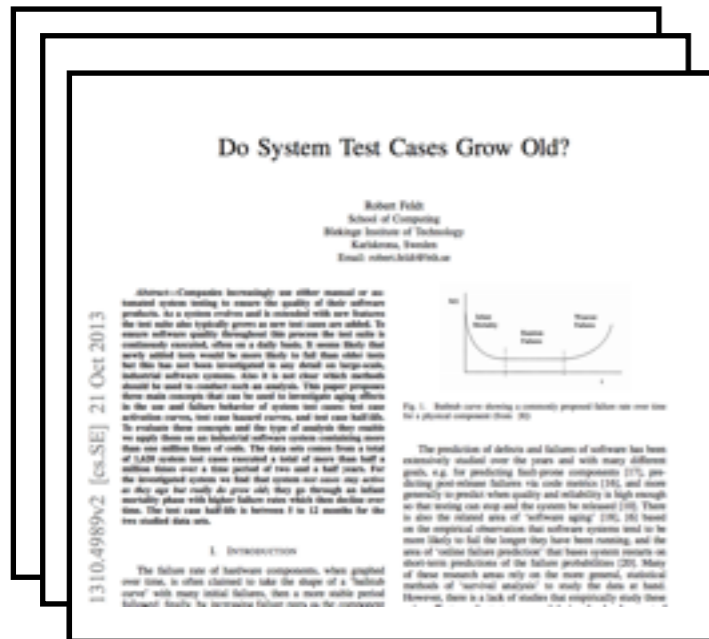
**GödelTest  
(Decay Histogram)**





**EXPLANEA**





→ **EXPLANEA** →

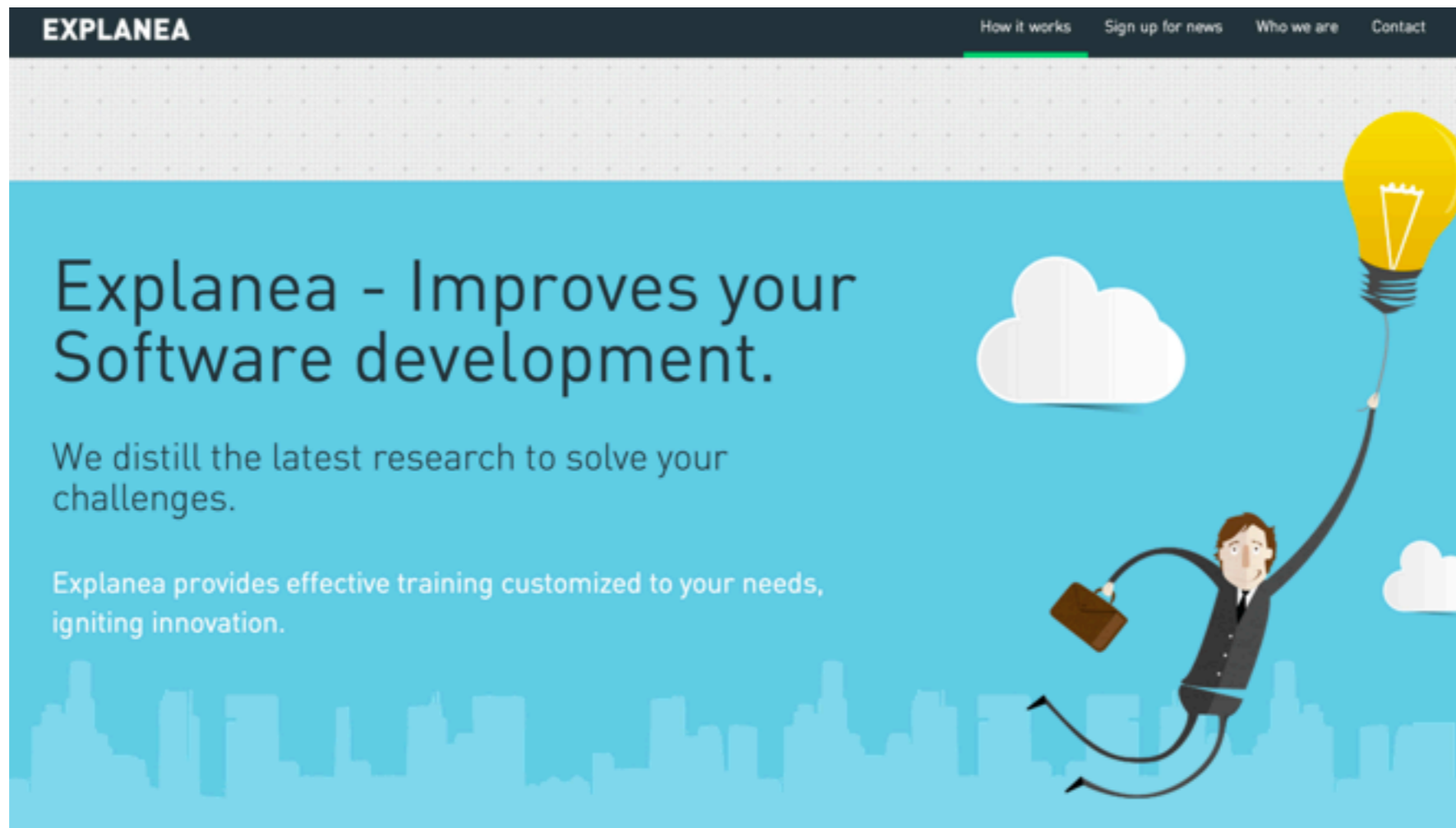


**We are looking for beta testers!**  
<http://explanea.com>

# Conclusions

- Visualisations + group discussions lead to high-level understanding of development patterns and problems
- Heatmaps excellent way to visualise large data sets and see “distant” connections
- Value is in the learning that happens, **NOT** in tools!
- Post-mortem project analysis **NOT** enough!
- Statistics and machine learning can optimize testing
- We need to better bridge the gap between research and practice. [explanea.com](http://explanea.com) is one, new approach.

# Thank you!



The image shows a screenshot of the Explanea website homepage. At the top, there is a dark navigation bar with the company name 'EXPLANEA' on the left and four menu items: 'How it works', 'Sign up for news', 'Who we are', and 'Contact'. The 'How it works' link is highlighted with a green underline. Below the navigation bar is a light gray header area with a subtle dot pattern. The main content area has a blue background. On the left, the text reads: 'Explanea - Improves your Software development.' followed by 'We distill the latest research to solve your challenges.' and 'Explanea provides effective training customized to your needs, igniting innovation.' On the right, there is an illustration of a man in a suit floating in the air, holding a large glowing yellow lightbulb by its cord. The background of the illustration includes white clouds and a silhouette of a city skyline at the bottom.

# Thank you!

Colleagues: R. Torkar, M. Staron

Steve Wittens, acko.net

