

Presentation of

*Software engineering research for computer games:  
A systematic review*

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Information and Software Technology (2010)

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## Background:

1. computer game development:
  - fast growing industry
  - rapid evolving (newer version in short interval)
  - innovative in hardware and software technologies
  - complicated, professional skills needed
2. software engineering (SE) techniques are needed for:
  - flexibility
  - maintainability
  - less cost and effort
  - better design ...
3. Different characteristics to classical SE development

## Motivation:

1. Picture on the advancement of SE methodologies for games is not clear
2. Lack of a systematic review
3. Assess the state of the art on research on SE for games
4. Discuss possible important areas for future research

# Methodology: Literature Review

1. research questions
2. search process
3. inclusion and exclusion criteria
4. quality assessment
5. data collection
6. data analysis

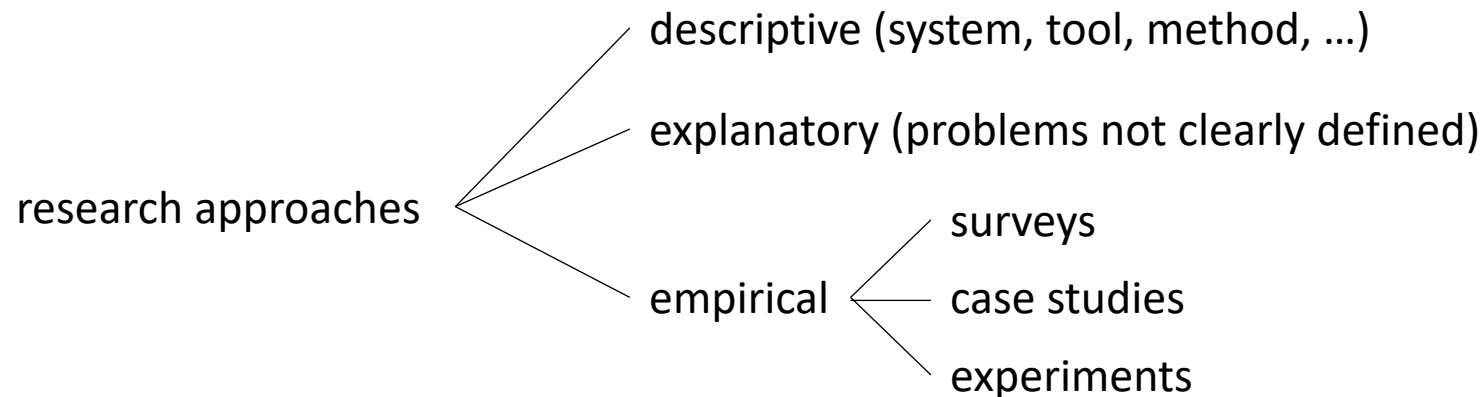
# Methodology Details: 1. Research Questions

Q1: Which is the **intensity of the research activity** on SE methods for game development?

Q2: What SE **research topics** are being addressed in the domain of computer games?

Q3: What **research approaches** do SE researchers use in the domain of computer games?

Q4: What **empirical research methods** do SE researchers use in the domain of computer games?



## Methodology Details: 2. Search Process

**Libraries:** ACM, IEEE, ScienceDirect, and SpringerLink

**Keyword:** “game”

**Filter:** “computer science” or “software engineering”

**search result:** 3463 papers, most are marginally related to SE

## Methodology Details: 3. Inclusion and Exclusion Criteria

**Inclusion:** closely related to SE issues

**Exclude:** based on title, on abstract, on full text

**remain:** 84 papers

## Methodology Details: 4. Quality Assessment

quality of the articles published is believed satisfactory

# Methodology Details: 5. Data Collection

Extracted from each paper: type (journal/conference/workshop); journal/conference name; publisher; publication year; country; classification of topic, research approach, research method

Software engineering		Empirical method	Description		
D.2.0	General – miscellaneous	Experiment	A set of subjects is asked to perform a task in a highly controlled environment. The results are derived from observing of the subjects during the experiment, from inspecting the task outcome or from questioning the subjects at the end of the procedure		
D.2.1	Requirements/specification				
D.2.2	Design tools and techniques				
D.2.3	Coding tools and techniques				
D.2.4	Software/program verification				
D.2.5	Testing and debugging				
D.2.6	Programming environments				
D.2.7	Distribution, maintenance and enhancement				
D.2.8	Metrics			Survey	A set of subjects is asked to fill-in questionnaires either directly, or via internet. The results are derived from the valid answers to the questionnaire
D.2.9	Management				
D.2.10	Design			Case study	A project, an activity or an assignment is monitored with respect to the methodology under study. Results are directly derived from project measurements
D.2.11	Software architecture				
D.2.12	Interoperability				
D.2.13	Software reuse				

topic classification

empirical method classification

## Methodology Details: 6. Data Analysis

Q1: **intensity of the research activity**: number of studies (1) published per year; (2) each digital library hosts; (3) each country and continent produced

Q2: **research topics**: topic classification

Q3: **research approaches**: research approach classification

Q4: **empirical research method**: research method classification

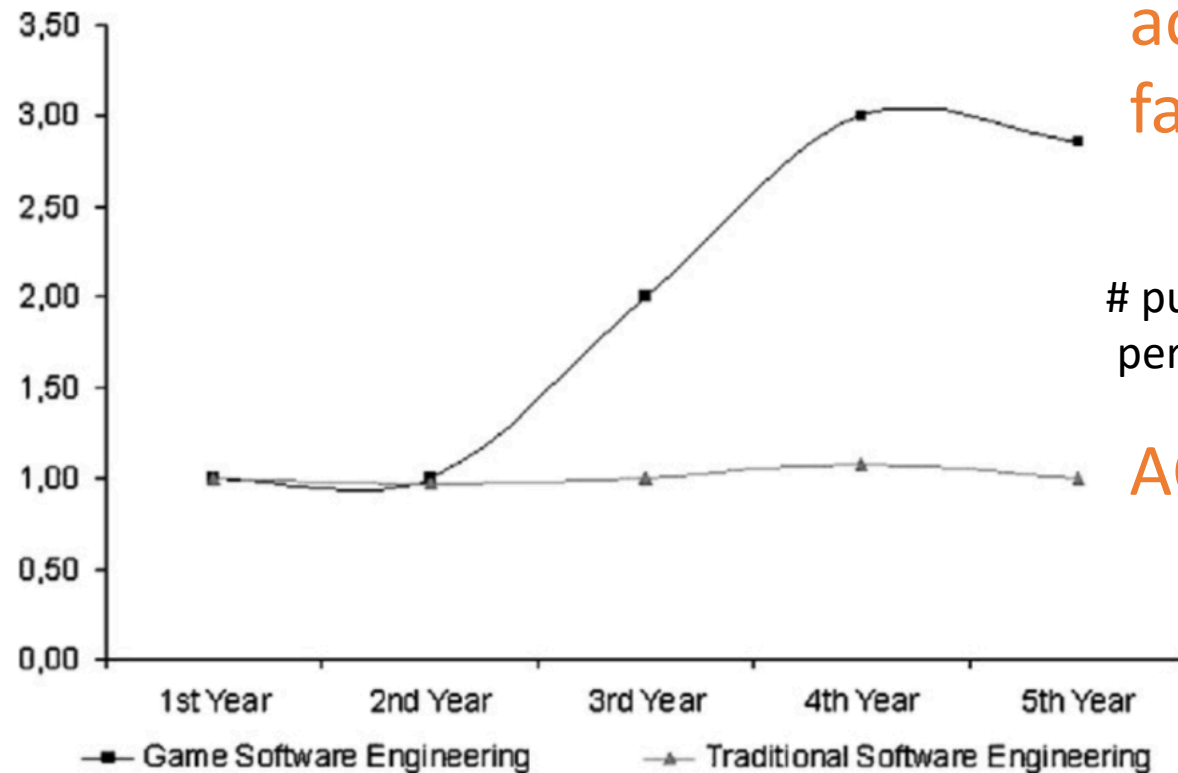


# Evaluation and Discussions: Research Activity

research activity per year:

Year		<2003	2004	2005	2006	2007	2008	2009	Total
Citation type									
Journal		2	3	1	1	8	6	5	26
Conference		2	4	6	6	5	16	15	54
Workshop		0	1	0	0	2	1	0	4
Total		4	8	7	7	15	23	20	84

activity increase ratio:

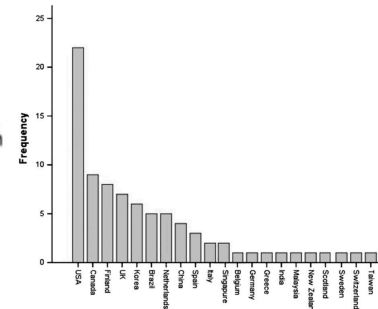


Research on SE for computer games increased activity during last 5 years, increase ratio faster than traditional SE.

# publications per publisher

Publisher name	# Publications
ACM	32
IEEE	25
Springer	19
Elsevier	8

ACM hosts most publications



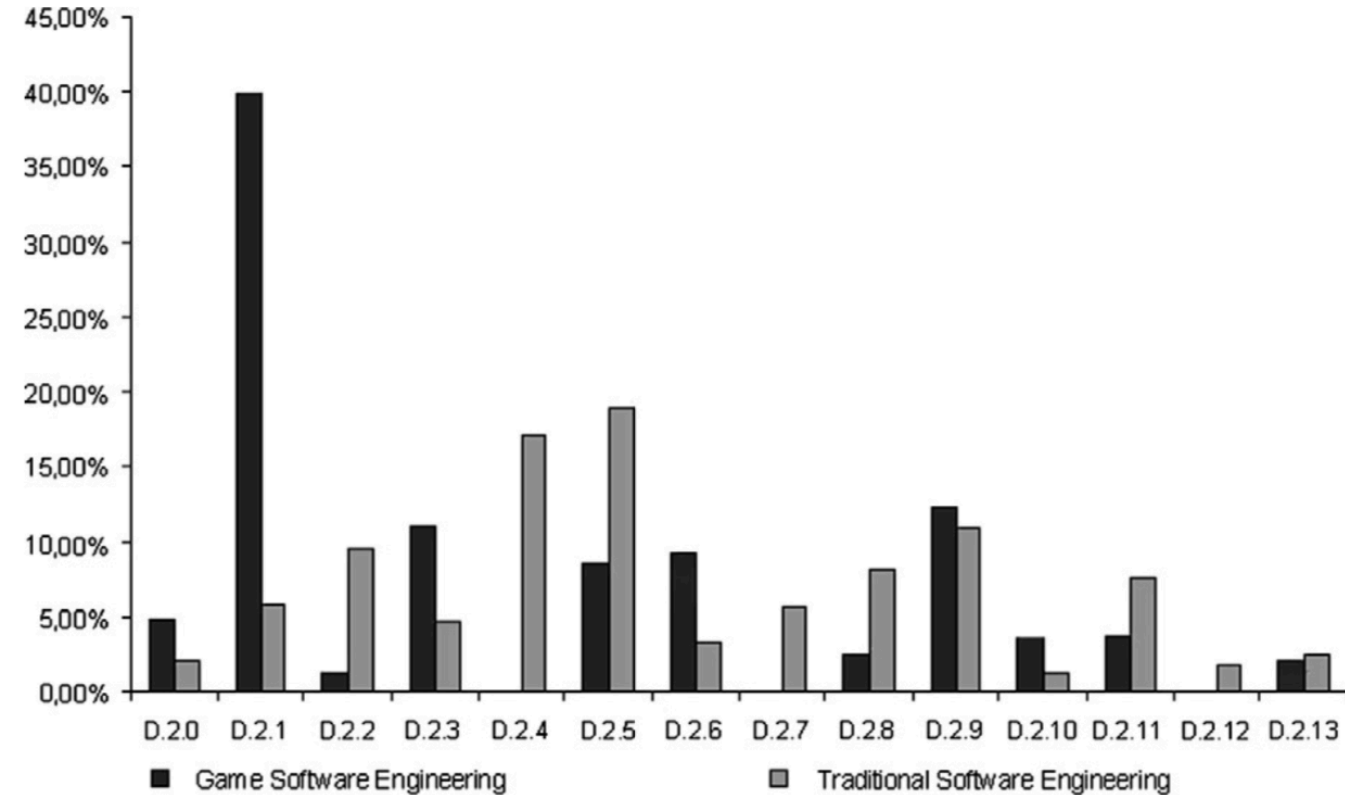
USA dominates SE gaming research

research activity per country

# Evaluation and Discussions: Research Topics

game engineering research topics

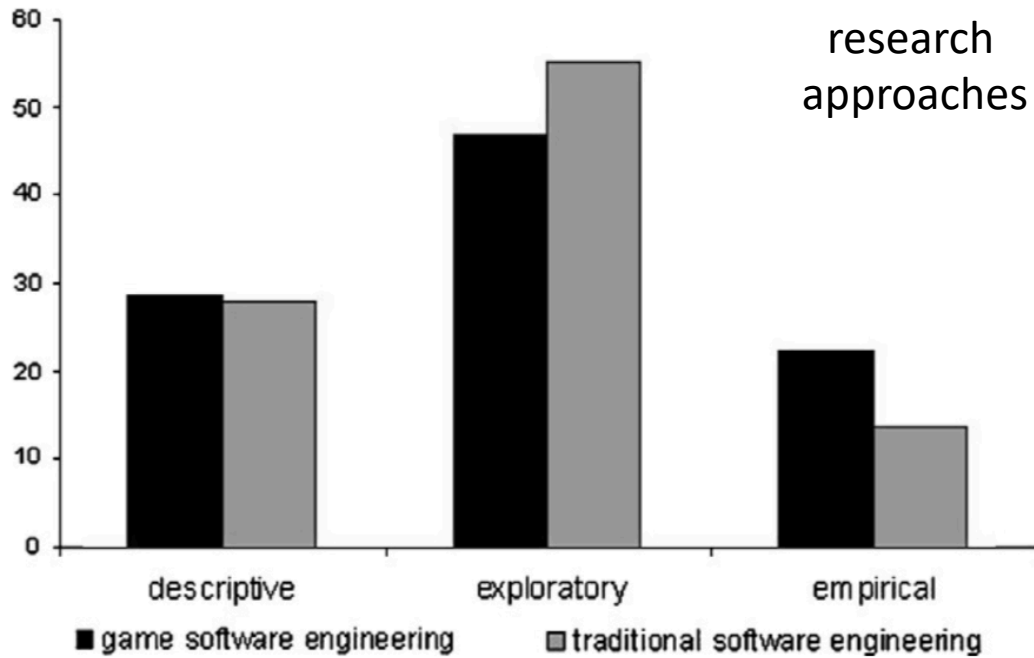
	Software engineering topic	Frequency	Percentage
D.2.0	General	4	4.76%
D.2.1	Requirements/specification	33	39.29%
D.2.2	Design tools and techniques	2	2.38%
D.2.3	Coding tools and techniques	10	11.90%
D.2.4	Software/program verification	0	0.00%
D.2.5	Testing and debugging	7	8.33%
D.2.6	Programming environments	8	9.52%
D.2.7	Distribution, maintenance and enhancement	0	0.00%
D.2.8	Metrics	2	2.38%
D.2.9	Management	10	11.90%
D.2.10	Design	3	3.57%
D.2.11	Software architecture	3	3.57%
D.2.12	Interoperability	0	0.00%
D.2.13	Software reuse	2	2.38%



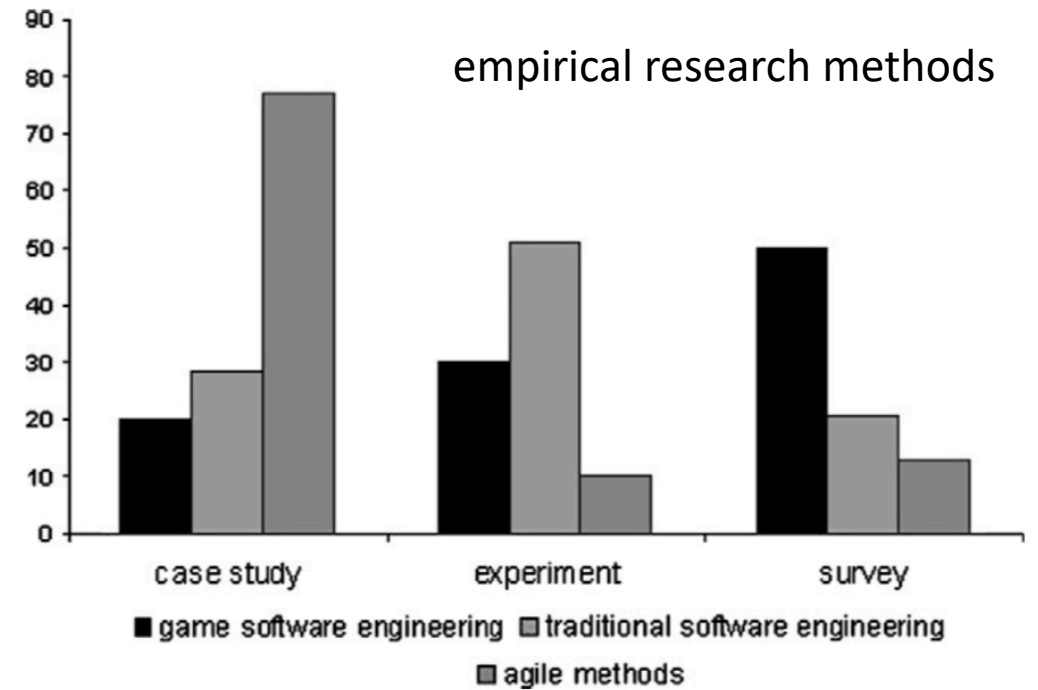
dominant topic: requirements  
some topics are not covered

reasons for the difference: (1) special needs and priorities of game development. (2) game engineering is a young domain, need more fundamental research. expect: topics neglected so far will attract interests when fundamental subjects mature..

# Evaluation and Discussions: Research Approaches & Empirical Methods



no significance differences



case study more frequent in agile  
survey more frequent in game  
experiment more frequent in traditional SE

reason: level of maturity: SE most mature -> most experiments; game research is young -> (1) it lacks existence project data, so fewest case study; (2) need knowledge from domain experts, so it has most survey.

# Strength and Weakness:

## Strength:

- clear presentation
- detailed procedure
- easy to follow
- informative statistical data
- comprehensive literature review
- plausible explanations

## Weakness:

- lack of technical details (code, algorithm ... )
- alternative explanations
- no profound understanding
- authors contribution to this field unclear

## Related Works:

[13]: differences between game SE and classical SE, practitioner's: limited lifecycle; corrective maintenance & adaptive maintenance.

[6, 10] possibility of employing the evidence-based paradigm in SE.

[1, 8] how to conduct a literature review

# Conclusion

a literature review for game SE research

follow literature review paradigm

statistical data

comparison between game SE and traditional SE

lack of technical details

**Thank you!**

## Questions:

1. According to the paper, which research topic was most addressed in the computer game software engineering?
2. Among the descriptive, explanatory, and empirical research approaches, the one most frequently mentioned in the domain of computer game software engineering was explanatory. Was this trend same as or different to the domain of traditional software engineering?
3. Among the empirical methods (surveys, case studies, experiments), which dominates in computer game software engineering? Which dominates in traditional engineering?