Soutien aux Projets Interuniversitaires de Solidarité dans les Amériques (PRISA)

Game Development
IoT Research
Ph.D. life in Montreal
New research opportunities

Cristiano Politowski
Ph.D. student at Concordia University - Montreal, Canada
c_polito@encs.concordia.ca

Outline

About me

Research team

Montreal

Research topics:

- Video game development
- Anti-Patterns
- IoT

I’m brazilian

but from the south
... from the countryside

Me (earlier)

Computer Science degree at UNIJUI - Santa Rosa - RS

Software Product Line and Language Grammars

Professor Fabricia Roos-Frantz

Computer Science masters' degree at UFSM - Santa Maria - RS

Video Game Development and Software Processes

Professor Lisandra M. Fontoura

Still me (industry)

Startup A: JavaEE, Struts 2, PostgreSQL, TomCat, Web things ...

Startup B: PHP, MySQL, Linux and Shell scripts, etc ...

Startup C: Lua, NginX, web performance, etc ...

Me (now)

Ph.D. student in Software Engineering

Since May/2018

Concordia University

Topics: IoT, Video Game Development, cool things in Software Engineering

Team & Research projects

Yann-Gaël Guéhéneuc is full professor at the Department of Computer Science and Software Engineering of **Concordia University** since 2017, where he leads the **Ptidej** team on evaluating and enhancing the **quality** of the software systems, focusing on the **Internet of Things** and researching new theories, methods, and tools to understand, evaluate, and improve the development, release, testing, and security of such systems.

B.Sc.	M.Sc.	Ph.D.	Post-doc.	R.A.	Other
0	3	8	2	0	1

How Ph.D. at Concordia works

Comprehension Exam: 2nd or 3rd term (term == 4 months [summer, fall, winter])

- Set up a committee
- Compile a list papers to read
- Make a report
- Oral presentation

Thesis proposal (qualification): within 18 months

- Same committee
- Present the methodology for your thesis
- Ph.D candidacy

Ptidej Post-docs

Rodrigo Morales. Post-doc. in progress. Improving Software Quality through Refactorings.

Md Saidur Rahman. Post-doc. in progress. Applying Machine Learning Techniques to the Identification and Correction of Anomalies in Data.

Team Ph.D.s

Manel Abdellatif. Ph.D. in progress. On the Migration towards Service-oriented Architectures.

Mouna Abidi. Ph.D. in progress. Design (Anti-)Patterns in Multi-language Systems.

Mashael (Layan) Etaiwi. Ph.D. in progress. Applying Consensus on Software Engineering Data.

William Flageol. Ph.D. in progress. Programming Languages and Design Constraints.

Manel Grichi. Ph.D. in progress. Change Impact Analyses in Multi-language Systems.

Zeinab (Azadeh) Kermansaravi. Ph.D. in progress. Mutations of Software Patterns.

Prabhdeep Singh. Ph.D. in progress. On the Ethics of the IoT.

Diana El-Masri. M.Sc. in progress. Polyglot Systems.

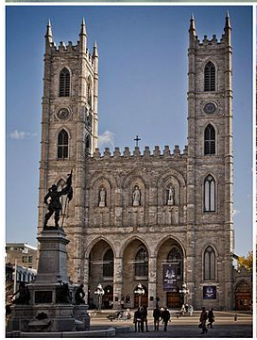
Team Masters

Natheepan Ganeshamoorthy. M.Sc. in progress. ML for Building Planes.

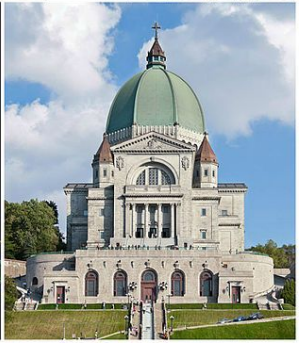
Vaibhav Jain. M.Sc. in progress. MGTT for IoT.

Fabio Petrillo is an associate professor at University of Quebec at Chicoutimi (Canada). His research interests include Empirical Software Engineering, Software Quality and Architecture, Debugging, Service-Oriented Architecture and Cloud. He has been recognized as a pioneer and an international reference on Computer Games and Software Engineering.

Montreal




Stade olympique
de Montréal



Montreal

Summer is amazing!

Winter not that much!

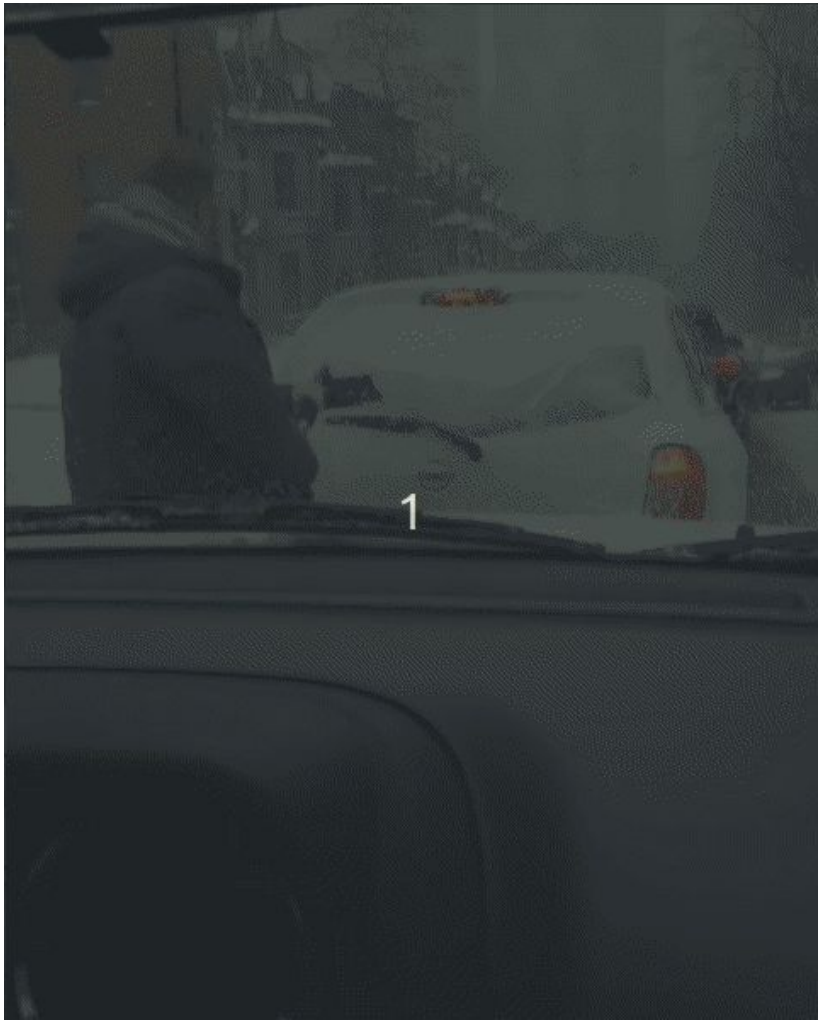
It is French first then English.

Multicultural!

Not that big (1.7KK)

@livemontreal


1


1


1


1


1

Masters’

It started with an email...

Are the Old Days Gone? A Survey on Actual Software Engineering Processes in Video Game Industry

Cristiano Politowski, Lisandra Fontoura
Federal University of Santa Maria
Santa Maria, Brazil
{cpolitowski,lisandra}@inf.ufsm.br

Fabio Petrillo, Yann-Gaël Guéhéneuc
École Polytechnique de Montréal
Montréal, Canada
fabio@petrillo.com,
yann-gael.gueheneuc@polymtl.ca

Games and Software Engineering Workshop – GAS 2016

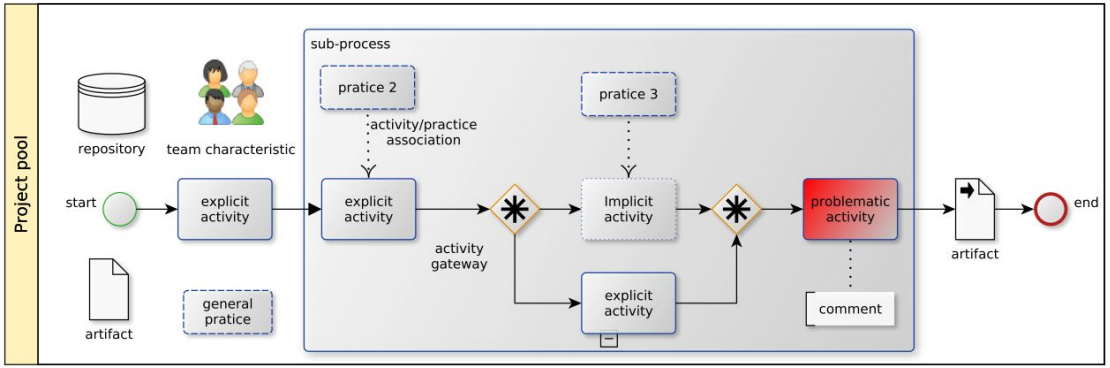


Figure 2: BPMN meta-model.

Table 3: Analyzed postmortem

Postmortem	Process	Agile
Brutal Legend	hybrid	yes
Kingdoms of Amalur: Reckoning	iterative	yes
Caseys Contraptions	iterative	yes
Sins of a Solar Empire	iterative	yes
Amnesia: A Machine for Pigs	iterative	yes
City Conquest	iterative	yes
Baldurs Gate Enhanced Edition	iterative	yes
Trine	waterfall	no
Natural Selection 2	iterative	yes
The Path	iterative	no
Dust An Elysian Tail	waterfall	no
Anomaly Warzone Earth	iterative	no
A Reckless Disregard for Gravity	ad-hoc	no
Scooby-Doo First Frights	waterfall	no
Spider-Man	hybrid	yes
Deadliest Warrior	waterfall	no
Zack Zero	waterfall	no
God of War Ascension	iterative	no
Electronic Symphony	waterfall	no
Guacamelee	iterative	no

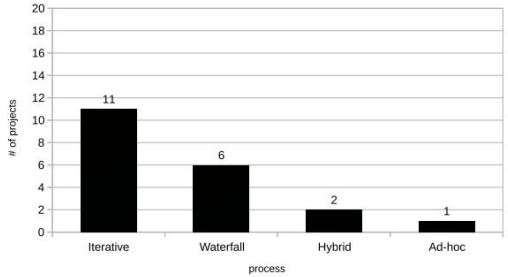


Figure 3: Process occurrences by category

activities with use of game design document. The production can be separated by level creation, experimentation and testing. Tasks are distributed by role, following a contextual sequence. This approach is usually adopted by small teams.

Waterfall process consists of well-separated sequence of phases, showing in Figure 7. First, a game conception is

Information and Software Technology 100 (2018) 103–118

Contents lists available at ScienceDirect

Information and Software Technology

journal homepage: www.elsevier.com/locate/infsof

Learning from the past: A process recommendation system for video game projects using postmortems experiences☆

Cristiano Politowski*,[a], Lisandra M. Fontoura[a], Fabio Petrillo[b], Yann-Gaël Guéhéneuc[b]

[a] Departamento de Computação Aplicada (DCOM), Universidade Federal de Santa Maria, Santa Maria, RS, Brazil
[b] Department of Computer Science & Software Engineering, Concordia University, Montréal Quebec H3G 1M8, Canada

Context

Game industry is billionaire, greater than cinema a music together

(NEWZOO,2016)

Game development is more complex and multidisciplinary

(GERSHENFELD; LOPARCO; BARAJAS, 2003)

(BLOW, 2004; MURPHY-HILL; ZIMMERMANN; NAGAPPAN, 2014)

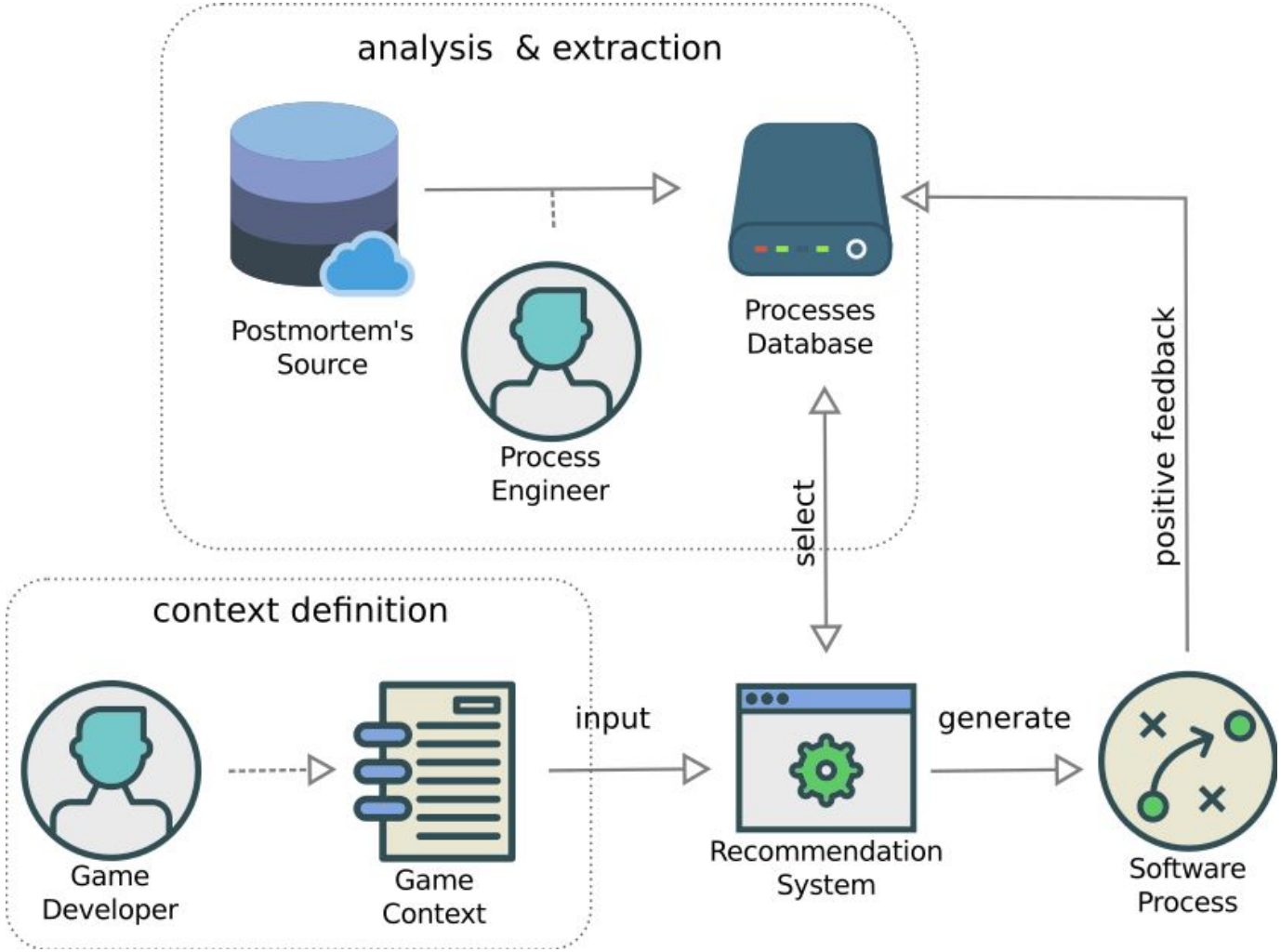
Particular characteristics and problems

(BLOW, 2004; MURPHY-HILL; ZIMMERMANN; NAGAPPAN, 2014)

Lack of maturity and systematic approaches

(PETRILLO et al., 2008; PETRILLO et al., 2009, POLITOWSKI et al., 2016a)

How to address these specific problems and help video game developers?

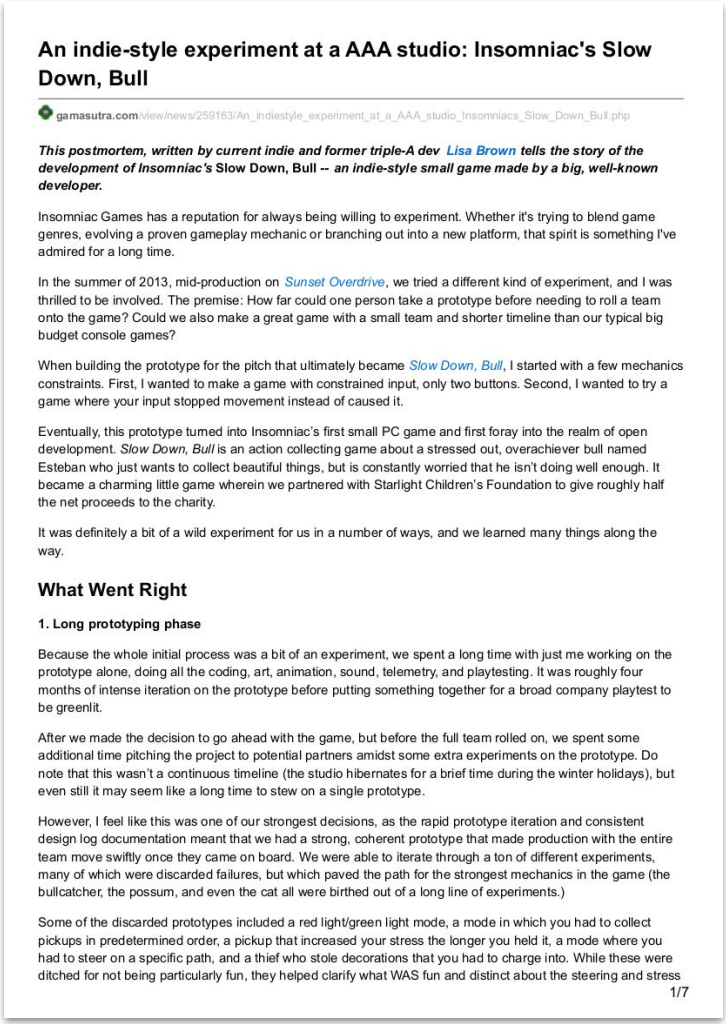

analysis & extraction
Postmortem's Source
Process Engineer
Processes Database
positive feedback
select
context definition
Game Developer
Game Context
input
Recommendation System
generate
Software Process

1. Data Preprocessing

Postmortems

What went right discusses the best practices adopted by developers, solutions, improvements, and project management decisions that help the project.

What went wrong discusses difficulties, pitfalls, and mistakes experienced by the development team in the project, both technical and managerial.



An indie-style experiment at a AAA studio: Insomniac's Slow Down, Bull

gamasutra.com/view/news/259163/An_indiestyle_experiment_at_a_AAA_studio_Insomniacs_Slow_Down_Bull.php

This postmortem, written by current indie and former triple-A dev Lisa Brown tells the story of the development of Insomniac's* Slow Down, Bull *-- an indie-style small game made by a big, well-known developer.

Insomniac Games has a reputation for always being willing to experiment. Whether it's trying to blend game genres, evolving a proven gameplay mechanic or branching out into a new platform, that spirit is something I've admired for a long time.

In the summer of 2013, mid-production on *Sunset Overdrive*, we tried a different kind of experiment, and I was thrilled to be involved. The premise: How far could one person take a prototype before needing to roll a team onto the game? Could we also make a great game with a small team and shorter timeline than our typical big budget console games?

When building the prototype for the pitch that ultimately became *Slow Down, Bull*, I started with a few mechanics constraints. First, I wanted to make a game with constrained input, only two buttons. Second, I wanted to try a game where your input stopped movement instead of caused it.

Eventually, this prototype turned into Insomniac's first small PC game and first foray into the realm of open development. *Slow Down, Bull* is an action collecting game about a stressed out, overachiever bull named Esteban who just wants to collect beautiful things, but is constantly worried that he isn't doing well enough. It became a charming little game wherein we partnered with Starlight Children's Foundation to give roughly half the net proceeds to the charity.

It was definitely a bit of a wild experiment for us in a number of ways, and we learned many things along the way.

What Went Right

1. Long prototyping phase

Because the whole initial process was a bit of an experiment, we spent a long time with just me working on the prototype alone, doing all the coding, art, animation, sound, telemetry, and playtesting. It was roughly four months of intense iteration on the prototype before putting something together for a broad company playtest to be greenlit.

After we made the decision to go ahead with the game, but before the full team rolled on, we spent some additional time pitching the project to potential partners amidst some extra experiments on the prototype. Do note that this wasn't a continuous timeline (the studio hibernates for a brief time during the winter holidays), but even still it may seem like a long time to stew on a single prototype.

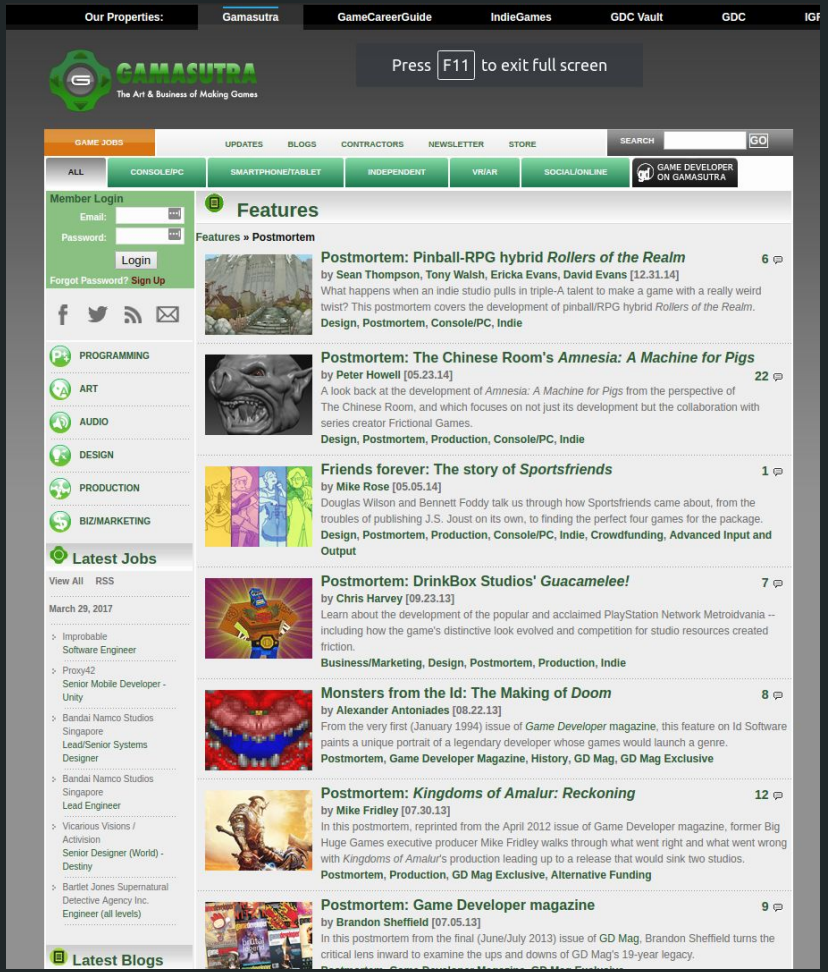
However, I feel like this was one of our strongest decisions, as the rapid prototype iteration and consistent design log documentation meant that we had a strong, coherent prototype that made production with the entire team move swiftly once they came on board. We were able to iterate through a ton of different experiments, many of which were discarded failures, but which paved the path for the strongest mechanics in the game (the bullcatcher, the possum, and even the cat all were birthed out of a long line of experiments.)

Some of the discarded prototypes included a red light/green light mode, a mode in which you had to collect pickups in predetermined order, a pickup that increased your stress the longer you held it, a mode where you had to steer on a specific path, and a thief who stole decorations that you had to charge into. While these were ditched for not being particularly fun, they helped clarify what WAS fun and distinct about the steering and stress

1/7

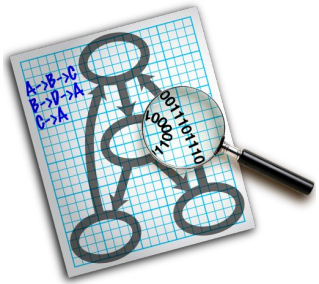
234 gathered
100 analysed
55 used

from 1997 until 2016

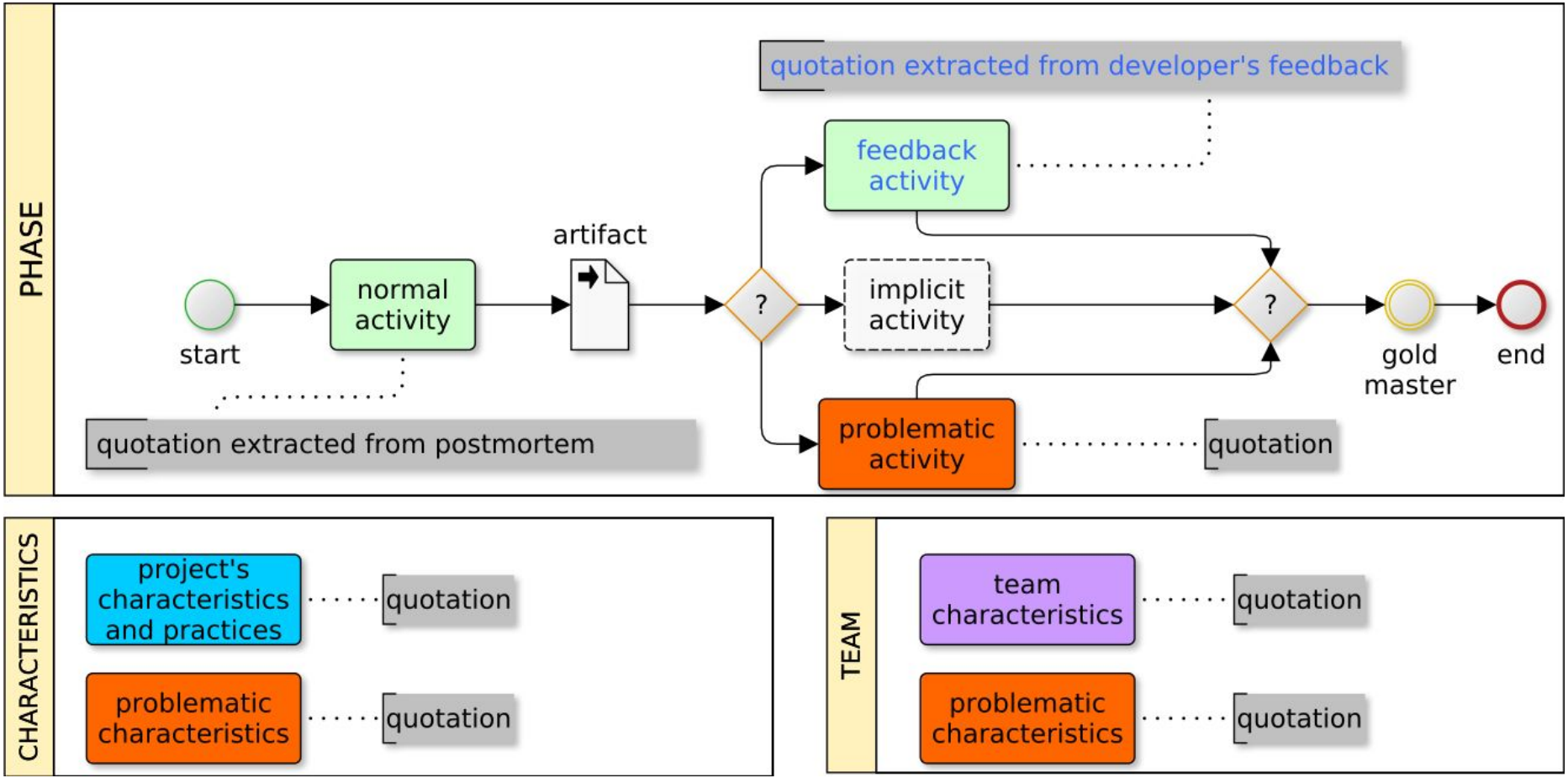


Building the Development Process

Each process is a set of elements...

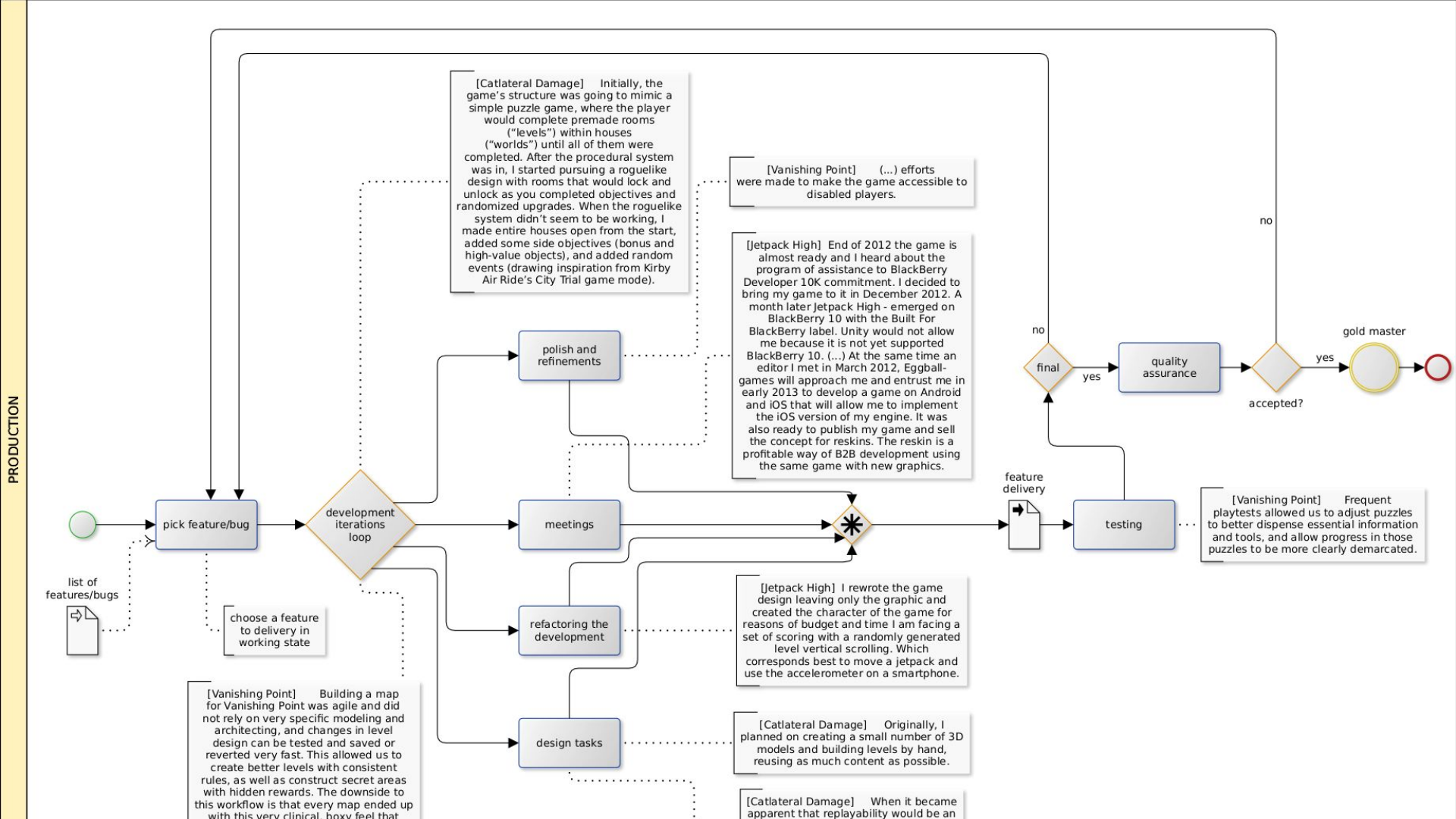



```
{
    "game" : "Slow Down, Bull",
    "phase" : "activities",
    "element" : "exploration phase",
    "desc" : "We were able to iterate
through a ton of different experiments,
many of which were discarded failures,
but which paved the path for the
strongest mechanics in the game",
    "prob" : false
}
```


PHASE
quotation extracted from developer's feedback
feedback activity
artifact
start
normal activity
?
implicit activity
?
gold master
end
quotation extracted from postmortem
problematic activity
quotation
CHARACTERISTICS
project's characteristics and practices
quotation
problematic characteristics
quotation
TEAM
team characteristics
quotation
problematic characteristics
quotation

Projects

- [1] Banner Saga 2
- [2] Stellaris
- [3] Red Skies
- [4] Ratchet & Clank (2016)
- [5] Offworld Trading Company
- [6] Mini Metro
- [7] Vanishing Point
- [8] Swing racers
- [9] Sunless Sea
- [10] Slow Down, Bull
- [11] Republique
- [12] Race the Sun
- [13] Prune
- [14] Out There
- [15] Ori and the Blind Forest
- [16] NFL RUSH Heroes and Rivals
- [17] Never Alone
- [18] Middle-earth Shadow of Mordor
- [19] Lost Within
- [20] Lords of the Fallen
- [21] Ink
- [22] I cant scape darkness
- [23] Goat simulator
- [24] Far Cry 2
- [25] Crashlands

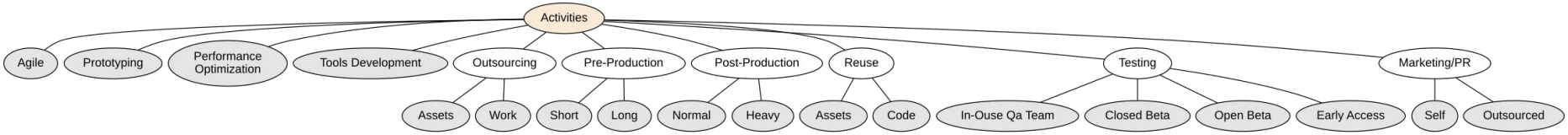

PRODUCTION
[Catlateral Damage] Initially, the game's structure was going to mimic a simple puzzle game, where the player would complete premade rooms ("levels") within houses ("worlds") until all of them were completed. After the procedural system was in, I started pursuing a roguelike design with rooms that would lock and unlock as you completed objectives and randomized upgrades. When the roguelike system didn't seem to be working, I made entire houses open from the start, added some side objectives (bonus and high-value objects), and added random events (drawing inspiration from Kirby Air Ride's City Trial game mode).
[Vanishing Point] (...) efforts were made to make the game accessible to disabled players.
[Jetpack High] End of 2012 the game is almost ready and I heard about the program of assistance to BlackBerry Developer 10K commitment. I decided to bring my game to it in December 2012. A month later Jetpack High - emerged on BlackBerry 10 with the Built For BlackBerry label. Unity would not allow me because it is not yet supported BlackBerry 10. (...) At the same time an editor I met in March 2012, Eggball-games will approach me and entrust me in early 2013 to develop a game on Android and iOS that will allow me to implement the iOS version of my engine. It was also ready to publish my game and sell the concept for reskins. The reskin is a profitable way of B2B development using the same game with new graphics.
no
no
final
yes
quality assurance
accepted?
yes
gold master
polish and refinements
pick feature/bug
development iterations loop
meetings
feature delivery
testing
[Vanishing Point] Frequent playtests allowed us to adjust puzzles to better dispense essential information and tools, and allow progress in those puzzles to be more clearly demarcated.
list of features/bugs
choose a feature to delivery in working state
refactoring the development
[Jetpack High] I rewrote the game design leaving only the graphic and created the character of the game for reasons of budget and time I am facing a set of scoring with a randomly generated level vertical scrolling. Which corresponds best to move a jetpack and use the accelerometer on a smartphone.
[Vanishing Point] Building a map for Vanishing Point was agile and did not rely on very specific modeling and architecting, and changes in level design can be tested and saved or reverted very fast. This allowed us to create better levels with consistent rules, as well as construct secret areas with hidden rewards. The downside to this workflow is that every map ended up with this very clinical, boxy feel that
design tasks
[Catlateral Damage] Originally, I planned on creating a small number of 3D models and building levels by hand, reusing as much content as possible.
[Catlateral Damage] When it became apparent that replayability would be an

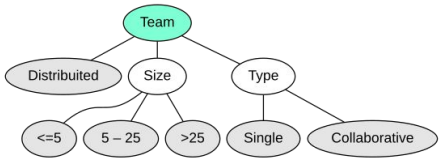
Getting feedback

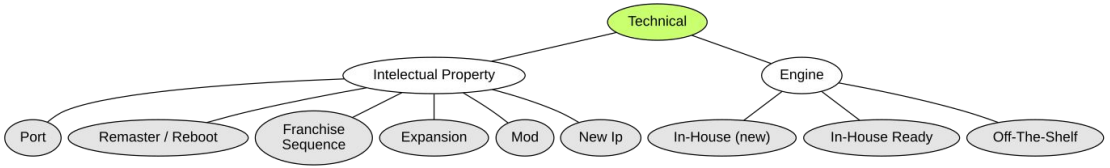
and then refactoring

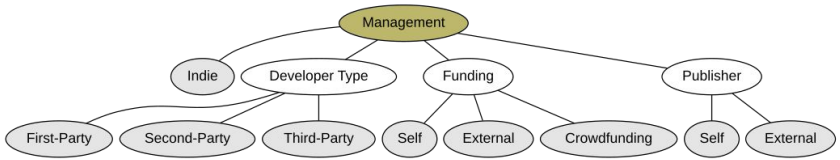
- Red Skies
- Offworld Trading Company
- Mini Metro
- Slow Down, Bull
- Prune
- Out There
- NFL Rush Heroes & Rivals

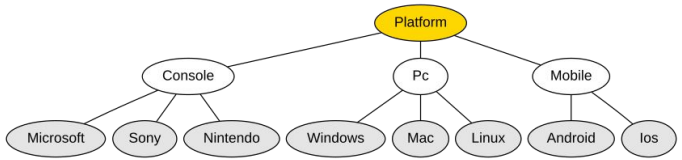
2. Creating a Video Game Context

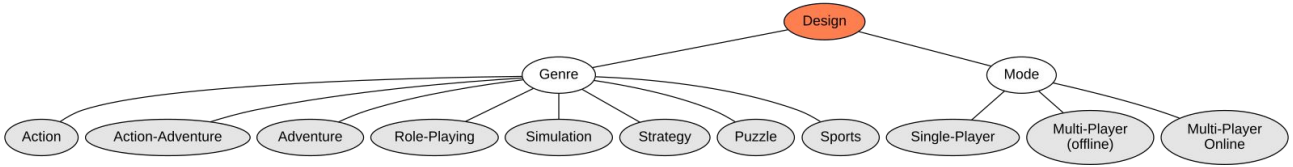

Activities
Agile
Prototyping
Performance Optimization
Tools Development
Outsourcing
Pre-Production
Post-Production
Reuse
Testing
Marketing/PR
Assets
Work
Short
Long
Normal
Heavy
Assets
Code
In-Ouse Qa Team
Closed Beta
Open Beta
Early Access
Self
Outsourced


Team
Distribuited
Size
Type
<=5
5 – 25
>25
Single
Collaborative


Technical
Intelectual Property
Engine
Port
Remaster / Reboot
Franchise Sequence
Expansion
Mod
New Ip
In-House (new)
In-House Ready
Off-The-Shelf


Management
Indie
Developer Type
Funding
Publisher
First-Party
Second-Party
Third-Party
Self
External
Crowdfunding
Self
External

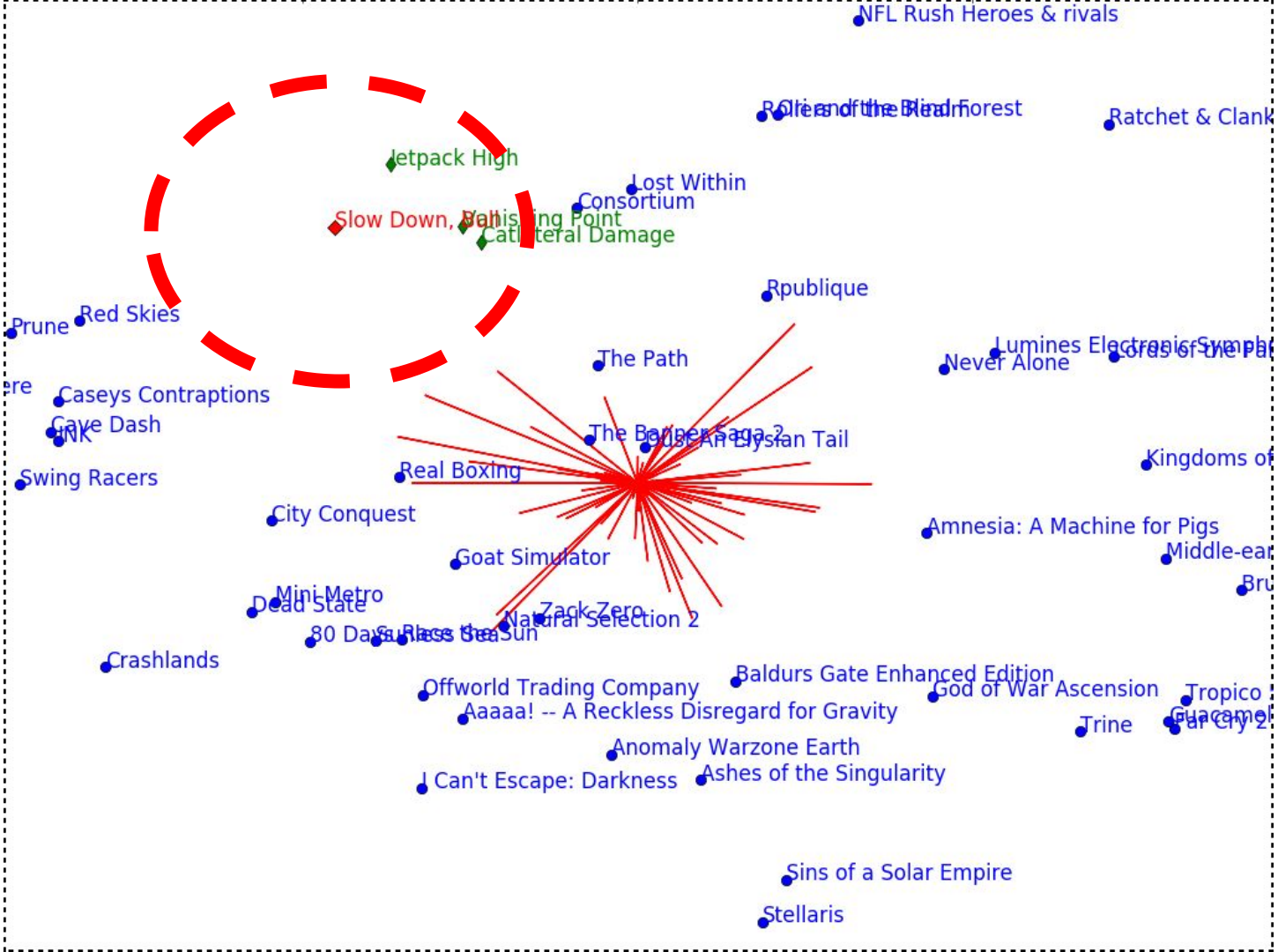

Platform
Console
Pc
Mobile
Microsoft
Sony
Nintendo
Windows
Mac
Linux
Android
Ios


Design
Genre
Mode
Action
Action-Adventure
Adventure
Role-Playing
Simulation
Strategy
Puzzle
Sports
Single-Player
Multi-Player (offline)
Multi-Player Online

Context structure em CSV

```
The Banner Saga 2,      1,0,0,0,0,1,0,1,1,0,0,0,0,0,0,0,1,0,1,0,0,1,0,1,0,0,1,1,0,1,0,1,0,0,0,1,0,0,0,1,0,1,1,0,1,1,0,1,1,0,0,0,1,0,0,0,0,1,0,0
Stellaris,              0,1,0,0,0,0,1,0,1,0,0,0,1,0,0,0,1,0,0,0,1,1,0,0,0,0,1,0,0,1,0,0,1,0,0,0,0,0,0,1,0,1,0,0,0,0,1,1,1,0,0,0,0,0,0,0,1,0,0,0,0,1
Red Skies,              0,1,1,0,0,0,1,0,0,0,0,0,0,1,1,0,1,0,1,0,0,1,0,1,0,0,1,1,0,1,0,1,0,0,0,0,0,0,0,1,0,0,1,0,0,0,0,0,0,1,1,1,0,0,0,0,0,0,0,0,1,0,0
Ratchet & Clank (2016), 0,1,0,0,0,0,1,0,0,1,1,1,0,1,0,0,1,0,0,0,0,1,0,1,1,0,1,0,0,1,0,0,1,0,0,1,0,0,0,0,0,1,0,0,1,0,0,0,0,0,0,1,0,0,0,0,0,0,1,0,0
Offworld Trading Compa, 1,1,0,0,0,0,1,0,1,0,0,0,1,1,1,1,1,0,1,0,0,1,0,0,0,0,1,1,0,1,0,1,0,0,0,0,0,0,1,0,0,1,0,0,0,1,1,0,0,0,0,0,0,0,1,0,0,1,0,1
Mini Metro,             0,1,0,0,0,1,1,0,1,0,0,0,0,1,0,1,1,0,1,0,0,1,0,0,0,0,0,1,1,0,1,0,1,0,0,0,0,0,0,1,0,0,1,0,0,0,1,1,1,0,0,0,0,0,0,1,0,0,0,1,0,0
Vanishing Point ,       0,0,0,0,1,0,0,1,0,0,0,0,0,0,0,0,0,0,0,0,1,1,0,0,0,0,0,1,1,1,0,0,0,1,0,0,0,0,0,1,0,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,1,0,0
Swing Racers ,          1,0,0,0,0,0,1,0,1,0,0,0,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,1,0,1,0,0,1,0,0,0,0,0,0,1,0,0,1,0,0,0,0,0,0,0,1,0,0,0,0,0,0,1,1,0,0
Sunless Sea,            0,1,0,0,0,1,1,0,1,0,0,0,0,1,0,1,1,0,0,1,0,0,1,1,0,0,1,0,0,1,1,0,1,0,0,0,0,0,1,0,0,1,0,0,0,1,1,1,0,0,0,0,0,1,0,0,0,0,1,0,0
"Slow Down, Bull",      1,1,0,0,0,1,0,1,1,0,0,0,1,0,0,0,0,0,0,1,0,0,1,0,1,0,0,1,1,1,0,0,0,1,0,0,0,0,0,1,0,0,1,0,0,0,1,0,0,0,0,0,0,0,0,0,0,1,0,1,0,0
Rpublique,              0,0,0,0,0,1,1,0,1,0,1,1,1,0,0,0,1,0,0,1,0,1,0,1,0,0,1,0,0,0,1,1,0,1,0,0,0,0,0,0,0,1,0,1,0,0,0,0,0,0,0,1,0,0,0,0,0,0,1,0,0
Race the Sun,           0,1,0,0,0,0,1,0,1,0,0,0,0,1,0,0,1,0,1,0,0,1,0,0,0,0,1,1,0,0,1,0,1,1,0,0,0,0,1,0,0,1,1,1,1,1,1,1,0,1,1,0,0,0,0,0,0,0,1,0,0
Prune,                  0,1,0,0,0,1,0,1,1,0,0,0,0,0,0,0,1,0,1,0,0,1,0,1,0,0,1,1,0,1,0,0,1,0,0,0,0,0,1,0,0,1,0,0,0,0,0,0,0,1,0,0,0,0,0,0,1,0,1,0,0
Out There,              0,0,0,0,1,1,0,1,1,0,0,0,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,1,0,1,0,0,1,0,0,0,0,0,1,0,0,1,0,0,0,0,0,0,1,1,0,0,1,0,0,0,0,0,1,0,0
Ori and the Blind Fores, 1,1,0,0,0,0,0,1,1,0,0,0,1,0,0,0,0,0,0,1,0,1,0,1,1,0,0,1,1,0,0,1,0,0,0,0,0,0,1,0,0,1,1,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,1,0,0
NFL Rush Heroes & rival, 0,1,0,0,0,0,0,1,0,1,0,1,1,0,0,0,0,0,0,1,0,0,1,0,0,1,0,1,0,0,1,0,0,0,1,0,0,0,0,0,1,0,0,0,0,0,0,0,1,1,1,0,0,0,0,0,1,0,1,0,0
Never Alone,            0,0,0,0,1,0,1,0,1,0,0,0,1,0,0,0,1,0,0,0,1,0,1,0,0,0,1,1,1,0,0,1,0,0,0,0,0,0,1,0,0,1,1,1,1,1,1,1,1,0,0,0,0,0,0,1,0,1,1,0
Middle-earth: Shadow of, 1,0,0,0,0,0,1,0,1,0,0,0,1,0,0,0,1,0,0,1,0,1,0,0,0,0,1,0,1,0,0,1,0,0,0,0,0,0,1,0,1,0,1,1,0,1,1,1,0,0,0,1,0,0,0,0,0,0,1,0,0
Lost Within,            0,1,0,0,0,0,1,0,1,0,0,0,1,1,0,0,1,0,0,0,1,0,1,0,0,0,1,1,1,0,0,1,0,0,0,0,0,0,1,0,0,1,0,0,0,0,0,1,1,0,0,1,0,0,0,0,0,1,0,0
Lords of the Fallen,    1,0,0,1,1,0,1,0,1,0,0,0,1,0,0,0,1,0,0,0,1,1,0,1,0,0,1,0,1,0,0,1,0,0,0,0,0,0,1,0,1,0,1,1,0,1,0,0,0,0,1,0,0,1,0,0,0,0,1,0,0
INK,                    0,1,0,0,1,1,1,0,0,1,0,0,0,0,1,0,1,0,1,0,0,1,0,1,0,0,1,1,0,1,0,0,1,0,0,0,0,0,1,0,0,1,0,0,0,0,1,0,0,0,0,0,1,0,0,0,0,1,0,1,0,0
I Can't Escape: Darkne, 0,0,0,1,0,0,0,1,0,1,0,0,0,1,0,0,1,0,1,0,0,1,0,0,0,0,1,1,0,1,0,0,1,0,0,0,0,0,1,1,0,0,0,0,0,1,1,1,0,0,0,1,0,0,0,0,0,0,1,0,0
(...)
```

3. Producing Recommendations


NFL Rush Heroes & rivals
Ratchet & Clank
Jetpack High
Lost Within
Consortium
Slow Down, Bandit
Collateral Damage
Rpublique
Red Skies
Prune
The Path
Never Alone
Caseys Contraptions
Cave Dash
Real Boxing
Swing Racers
City Conquest
Amnesia: A Machine for Pigs
Goat Simulator
Mini Metro
Dead State
Zack Zero
Natural Selection 2
Crashlands
Offworld Trading Company
Baldurs Gate Enhanced Edition
God of War Ascension
Aaaaa! -- A Reckless Disregard for Gravity
Trine
Anomaly Warzone Earth
Ashes of the Singularity
Sins of a Solar Empire
Stellaris

4. Validating

Quantitative, Qualitative, and Case Study

Quantitative Evaluation

Quantitative Evaluation

Correctness: How close are the recommendations to a set of recommendations that are assumed to be correct?

Coverage: To what extent does the recommendation system cover a set of items or user space?

	Recommended	Not Recommended
Used	True Positives (TP)	False Negatives (FN)
Not Used	False Positives (FP)	True Negatives (TN)

Correctness

Precision	Recall	Accuracy	FP Rate	FN Rate	Specificity	F-Measure
42,11%	10,09%	63,49%	7,53%	34,55%	92,47%	16,28%
17,97%	13,07%	71,37%	14,48%	19,79%	85,52%	15,13%
23,81%	5,52%	77,57%	4,42%	19,81%	95,58%	8,97%
42,42%	3,76%	57,92%	3,63%	41,48%	96,37%	6,91%

Coverage

Sr	Sa	Ss	Catalog	W. Catalog
76	913	317	8,32%	10,09%
128	913	176	14,02%	13,07%
42	913	181	4,60%	5,52%
33	913	372	3,61%	3,76%

Qualitative Evaluation

With 4 game developers

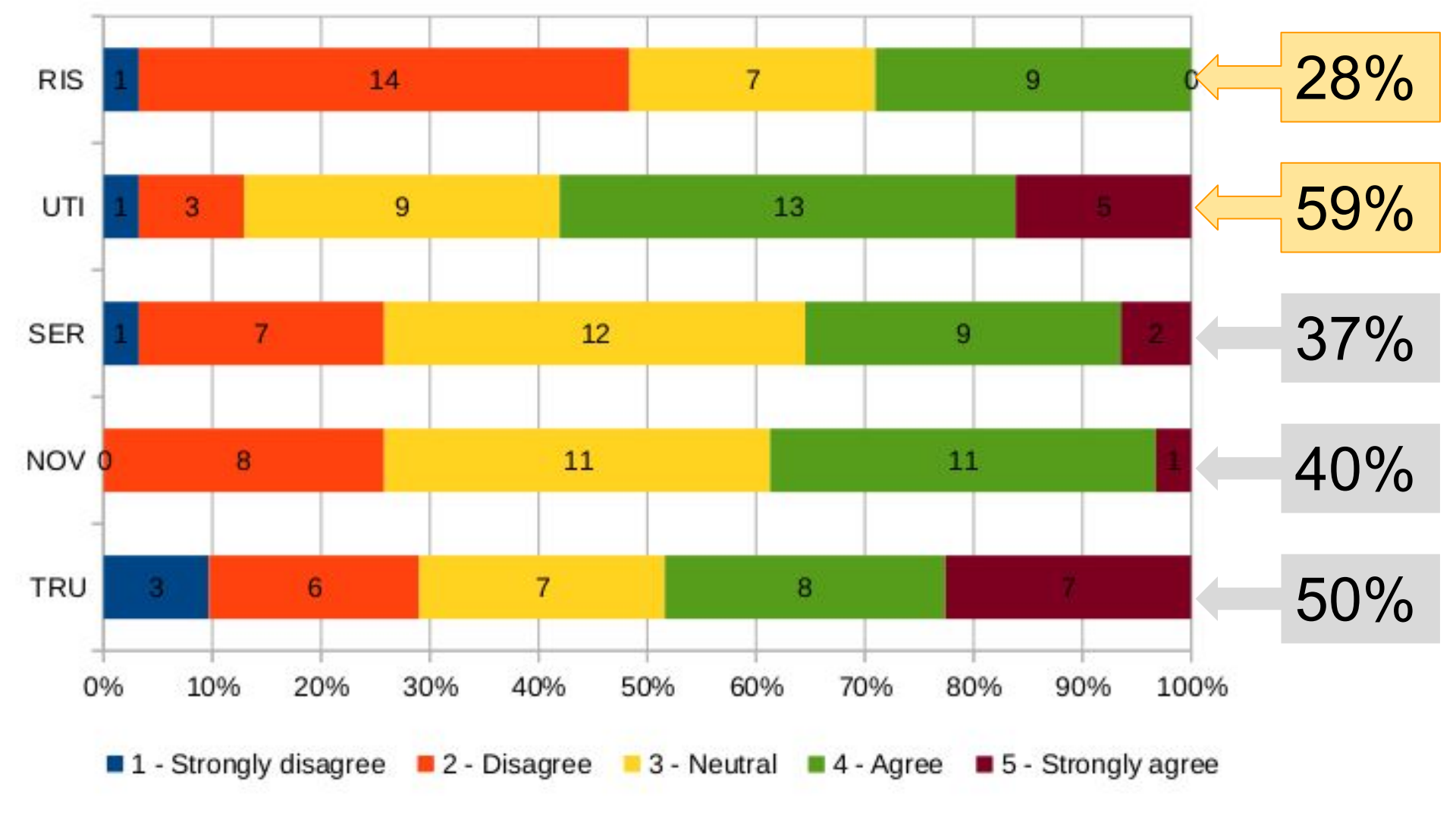
Game: Slow Down, Bull

“(...) this might be a useful thing to look at in the beginning, but I would not use it to create a production pipeline because the circumstances have almost assuredly changed since.”

Case Study

We interviewed video game development team

1. (**Trustworthiness**) The recommendation is similar compared to my project.
2. (**Novelty**) The recommendation is new to me (regardless its usefulness).
3. (**Serendipity**) The recommendation is surprisingly good for my project.
4. (**Utility**) The recommendation is useful to my project.
5. (**Risk**) It would be risky to use the recommendation in my project (considering other practices already settled).


RIS
1
14
7
9
0
UTI
1
3
9
13
5
SER
1
7
12
9
2
NOV
0
8
11
11
1
TRU
3
6
7
8
7
28%
59%
37%
40%
50%
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
1 - Strongly disagree
2 - Disagree
3 - Neutral
4 - Agree
5 - Strongly agree

Contributions

Video game processes database

database of game development processes from the analysis of 55 postmortems

Video game project context attributes

video game project characteristics, like team attributes and technical details

Recommendation System

recommendation system capable of generating processes based on previous projects with similar contexts

Threats of Validity

...some of them

The postmortem main purpose is not describe processes' elements.

Recommended process cannot define specifics tasks to be followed by developers.

Possible *Overfitting* issues.

Future works (already going)

Gather more resources and feedbacks from video game developers

Use information retrieval techniques to minimize the analysis effort.

Use a more formal video game context definition.

Use a more robust Machine Learning approach instead of PCA.

Improve the visualization process.

Add more metadata (like flow) in the generated process.

Create a SaaS to allow a more formal postmortem structure.

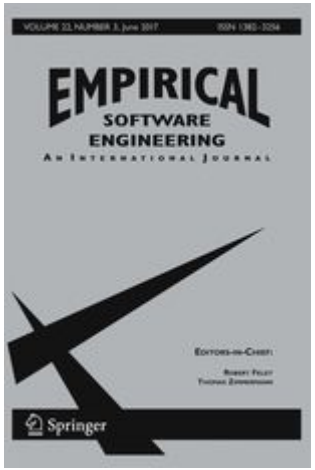
Ph.D. so far

Anti-Patterns
&
Code clarity

Empirical Software Engineering manuscript No.
(will be inserted by the editor)

Large Scale Quasi-replicative Studies of the Impact of Spaghetti Code and Blob Anti-patterns on Program Comprehension

Cristiano Politowski · Foutse Khomh · Simone Romano · Giuseppe Scanniello · Fabio Petrillo · Yann-Gaël Guéhéneuc · Abdou Maiga

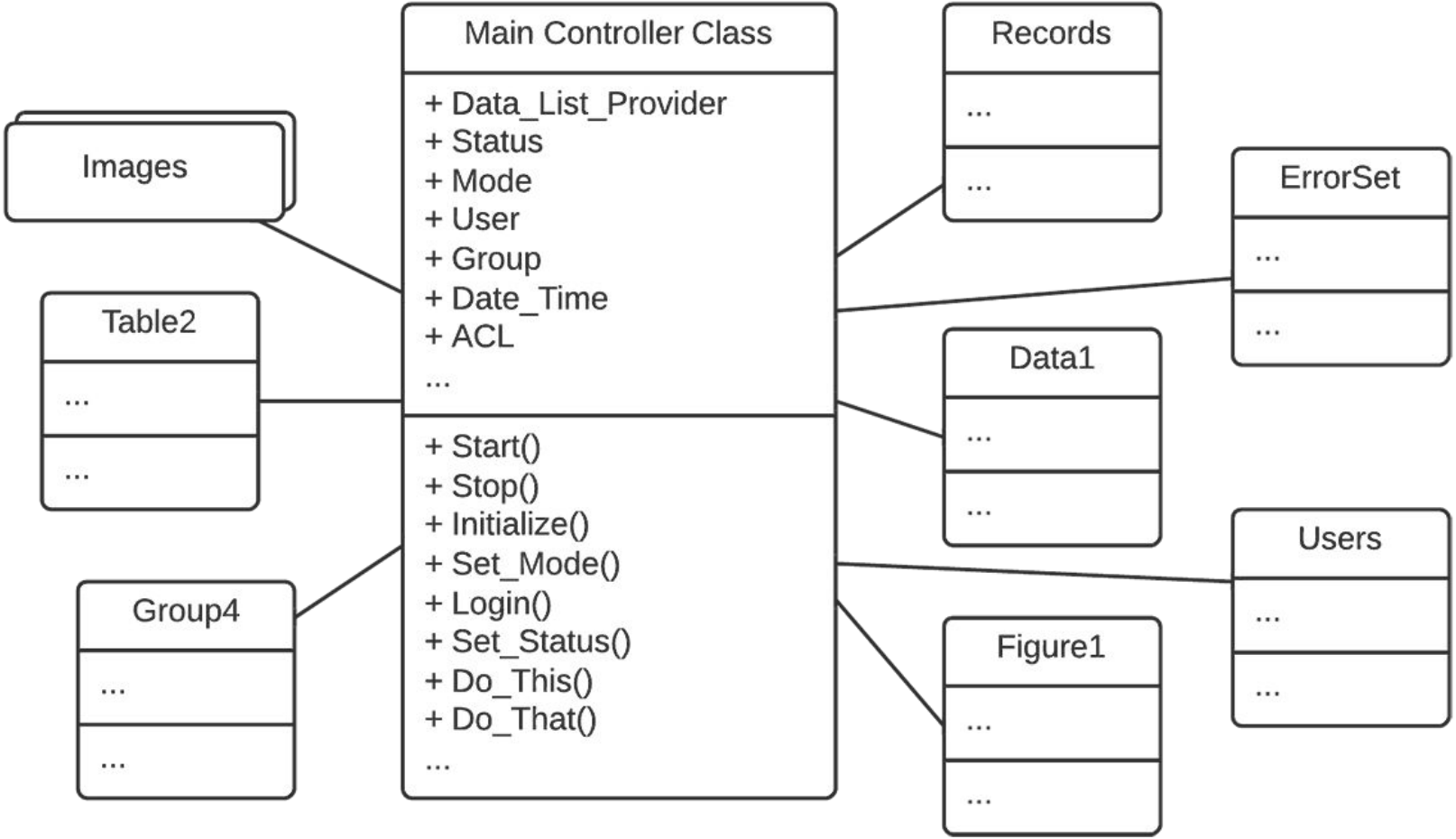


Blob Anti-Pattern

The Blob is found in designs where one class **monopolizes** the processing, and other classes primarily encapsulate data.

The key problem here is that the majority of the **responsibilities** are allocated to a **single class**.

https://sourcemaking.com/antipatterns/the-blob


Main Controller Class
+ Data_List_Provider
+ Status
+ Mode
+ User
+ Group
+ Date_Time
+ ACL
...
+ Start()
+ Stop()
+ Initialize()
+ Set_Mode()
+ Login()
+ Set_Status()
+ Do_This()
+ Do_That()
...
Images
Table2
...
...
Group4
...
...
Records
...
...
ErrorSet
...
...
Data1
...
...
Users
...
...
Figure1
...
...

Spaghetti Code Anti-Pattern

Spaghetti Code appears as a program or system that contains **very little** software **structure**.

Coding and progressive extensions compromise the software structure to such an extent that the structure **lacks clarity**, even to the original developer, if he or she is away from the software for any length of time.

Table 3: Group of experiments.

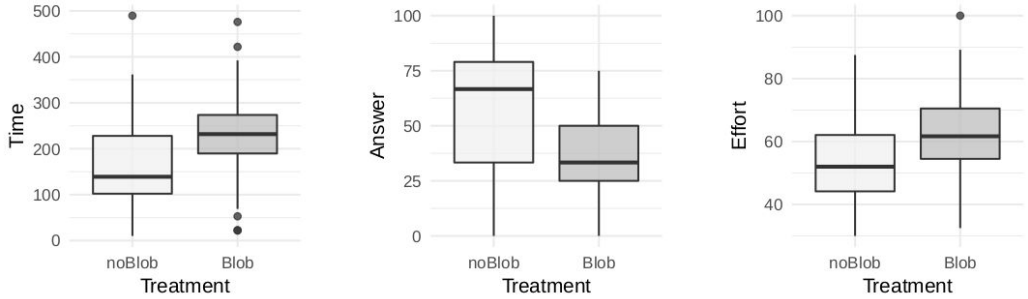
Local	Anti-pattern	#APs	Experiment	Participants	Data Origin
Montréal, QC, Canada	Blob	1	#1	24	Abbes et al. (2011)
Montréal, QC, Canada	Spaghetti Code	1	#2	24	Abbes et al. (2011)
Ottawa, ON, Canada	Blob	2	#3	30	This paper
Ottawa, ON, Canada	Spaghetti Code	2	#4	29	This paper
Potenza, Italy	Blob	2	#5	41	This paper
Potenza, Italy	Spaghetti Code	2	#6	38	This paper

#APs means how many instances of the anti-pattern are in the code.

Table 6: Design of the experiments #3, #4, #5 and #6, for the Blob and Spaghetti Code anti-patterns, respectively, showing the participants IDs.

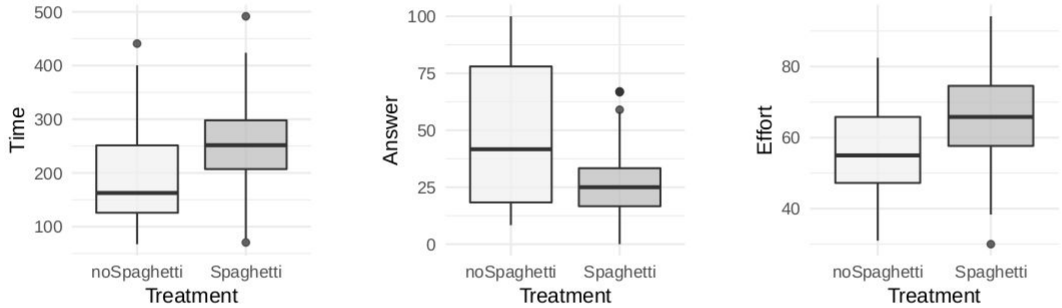
Exp	Anti-pattern	Object	Participants' ID														
#3	Blob	iTrust	1	12	44	45	46	11	13	15	17	24					
#3	Blob	Azureus	42	43	2	6	8	9	14	18	21	22					
#3	Blob	SIPComm	23	33	3	4	5	7	10	16	19	20					
#3	-	iTrust	33	42	2	3	5	7	8	18	19	21					
#3	-	Azureus	1	12	23	44	45	4	10	11	16	20	24				
#3	-	SIPComm	43	46	6	9	13	14	15	17	22						
#5	Blob	iTrust	1	12	43	6	7	9	15	21	27	29	36	37			
#5	Blob	Azureus	44	46	3	4	10	14	17	18	22	26	28	34	38	40	
#5	Blob	SIPComm	33	42	45	2	8	11	16	19	20	24	30	31	35	39	41
#5	-	iTrust	33	44	46	3	10	11	16	18	19	24	31	35	38	40	
#5	-	Azureus	1	42	45	2	7	8	15	20	27	29	30	36	39	41	
#5	-	SIPComm	12	43	4	6	9	14	17	21	22	26	28	34	37		
#4	Spaghetti Code	ArgoUML	1	33	45	2	6	7	10	11	15	19					
#4	Spaghetti Code	JHotDraw	12	23	46	3	9	13	16	17	18	22					
#4	Spaghetti Code	Rhino	42	43	44	4	5	8	14	20	21						
#4	-	ArgoUML	12	23	43	3	5	8	13	14	16	18					
#4	-	JHotDraw	1	33	42	44	2	4	10	15	19	20	21				
#4	-	Rhino	45	46	6	7	9	11	17	22							
#6	Spaghetti Code	ArgoUML	23	46	3	4	10	14	17	18	26	28	32	34	38	40	
#6	Spaghetti Code	JHotDraw	1	43	6	9	13	15	21	25	27	29	36				
#6	Spaghetti Code	Rhino	33	42	45	2	5	8	11	16	19	24	31	35	39		
#6	-	ArgoUML	1	42	45	2	8	13	15	25	27	29	36	39			
#6	-	JHotDraw	33	46	3	5	10	11	16	18	19	24	31	32	35	38	40
#6	-	Rhino	23	43	4	6	9	14	17	21	26	28	34				

Fig. 1: Boxplot of the exploratory analysis with three dependent variables (time, answer, and effort) and the Blob anti-pattern (treatment).



(a) Time spent. (b) Correctness of Answers. (c) Overall Effort.

Fig. 3: Boxplot of the exploratory analysis with three dependent variables (time, answer, and effort) and the Spaghetti Code anti-pattern (treatment).



(a) Time spent. (b) Correctness of Answers. (c) Overall Effort.

Video Game Development & Problems

This paper opened the researchers' eyes regarding problems in the game industry

What Went Wrong? A Survey of Problems in Game Development

FÁBIO PETRILLO, MARCELO PIMENTA, FRANCISCO TRINDADE, and CARLOS DIETRICH

Institute of Informatics, Federal University of Rio Grande do Sul, Brazil

---

Despite its growth and profitability, many reports about game projects show that their production is not a simple task, but one beset by common problems and still distant from having a healthy and synergetic work process. The goal of this article is to survey the problems in the development process of electronic games, which are mainly collected from game postmortems, by exploring their similarities and differences to well-known problems in traditional information systems.

Categories and Subject Descriptors: K.8.0 [**Personal Computing**]: General—*Games*; D.2.9 [**Software Engineering**]: Management; K.6.3 [**Management of Computing and Information Systems**]: Software Management

General Terms: Management, Human Factors

Additional Key Words and Phrases: Electronic games, game development, problems in game development, survey, postmortems

ACM Reference Format:

Petrillo, F., Pimenta, M., Trindade, F., and Dietrich, C. 2009. What went wrong? A survey of problems in game development. ACM Comput. Entertain. 7, 1, Article 13 (February 2009), 22 pages. DOI = 10.1145/1486508.1486521 http://doi.acm.org/10.1145/1486508.1486521

Summary

RQ: What are the problems in video game development?

Postmortems: 98 to 2018 (20 years! *We need help!*)

Ground-Theory from Postmortems

- The goal of GT is to generate theory rather than test or validate existing theory. GT is suitable for investigating questions such as *what's going on here?**

*Adolph, S., Kruchten, P. and Hall., W. 2012. Reconciling perspectives: A grounded theory of how people manage the process of software development.

This paper is good! :)

Grounded Theory in Software Engineering Research: A Critical Review and Guidelines

Klaas-Jan Stol
Lero—the Irish Software Research Centre, University of Limerick
Ireland
klaas-jan.stol@lero.ie

Paul Ralph
Department of Computer Science
University of Auckland
New Zealand
paul@paulralph.name

Brian Fitzgerald
Lero—the Irish Software Research Centre, University of Limerick
Ireland
bf@lero.ie

ABSTRACT

Grounded Theory (GT) has proved an extremely useful research approach in several fields including medical sociology, nursing, education and management theory. However, GT is a complex method based on an inductive paradigm that is fundamentally different from the traditional hypothetico-deductive research model. As there are at least three variants of GT, some ostensibly GT research suffers from *method slurring*, where researchers adopt an arbitrary subset of GT practices that are not recognizable as GT. In this paper, we describe the variants of GT and identify the core set of GT practices. We then analyze the use of grounded theory in software engineering. We carefully and systematically selected 98 articles that mention GT, of which 52 explicitly claim to use GT, with the other 46 using GT techniques only. Only 16 articles provide detailed accounts of their research procedures. We

in computer science has been growing for the last decade (Fig. 1). Early examples of the use of GT in software engineering are by Carver [13] and Coleman and O'Connor [18].

Grounded theory is a method originally described by Glaser and Strauss in their seminal book *The Discovery of Grounded Theory* [38]. The goal of GT is to *generate* theory rather than *test* or *validate* existing theory. GT is suitable for investigating questions such as *what's going on here?* [2].

As a relatively young discipline, SE has yet to establish and validate abundant formal theories. Given the unique and novel aspects of the underlying technology in SE, theories from other disciplines may not be easy to borrow and adapt for SE. Inductive approaches such as GT are therefore useful to construct a relevant conceptual and theoretical foundation for the field.

Postmortem: Stoic Studio's The Banner Saga 2

gamasutra.com/view/news/274238/Postmortem_Stoic_Studios_The_Banner_Saga_2.php

John Watson is the co-owner and technical director of Stoic Studio. He has been programming since he was 6. He came to Stoic after doing some work on the Hubble at NASA, and serving as lead combat programmer on Bioware's The Old Republic.

INTRODUCTION

Banner Saga 2 is the second part of a planned trilogy. After the successful launch of *Banner Saga 1*, we had a mighty tailwind and our sails were full.

However, we soon hit some challenges which slowed us down and distracted us for some time.

After what amounted to two years of brutal crunch to get the first game launched we took a much-needed break. The three of us variously rested, traveled and caught up on the parts of our lives that had been suppressed or neglected.

Then, a series of technical projects, including localization and porting, consumed most of John Watson's time for the next year. Alex Thomas, the writer of the first game, decided to set off on his own to work on his own project. We brought Drew McGee on to write the next game, and he and Arnie Jorgensen began preproduction and planning. We had some false starts, but a year later, with E3 2015 looming on the horizon, we started production in earnest. We brought Matthew Rhoades onto the team for technical design work and that E3 showing was our first fully fleshed out vertical slice of the game.

WHAT WENT WELL

1) Everyone Worked Hard

With such a small team, this is incredibly important. There were four of us working full time on the game, with important collaborations occurring at various times throughout. Composer Austin Wintory is involved from day one in blocking out the story arc with us. Igor Artyomenko, a fantastic artist hailing from Kazakhstan, came in to help Arnie with the art load. KPow Audio are involved in planning. Powerhouse Animation needs to get their workload in the pipeline early, because they could easily become a bottleneck otherwise.

The four full-timers spent every day collaborating on Slack, with impromptu video chat meetings throughout the day, and a daily kickoff video meeting each morning at 9 a.m. We tracked our tasks and milestones carefully, and everyone did their best to maintain forward momentum and prevent blocking anybody else.

informed both Austin Wintory's and Kpow's efforts on *Banner Saga 2*. Powerhouse animation had created an immense number of animations for the first game, so when we gave them another sizeable workload, they were able to ramp up immediately.

WHAT WENT POORLY

1) Tools

Since John's time was almost entirely consumed in creating new features and supporting localization and porting efforts, the content development tools didn't advance as much as they could have. Many of the irritants and inconveniences of the tools from the first game persisted throughout development.

> ***"Many of the irritants and inconveniences of the tools from the first game persisted throughout development."***

The game content is almost entirely data-driven, but some of the systems, notably the ability system, has no tool to assist in its data creation. So combat abilities, some of the most complex behaviors in the game, have to be created by editing JSON in a text editor. There are other subsystems that likewise have no tool, and require manual JSON intervention.

The game dialog and story was written in Inkle Writer, a free tool by our friends at Inkle who are responsible for

README.md | problems.md | 1_the-banner-saga-2.json

```
{
    "postmortem": {
        "title": "Postmortem: Stoic Studio's The Banner Saga 2",
        "year": 2016,
        "source": "http://www.gamasutra.com/view/news/274238/Postmortem_Stoic_Studios_The_Banner_Saga_2.php",
        "game": {
            "name": "The Banner Saga 2",
            "platform": [
                "pc",
                "console",
                "mobile"
            ],
            "genre": [
                "rpg"
            ],
            "mode": [
                "single"
            ]
        },
        "problems": [
            {
                "group": "management",
                "type": "planning",
                "quote": "We had some false starts, but a year later, with E3 2015 looming on the horizon, we started production in earnest."
            },
            {
                "group": "production",
                "type": "tools",
                "quote": "Since John's time was almost entirely consumed in creating new features and supporting localization and porting efforts, the content development tools didn't advance as much as they could have. Many of the irritants and inconveniences of the tools from the first game persisted throughout development. (...) Our heavy usage of Inkle Writer, however, has exceed its intended limits and causes problems on a regular basis. (...) The game engine itself is based on Adobe AIR, which is a fairly capable piece of technology. (...) The kicker is that it's a total black box, and no source code license is available, so when something goes wrong, you may well just be screwed"
            },
            {
                "group": "production",
                "type": "technical",
                "quote": "The game content is almost entirely data-driven, but some of the systems, notably the ability system, has no tool to assist in its data creation. So combat abilities, some of the most complex behaviors in the game, have to be created by editing JSON in a text editor. There are other subsystems that likewise have no tool, and require manual JSON intervention. (...) One of the things that consumed a heap of John's time was console porting. (...) This particular console porting house was not able to do gameplay enhancements like implementing the gamepad controller interfaces."
```

problems.md Preview

Problems

Production

> aspects regarding the pre-production, production and post-production

- **Design**
  - Any problem regarding the design of the game, like balancing the gameplay. Not a technical detail.
- **Documentation**
  - Not planning the game before hand, not documenting the code, artifacts or game plan.
- **Tools**
  - Any problem with tools like engines, APIs, development kits, third-party software, etc.
- **Technical**
  - Problems with the team code/assets infra-structure.
- **Testing**
  - Any problem regarding testing the game.
- **Bugs**
  - When there are too many bugs in the game/engine.
- **Prototyping**
  - Lack of or no prototyping phase nor validation of the gameplay/feature.

Project Management

- **Unrealistic Scope**
  - Planning too many features that end up impossible to implement it in a reasonable time.
- **Feature Creep**
  - Adding non planned new features to the game during its implementation.
- **Cutting Features**
  - Cutting features previously planned because some other factor like near deadline.
- **Delays**
  - Problems regarding any delay in the production.
- **Crunch Time**
  - When developers spent extra hours working in the project.
- **Communication**
  - Problems regarding communication with the any stakeholder.
- **Team**
  - Problems in setting up the team, lost of professionals during the development or outsourcing.
- **Over Budget**
  - Project costed more money than expected.
- **Multiple Projects**
  - When there is more than one project being developed at the same time.
- **Planning**
  - Problems involving too much time planing/scheduling or lack of it.

Business

- **Marketing**

IoT
&
Gameplay testing

Biometrics and classifier fusion to predict the fun-factor in video gaming

Andrea Clerico[1], Cindy Chamberland[2,3,4], Mark Parent[2], Pierre-Emmanuel Michon[3,4], Sébastien Tremblay[2], Tiago H. Falk[1], Jean-Christophe Gagnon[5] and Philip Jackson[2,3,4]
[1]Institut National de la Recherche Scientifique
[2]Université Laval
[3]Centre Interdisciplinaire de Recherche en Réadaptation et Intégration Sociale
[4]Centre de Recherche de lInstitut Universitaire en Santé Mentale de Québec
[5]Ubisoft Québec

Fig. 1: Graphic interface developed in order to give players a visual feedback of their fun ratings.

Fig. 3: Experiment set-up for dataset collection.

Fig. 2: USB controller (PowerMate, Griffin Technology) used to rate the level of fun.

Improving engagement assessment in gameplay testing sessions using IoT sensors

Cristiano Politowski
ORCiD: 0000-0002-0206-1056
Concordia University
Montreal, Canada
c_polito@encs.concordia.ca

Fabio Petrillo
ORCiD: 0000-0002-8355-1494
Université du Québec à Chicoutimi
Chicoutimi, Canada
fabio@petrillo.com

***Abstract*—Video game industry is a multimillionaire market which makes solo indie developers millionaire in one day. However, success in the game industry it is not a coincidence. Video game development is an unusual kind of software that mix multidisciplinary teams, as software engineers, designer and artists. Further, for a video game be well received, it must be fun and polished, so exhaustively well tested.**

Testing in video game development ranges from different types, in different parts of the process. For example, measuring the engagement of players in a test session can drive the development drastically. The designers/developers analyze actions taken by

This task is the gameplay testing[2]. Gameplay testing means endless iterations by development teams in the last mile of the production. These iterations sometimes involve months of crunches by the team [10].

Gameplay testing sessions are crucial to delivering the fun (successful) game. In this sessions, testers play a specific build of the game, most of the time not knowing the game, on which, at the same time, the game designer assess the level of the game or a feature recently implemented. In the end, what the developers want to see is if the game is fun and if the players

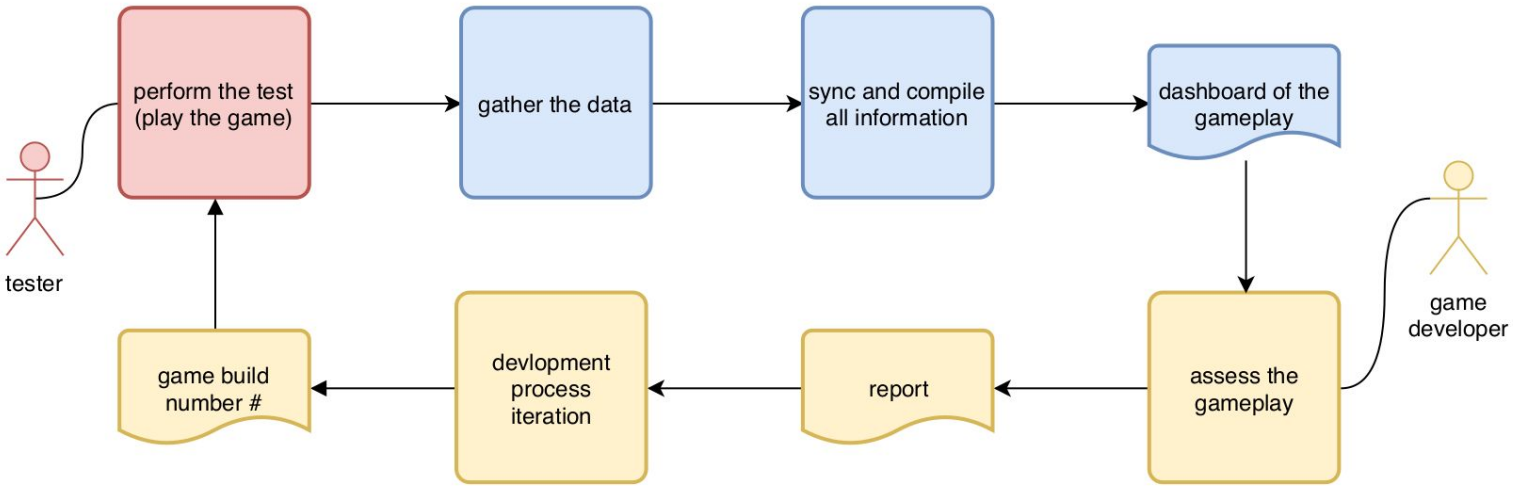


Figure 1: Workflow of the framework.

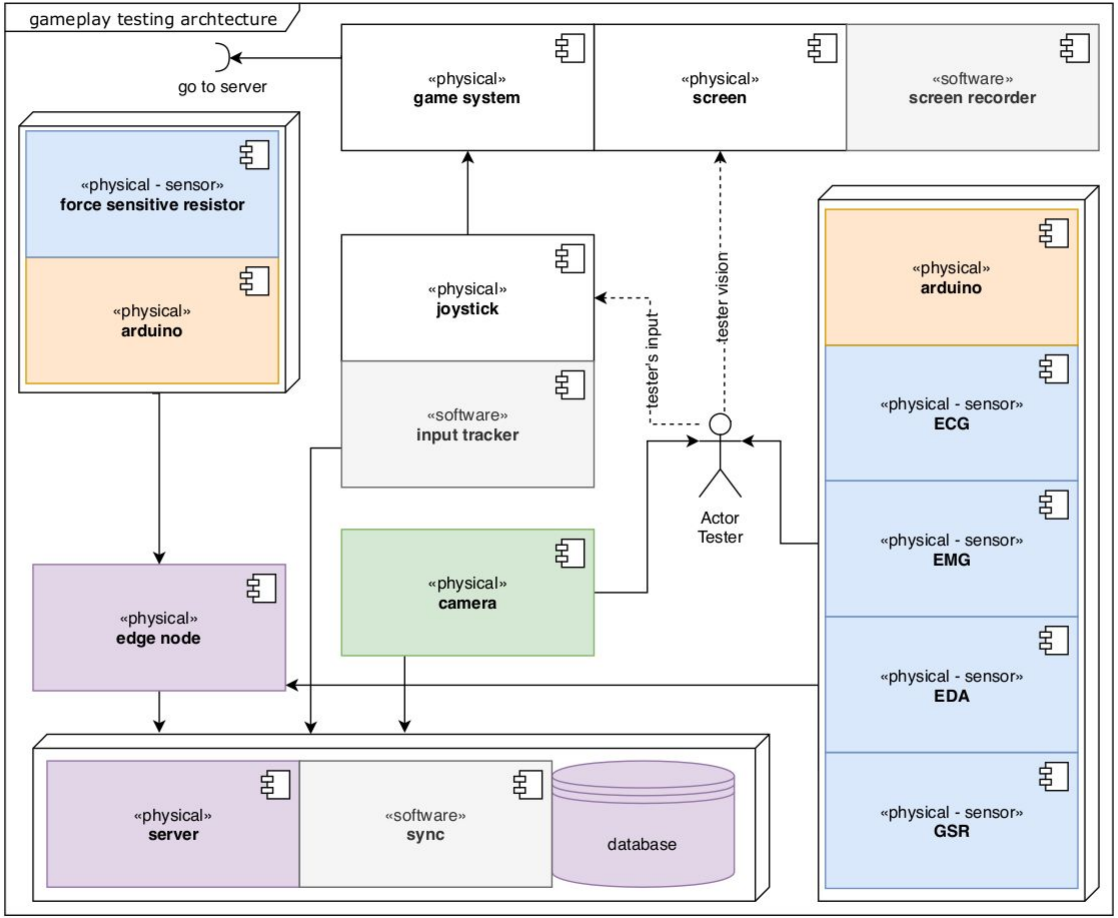
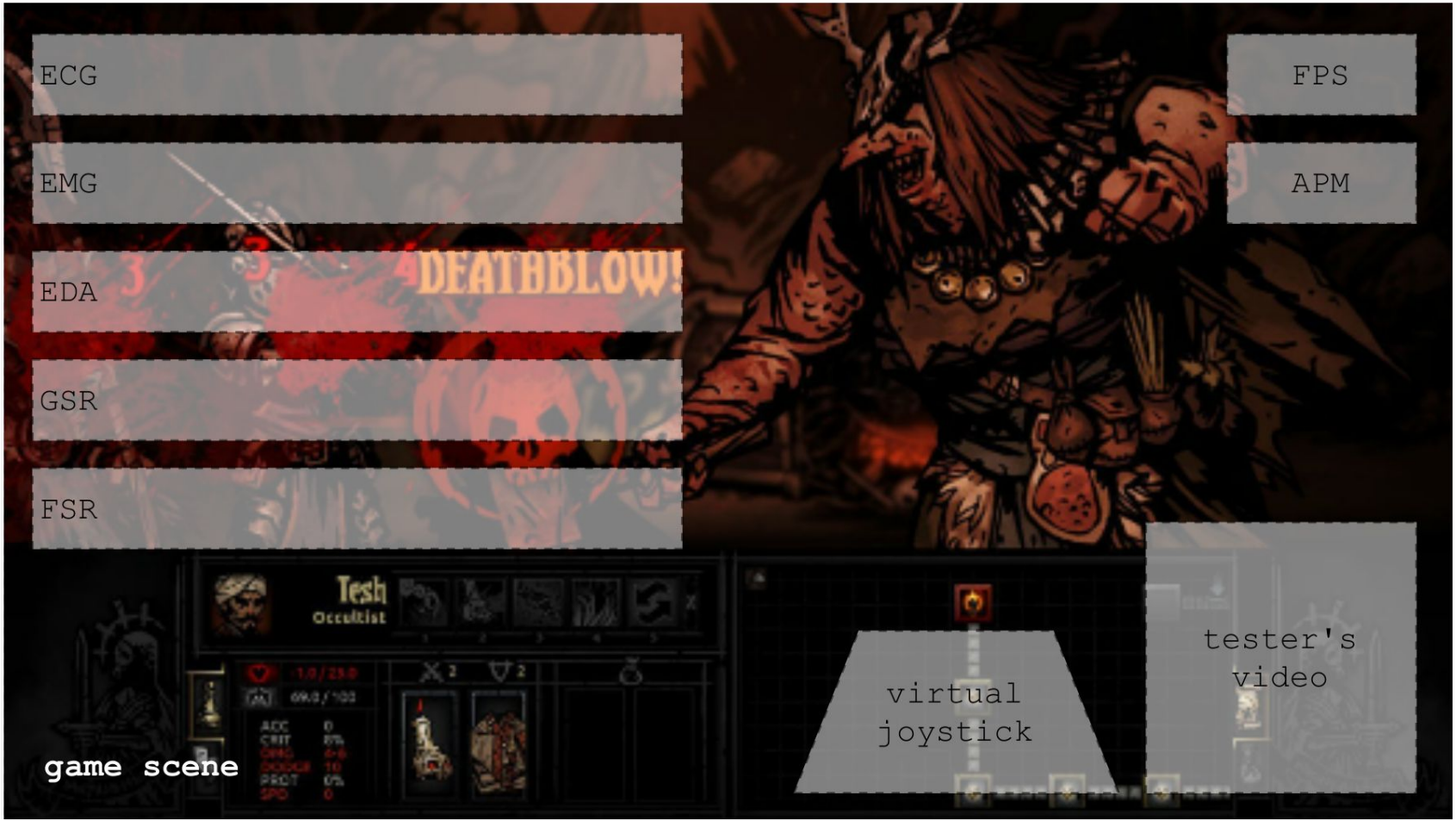


Figure 2: Proposed architecture in UML2 component diagram.


3
3
4DEATHBLOW!
Tesh
Occultist
-1.0 / 23.0
69.0 / 100
ACC 0
CRIT 8%
DMG 4-6
DODGE 10
PROT 0%
SPD 0
2
2


ECG
EMG
EDA
GSR
FSR
FPS
APM
DEATHBLOW!
Tesh
Occultist
virtual
joystick
tester's
video
game scene

What else?
Let’s work together!

fx Vendor

	A	B	C	D	E	F
1	Vendor	Item_id	Product	Model	Category	Link
302	Amazon.ca	hw01	SunSprite Solar-Powered Light Tracker		Wearables- Healthcare and Wellness	https://www.amazon.ca/SunSprite-Wearable-Light-Tracker/dp/B00KX5X4T6
303	Amazon.ca	hw02	Fever Scout wearable Smart Thermometer		Wearables- Healthcare and Wellness	https://www.amazon.ca/Fever-Scout-Thermometer-continuously-temperature/dp/B01E5PVBXA
304	Amazon.ca	hw04	withings Smart Scale- Body	Body	Wearables- Healthcare and Wellness	https://www.amazon.ca/Withings-WS-50-Smart-Analyzer-Black/dp/B00BKRQ4E8
305	Amazon.ca	hw05	Omron 10 Series Wireless Upper Arm Blood Pressure M	10 Series	Wearables- Healthcare and Wellness	https://www.amazon.ca/Omron-Digital-Pressure-Bluetooth-Technology/dp/B00KW4PQ82
306	BestBuy	hw04	withings Smart Scale- Body	Body	Wearables- Healthcare and Wellness	https://www.bestbuy.ca/en-ca/product/nokia-body-cardio-wi-fi-bluetooth-smart-scale-body-analyzer-black/12370697.asp
307	Navigil	ss08	Navigil Safety Wristwatch	S1 Wearable Personal Safety Wristwatch	Wearables- Security and Prevention	https://www.navigil.com/s1-wristwatch/
308	Occly Security	ss01	Occly Blinc and Linc- Body Cameras & Personal Alarm	Blinc and Linc	Wearables- Security and Prevention	https://www.occlysecurity.com/blinc-and-linc
309	RapidSOS	ss07	RapidSOS- Emergency API	Emergency API	Wearables- Security and Prevention	https://info.rapidsos.com/learn-more-wearables
310	React Mobile	ss04	React Sidekick Personal Panic Button		Wearables- Security and Prevention	https://www.reactmobile.com/store
311	Revolar	ss05	Revolar wearable panic button	Classic	Wearables- Security and Prevention	https://revolar.com/products/revolar-classic
312	Revolar	ss05	Revolar wearable panic button	Instinc	Wearables- Security and Prevention	https://revolar.com/products/revolar-instinct-personal-safety-device
313	Wearsafe	ss02	Wearsafe Personal Emergency Response Tag		Wearables- Security and Prevention	https://wearsafe.com/get-wearsafe/
314	staples.ca	ss02	Wearsafe Personal Emergency Response Tag		Wearables- Security and Prevention	https://www.staples.ca/en/thermor-00010-wearsafe-tag-white/product_2896525_1-CA_1_20001?akamai-feo=off
315	ibandplus	sl03	iBand+		Wearables- Sleep	http://www.ibandplus.com/
316	apple	sl01	Beddit Sleep Monitor		Wearables- Sleep	https://www.apple.com/shop/product/MUFM2LL/A/beddit-sleep-monitor
317	Amazon.ca	sl02	ResMed S+		Wearables- Sleep	https://www.amazon.ca/S-ResMed-Personal-Sleep-Solution/dp/B00NP52QE0
318	haptx	sc01	HaptX Gloves Development Kit		Wearables- Smart Clothing	https://haptx.com/
319	stretchsense	sc02	StretchSense StretchSPORT kit		Wearables- Smart Clothing	https://www.stretchsense.com/article-resources/
320	intel	sp07	Recon Jet Smart Glasses		Wearables- Sport and Fitness	https://www.intel.ca/content/www/ca/en/support/products/97509/emerging-technologies/wearable-devices/recon-produ
321	Moov	sp06	Moov HR	Moov HR Burn	Wearables- Sport and Fitness	https://welcome.moov.cc/moovhr/specs
322	Moov	sp06	Moov HR	Moov HR Sweat	Wearables- Sport and Fitness	https://welcome.moov.cc/moovhr/specs
323	Orphe	sp04	Orphe Smart Footwear		Wearables- Sport and Fitness	https://en.orphe.shoes/
324	PhiPAL	sp05	PhiPAL Helmet		Wearables- Sport and Fitness	http://www.phipal.io/product/phipal/
325	Samsung	sp01	Samsung Gear Fit2 Pro Fitness Tracker	Fit2 Pro	Wearables- Sport and Fitness	https://www.samsung.com/ca/wearables/gear-fit2-pro-r365/SM-R365NZKAXAC/
326	Xenoma	sp02	Xenoma E-skin		Wearables- Sport and Fitness	https://xenoma.com/eskin-dk
327	staples.ca	sp01	Samsung Gear Fit2 Pro Fitness Tracker	Fit2 Pro	Wearables- Sport and Fitness	https://www.staples.ca/en/Samsung-Gear-Fit2-Pro-Red-SM-R365NZRNXAC/product_SS7529099_1-CA_1_20001
328	The Source	sp01	Samsung Gear Fit2 Pro Fitness Tracker	Fit2 Pro	Wearables- Sport and Fitness	https://www.thesource.ca/en-ca/health--and--wearable-tech/fitness-trackers/fitness-trackers/samsung-gear-fit2-pro-act
329	Walmart	sp01	Samsung Gear Fit2 Pro Fitness Tracker	Fit2 Pro	Wearables- Sport and Fitness	https://www.walmart.ca/en/ip/samsung-gear-fit-2-pro-black-large/6000197650432
330	Amazon.ca	sp08	Pebble Time Smartwatch		Wearables- Sport and Fitness	https://www.amazon.ca/Pebble-501-00020-Time-Smartwatch-Black/dp/B0106IS5XY/ref=lp_8005325011_1_2?srs=800
331	Amazon US	sp08	Pebble Time Smartwatch		Wearables- Sport and Fitness	https://www.amazon.com/Pebble-Technology-Corp-501-00020-Smartwatch/dp/B0106IS5XY
332	BestBuy	sp01	Samsung Gear Fit2 Pro Fitness Tracker	Fit2 Pro	Wearables- Sport and Fitness	https://www.bestbuy.ca/en-ca/product/samsung-gear-fit2-pro-fitness-tracker-with-heart-rate-monitor-large-black/116453
333	BestBuy	cm07	Ultra-thin Wireless Keyboard and Mouse Combo			https://www.bestbuy.ca/en-ca/product/axgear-wireless-2-4g-mini-keyboard-mouse-combo-cordless-slim-design-for-des
334						

300+ IoT items? We can play with that!

Opportunities

ICPC 19 International Conference on Program Comprehension 2019

Sat 25 - Sun 26 May 2019 Montreal, QC, Canada

co-located with ICSE 2019

Attending | Tracks | Organization | Search | Series | Sign in | Sign up

27th IEEE/ACM International Conference on Program Comprehension 2019

The 27th IEEE/ACM International Conference on Program Comprehension (ICPC) is the premier venue for work in the area of program comprehension. It encompasses both human activities for comprehending the software and technologies for supporting such comprehension. ICPC 2019 promises to provide a quality forum for researchers and practitioners from academia, industry, and government to present and to discuss state-of-the-art results and best practices in the field of program comprehension.

ICPC 2019 Tracks

Technical Research | Tools Demo | Replications | Negative Results

Upcoming Important Dates

Mon 18 Feb 2019
Tools Demo Papers Due

Fri 1 Mar 2019
Replications Author Notification

Fri 1 Mar 2019
Negative Results Author Notification

Tue 5 Mar 2019
Tools Demo Author notification

Tue 5 Mar 2019
Technical Research Author Notification

PRISA

One/two weeks researching in Montreal

Master’s or Ph.D. students only

Brazil, Canada, and Uruguay

Money for conferences


McGill


POLYTECHNIQUE
MONTRÉAL
TECHNOLOGICAL
UNIVERSITY


UQÀM


UNIVERSITÉ
Concordia
UNIVERSITY

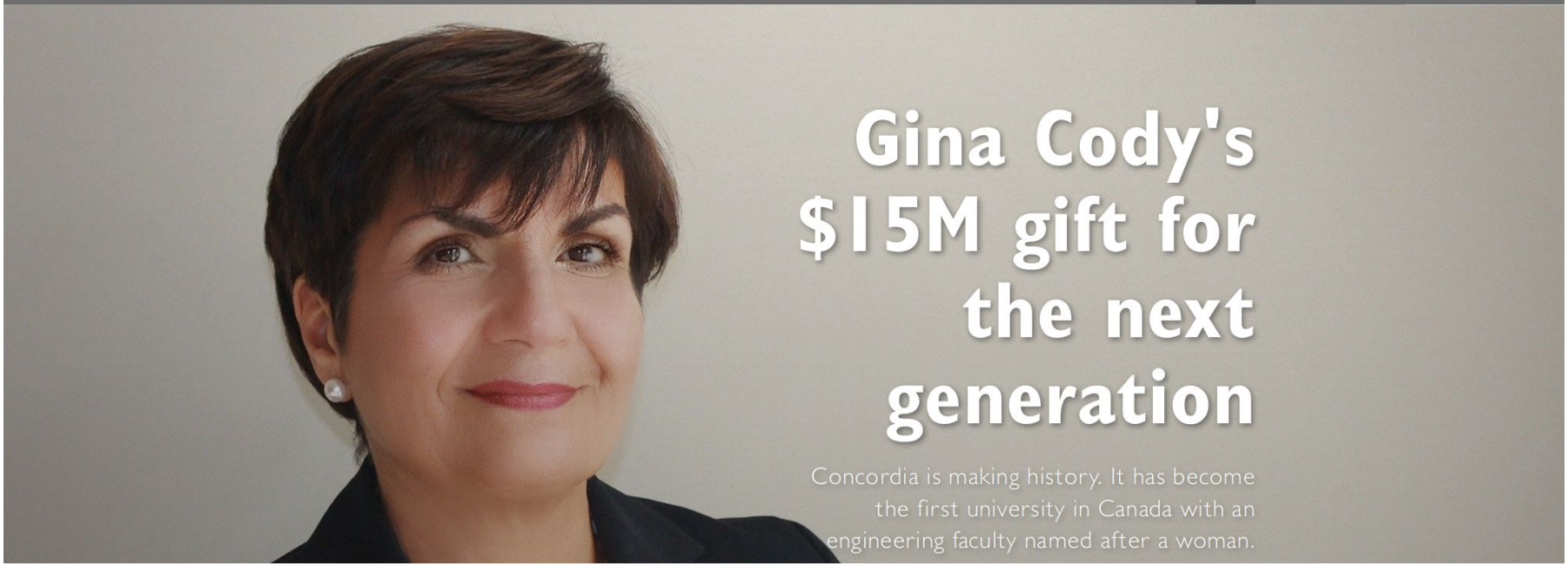

Université
de Montréal

MyConcordia Cspace Webmail Library Directories A-Z Maps The Campaign for Concordia Quick links

Université Concordia University

Gina Cody School of Engineering and Computer Science

ABOUT THE SCHOOL PROGRAMS STUDENTS FACULTY & RESEARCH ALUMNI NEWS & EVENTS



McGill University receives $200M donation for graduate scholarships

Money from John and Marcy McCall MacBain will go toward scholarship program

Sarah Leavitt · CBC News · Posted: Feb 13, 2019 10:30 AM ET | Last Updated: February 13

John and Marcy McCall MacBain, the founders of the McCall MacBain Foundation, made the $200-million donation to McGill University. (McGill University)

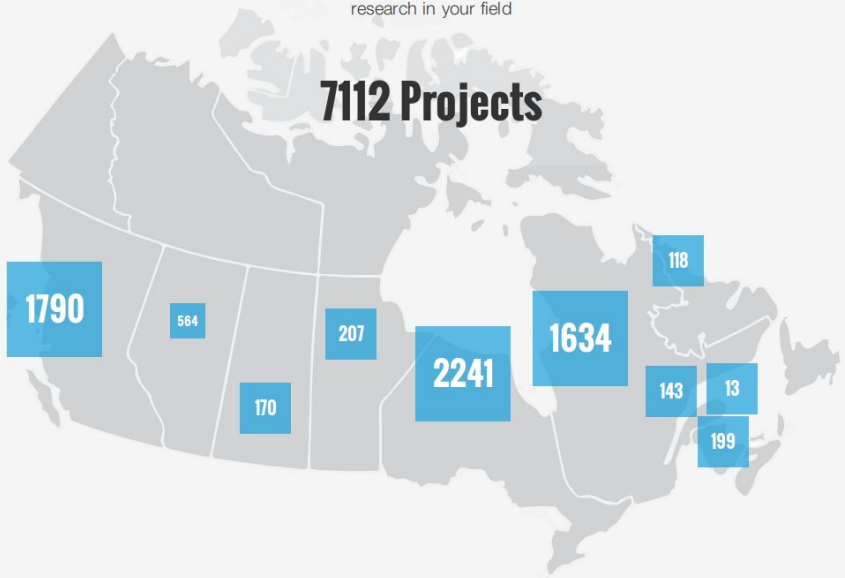
UQAC

UNIVERSITÉ DU QUÉBEC
À CHICOUTIMI

They need students!

Projects

Search our project database to find current and past Mitacs-funded research in your field



Projects by category

Final Thoughts


THERE'S A CONFERENCE IN OUR FIELD COMING UP.
IT'S IN THE MIDDLE OF NOWHERE AND NOBODY IMPORTANT IS GOING.
STILL... ONE OF US SHOULD GO.
AND BY "ONE OF US" YOU MEAN..?
THE ONE THAT'S NOT IMPORTANT.
JORGE CHAM © 2017
WWW.PHDCOMICS.COM

Springer

springer.com

Reviewer Certificate of Recognition

The Editors of

Empirical Software Engineering

thank Cristiano Politowski
for serving as a peer reviewer of our journal.

Your hard work, support, and feedback are greatly appreciated.
Thank you for your contribution in 2018.

Thank you

Robert Feldt and Thomas Zimmermann

Part of SPRINGER NATURE

A55036

Cristiano Politowski
crispolitowski@gmail.com

Suggestions and critics are very welcome!