# Benchmarking Exploratory OLAP

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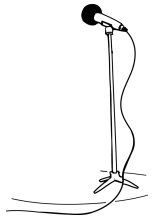

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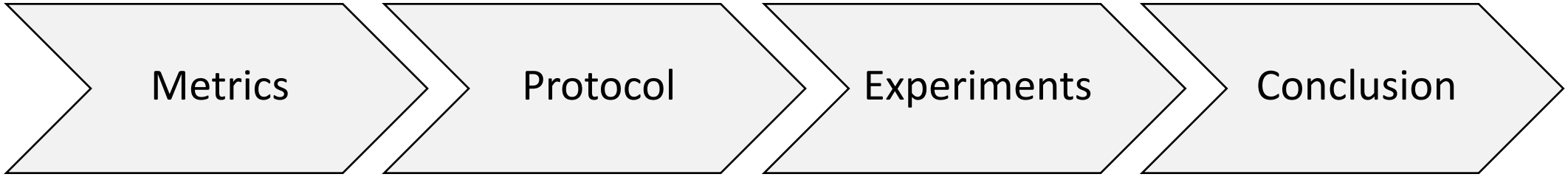
# Cube exploration techniques

| Reference | Category | Input | | | Output |
|---|---|---|---|---|---|
| | | DB instance | Query log | Current query | |
| [IJBIDM, 2009] | Automatic exploration | ✓ | | ✓ | Tuples |
| [DSS, 2015] | Automatic exploration | | ✓ | ✓ | Sequence of queries |
| [IJDWM, 2011] | Automatic exploration | ✓ | ✓ | ✓ | Queries |
| [DaWaK, 2013] | Automatic exploration | | ✓ | ✓ | Queries |
| [IS, 2015] | Visual optimization | ✓ | | ✓ | Queries |
| | Automatic exploration | | | | Result highlighting |
| [TKDE, 2011] | Visual optimisation | | | ✓ | Query |
| [VLDB, 2000] | Data prefetching | ✓ | ✓ | ✓ | Tuples |
| [VLDB, 1999] | Data prefetching | ✓ | | ✓ | Tuples |
| [ICDE, 2014] | Data prefetching | ✓ | | ✓ | Sequence of queries |
| [DaWaK, 2000] | Data prefetching | | ✓ | ✓ | queries |

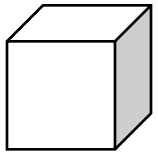
# Outline



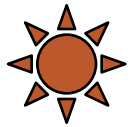
# Metrics

FOR SCORING AN OLAP EXPLORATION

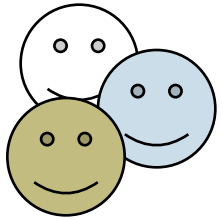
# What is an OLAP exploration?



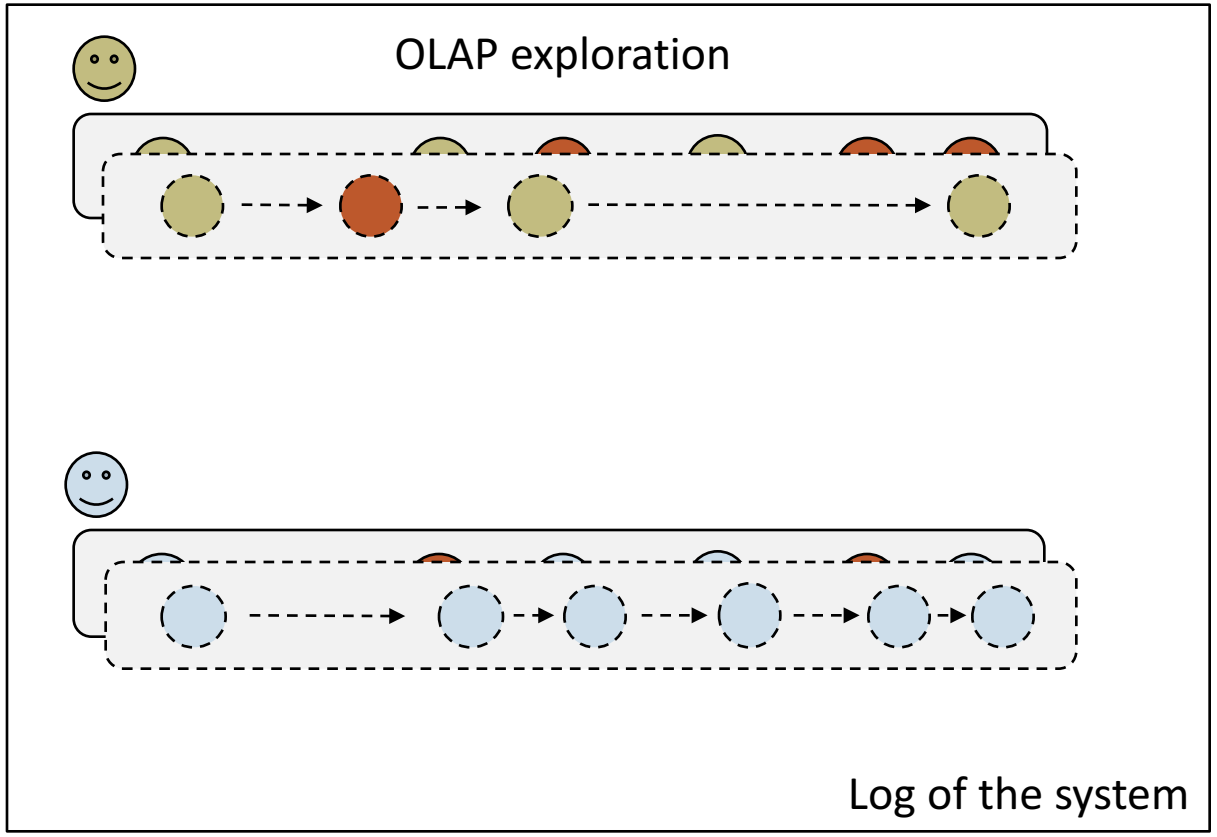
Database

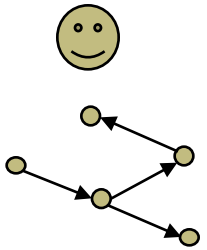


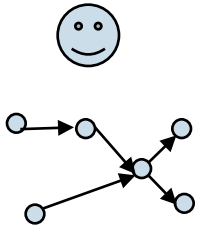
Exploration assistant



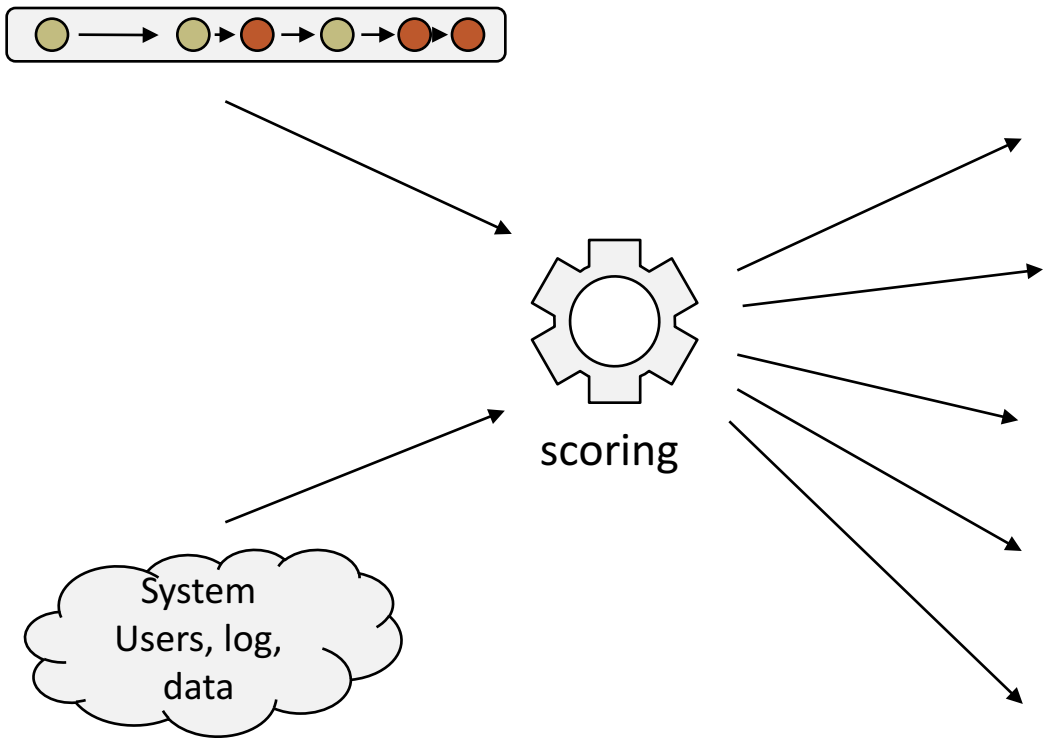
Users





# Scoring an OLAP exploration

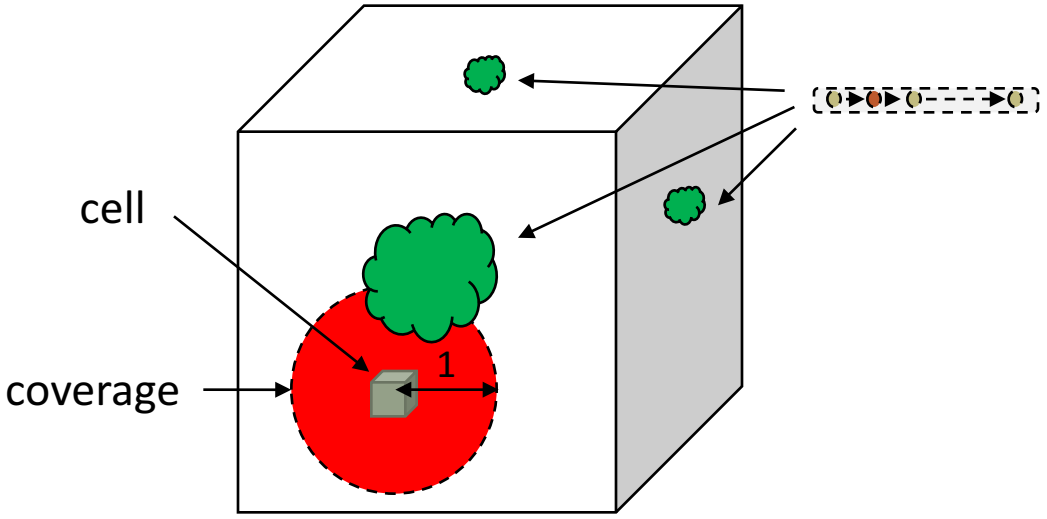



**5 user centric categories[White et Al., 2009] of metrics**

- Task time
- User engagement (Web search)
- Task success (Information retrieval)
- Information novelty (Information theory)
- Learning and cognition (e-learning)

# Task success

## EXPLORATION COMPLETENESS




Exploration is complete for a cell when its whole coverage is retrieved

## RECALL & PRECISION

Relevant set

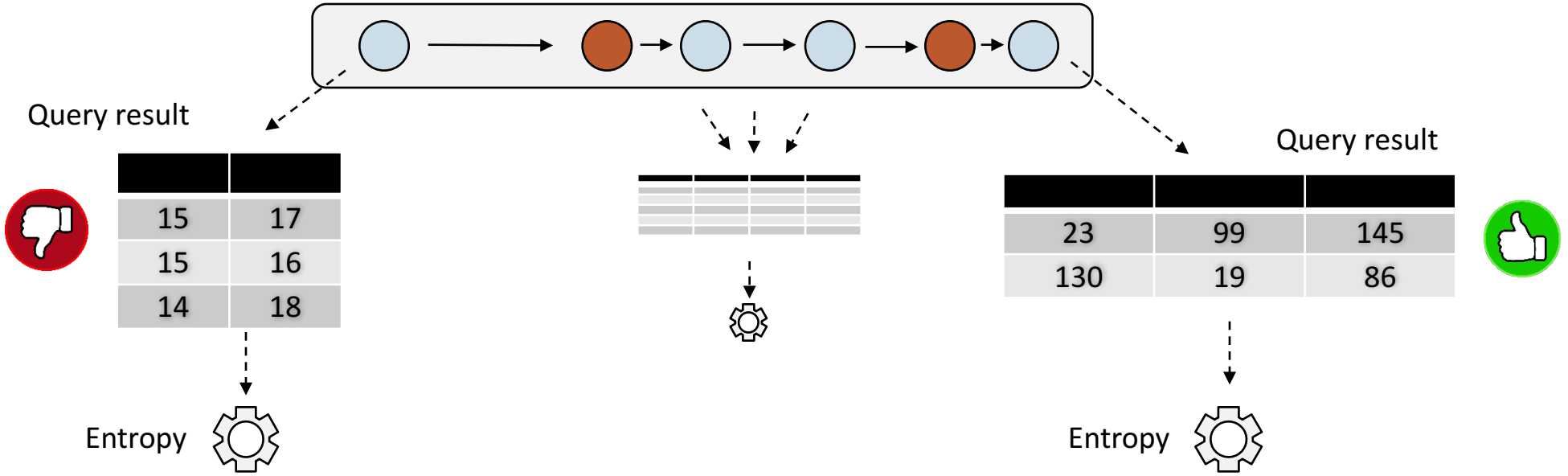
The whole coverage of a given set of cells

- Usually the cells in the first query of the exploration

Retrieved set

All the cells retrieved during a given OLAP exploration

# Information Novelty




Score = **Average entropy** for all the queries in the exploration

# Knowledge Tracing[UMUAI, 1995]

## DESCRIPTION

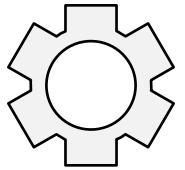
- Used in e-learning to evaluate students
- Evaluates the degree to which a skill is mastered after an exercice n: $P(L_n)$

| **4 parameters** | |
|---|---|
| P(t) | probability the skill will be learned at each opportunity to use the skill |
| $P(L_0)$ | probability skill is initially mastered |
| P(g) | probability to guess |
| P(s) | probability to slip |

## PRINCIPLE

[✓, ✓, ✓, ✗, ✗, ✓]
Exercices results

KT parameters

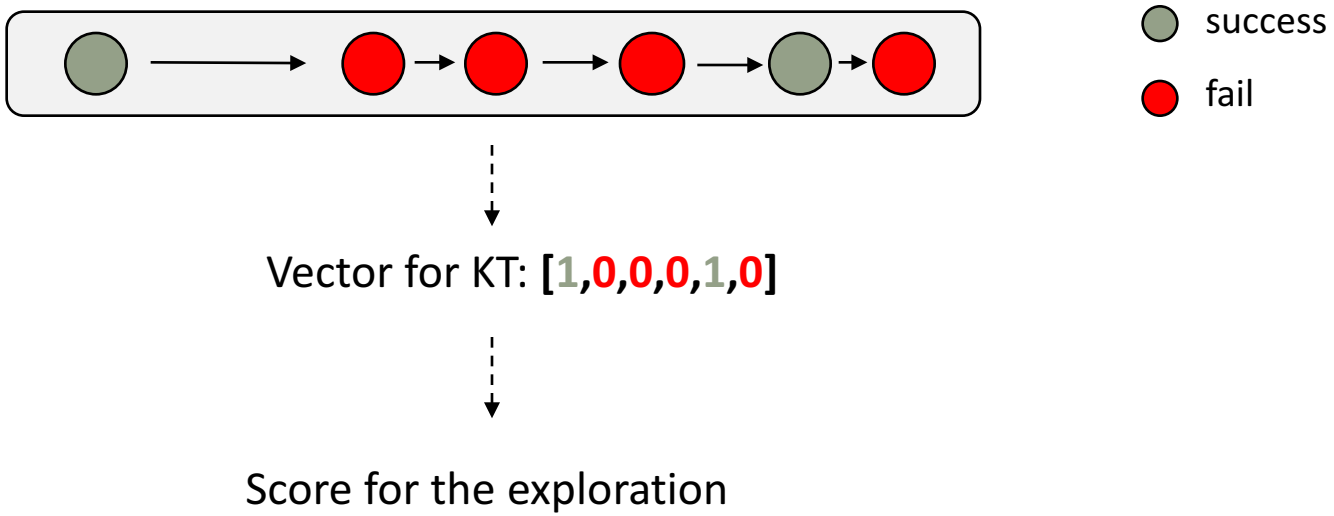


KT formula

Score: probability the skill is mastered after the exercices resolution

# In our case

Exercice: propose a « good » query (i.e. with high Novelty)…



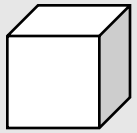
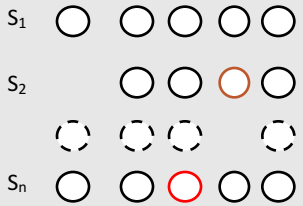
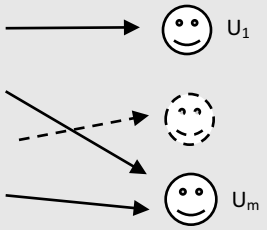
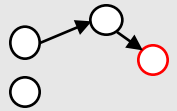
# Benchmark

GENERATING A REALISTIC OLAP SYSTEM

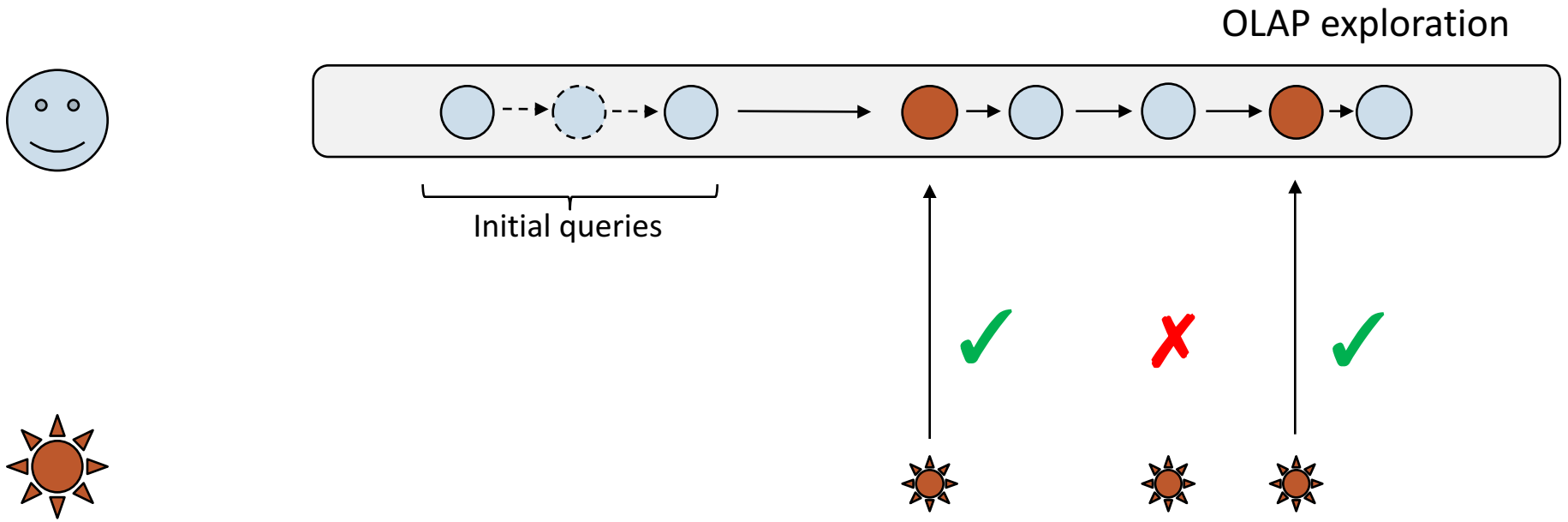
HAVING SUTS GENERATE EXPLORATIONS

# Benchmark overview

Only state of the art techniques

| Data generation | Log generation | User creation | User model |
|---|---|---|---|
| SSB [TPCTC, 2009]  |   |   |  |
| PDGF[TPCTC, 2010] | Cubeload[CAISE, 2014] | Fuzzy C Medoid[IEEE-FS, 2001]<br>OLAP session similarity[KAIS, 2014] | Markov[WILEY, 1976] |

# Simulating an exploration




Exploration assistant
System Under Test (SUT)

# Experiments

# Conducted tests

| | **Tested SUTs** |
|---|---|
| | No SUT<br>User plays alone (baseline) |
| Basic SUTs | **Random**<br>Randomly generates queries over the schema |
| Basic SUTs | **Naive**<br>Generate queries in the neighborhood of the current one |
| Basic SUTs | **Cheater**<br>Generates queries to retrieve the whole coverage |
| Literature | **Falseto**[DOLAP, 2014]<br>Collaborative OLAP recommendation system |
| Literature | **Cinecube**[Journal Inf. Syst., 2015]<br>*Gaining insights by highlighting cells* |

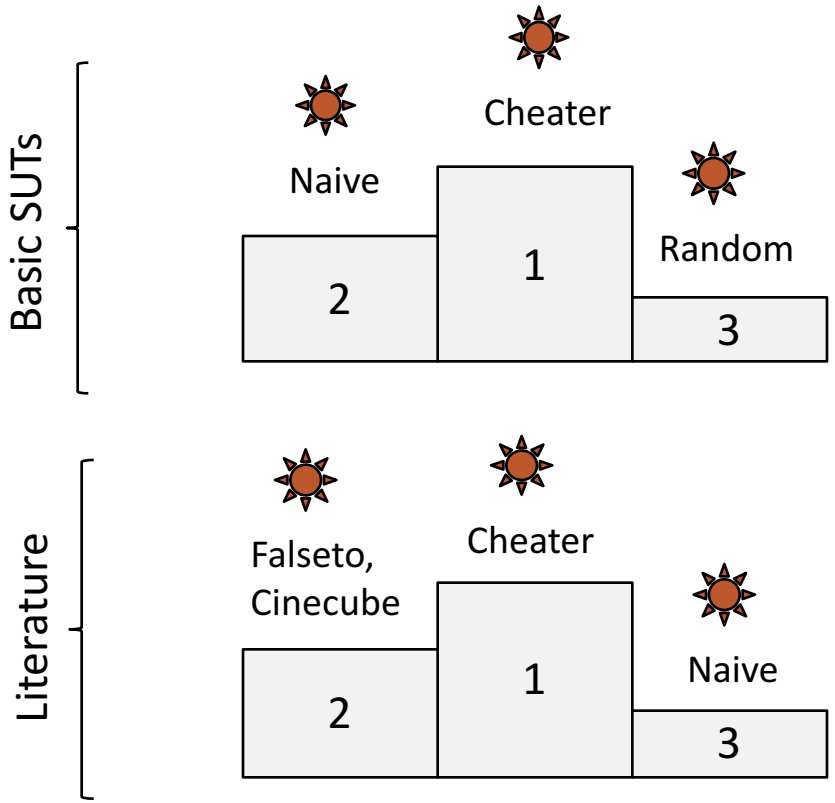
## SETTINGS

System parameters:

- Database: SSB schema with skewed data
- 9 users, 50 sessions, 375 queries
- 100 explorations for each SUT
- SUTs play at most 50 times for an exploration

# What we obtained

## GLOBAL RANKING




**Behaviors**

**Falseto**
Clearly helps the user, with more diverse exploration

High recall
Low precision

**Cinecube**
Clearly helps the user

Recall worse than Falseto
High precision: recommandations in the neighborhood

# To conclude

| Benchmark | Implementation | First validation | Future works |
| --- | --- | --- | --- |
| • Metrics<br>• Protocol | • Java API<br>• Webapp being developed | • Basic SUTs<br>• SUTs from the literature | • Test more SUTs<br>• Extension to relational DB |

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| | |
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# Thank you…

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|---|---|
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| Benchmark website | http://www.info.univ-tours.fr/~marcel/benchmark.html |