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# What Makes A Task Difficult?

*An Empirical Study of  
Perceptions of Task Difficulty*

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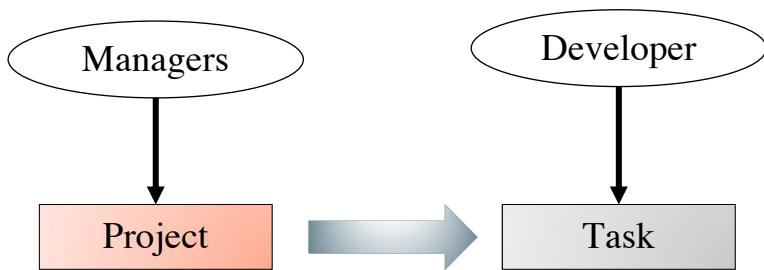




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# Task Difficulty

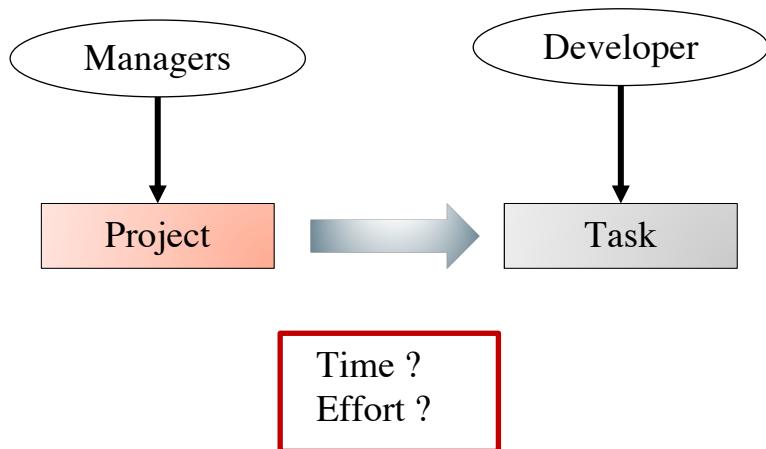
Software Engineering





# Task Difficulty

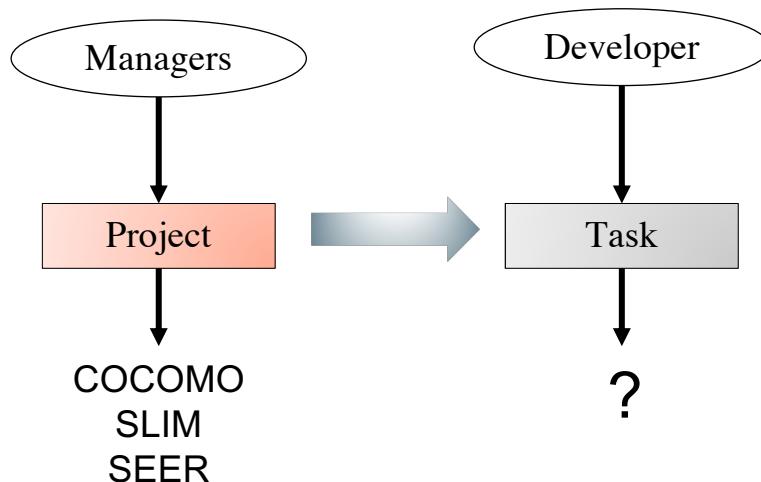
Software Engineering





# Task Difficulty

## Software Engineering



“... software engineers are in **great need** for techniques for **accurate effort estimation**, and they **are not necessarily knowledgeable** about techniques they can use to meet their needs.” [ Ivanov et al. , FSE2017 ]



# Goal

**When and why do developers estimate task difficulty,  
AND  
if they use metrics (and which).**

## RQs:

1. Why do developers perform task estimation?
2. How comfortable are developers when performing estimations?
3. What project metrics do developers find useful when estimating task difficulty?



# Methodology



33 responses  
2 companies

15 participants  
34 minute (avg.)

557 cards  
23 categories



# Exploratory Survey

Participants thought of:

- One difficult task
- One easy task

Rate the metrics :

Essential
Worthwhile
Unimportant
Unwise

Cat.	Metric
CODE	<b>LOC</b> - Lines of Code
	<b>CCOM</b> - Cyclomatic complexity
	<b>CTCR</b> - Comment To Code Ratio
TASK	<b>CMTT</b> - Task Comments
	<b>FILT</b> - Task Files
	<b>REOP</b> - Reopens
PROCESS	<b>DEVT</b> - Developers associated with task
	<b>FCOM</b> - # commits of the file
	<b>CENT</b> - Centrality
	<b>DEVF</b> - Developers associated with file



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# Follow-up Interview

- Task Assignment
- Task Management
- Metric Ratings (survey)
- Identifying difficult tasks

# RQ1: Why do developers perform task estimation?



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## Prioritizing tasks

7 out of 15



## Ensuring optimal task assignments

11 out of 15





# RQ1: Why do developers perform task estimation?



## Prioritizing tasks

7 out of 15

“ I choose the difficult task first, ...” [P14]

“ ... I follow the one which are easier to solve first.” [P7]

## Ensuring optimal task assignments



11 out of 15

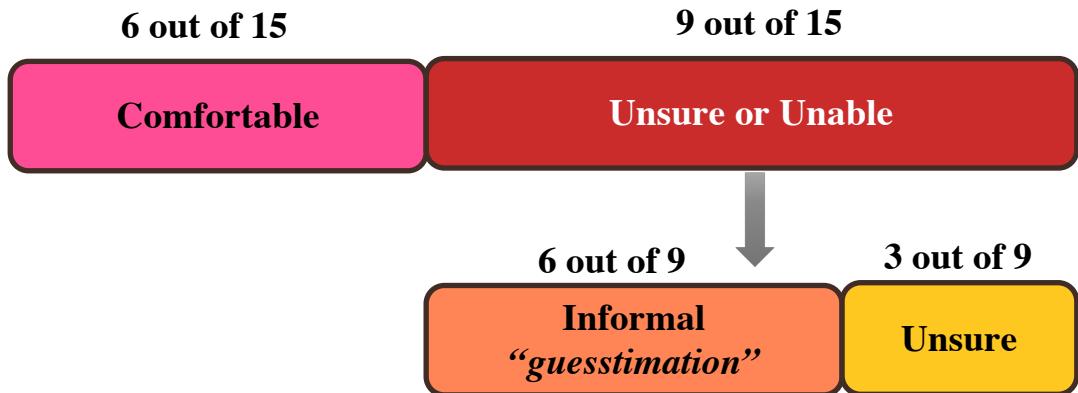
“ ... [if] I am given a task which is relatively simple to me, then the team is losing out on my experience.” [P12]

Every developer finds it essential to perform task estimation.

Some do it without acknowledging it as a separate task.

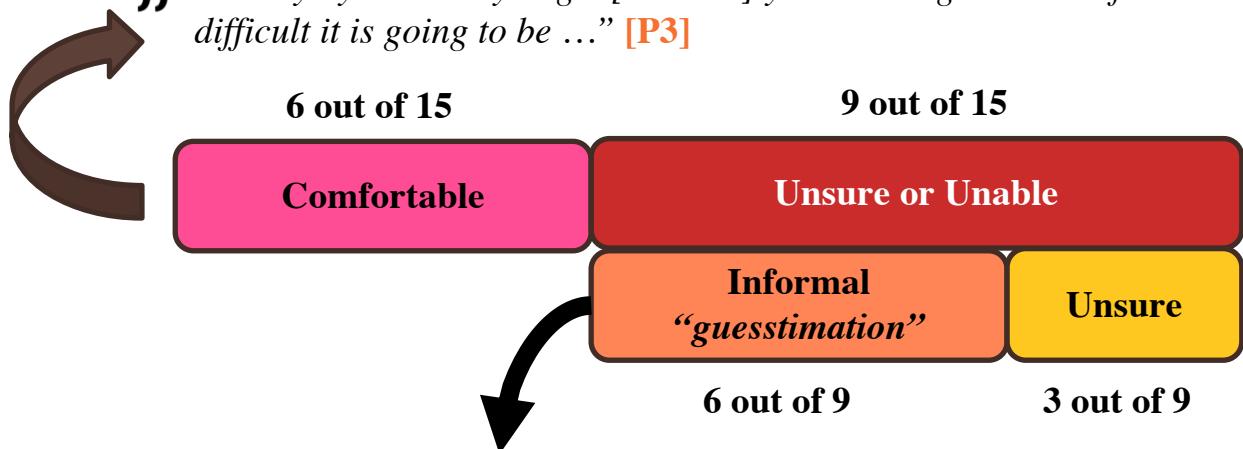


## RQ2: How comfortable are developers when performing estimations?



## RQ2: How comfortable are developers when performing estimations?

“ Usually by the time you get [the task] you have a good idea of how difficult it is going to be ...” [P3]



“ there is no rule ... to say that if [this happens] ... then [the task] is difficult”. [P5]

*Developers are either unaware of various metrics.*

*Or performing estimation with those metrics is difficult.*



## RQ3: What metrics do developers find useful when estimating task difficulty?

P11 says prioritizing work “... *requires looking at the code.*”



### Useful Metrics (Survey)

Developers claim that some of the existing metrics are **useful**.



### Additional Metrics (Interview)

There are **additional**, non-traditional metrics that developers find important.



# Useful Metrics

Rank	Metric	E	W	UI	UW	W+%
1	DEVT ( $T$ )	9	17	2	5	78.8
2	FILT ( $T$ )	6	18	2	7	72.7
3	DEVF ( $P$ )	8	15	3	7	69.7
3	FCOM ( $P$ )	6	17	8	2	69.7
4	LOC ( $C$ )	3	19	4	7	66.7
5	CCOM ( $C$ )	7	14	4	8	63.6
5	REOP ( $T$ )	4	17	5	7	63.6
5	CENT ( $P$ )	4	17	5	7	63.6
6	CMTT ( $T$ )	6	14	6	7	60.6
7	CTCR ( $C$ )	6	10	7	10	48.5



# Useful Metrics

#	Metric	E	W	UI	UW	W+%
1	DEVT ( $T$ )	9	17	2	5	78.8
2	FILT ( $T$ )	6	18	2	7	72.7
3	DEVF ( $P$ )	8	15	3	7	69.7
3	FCOM ( $P$ )	6	17	8	2	69.7

# Useful Metrics



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1

DEVT (Task)

2

FILT (Task)

Reflect the amount of work required to complete the task.

---

3

DEVF (Process)

3

FCOM (Process)

These reflect the evolution (history) of the file.

Traditionally, Code metrics used in models.

Developers find Task and Process metrics more useful.



# Additional Metrics

Category	Metric
Collaboration	Communication, Coordination, Clients, Access
Project History	Task Lifetime, Defects
Task Character	Priority, Dependencies
Task Type	Bug Reproduction, Framework, Testing



# IMPLICATIONS



## Formal Models for Task Estimation

Develop formal models that developers can use themselves.

## Task Metrics



Including task-related metrics in formal task estimation models.



## Measuring Additional Metrics

Find ways to measure additional metrics that developers find useful.

# Thank you for listening !

Have more questions?

Please email it to **Rafael Leano:**

[leanor@oregonstate.edu](mailto:leanor@oregonstate.edu)



# IMPLICATIONS



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