

# Towards Measurable Motivation in Software Development

Authors: Niladri Saha (TAU), Abdullah Israr (TAU), Outi Sievi-Korte (TAU), Fabian Fagerholm (Aalto University)

Presenter: Outi Sievi-Korte, Tampere University,  
[outi.sievi-korte@tuni.fi](mailto:outi.sievi-korte@tuni.fi)



# Presenter: Outi Sievi-Korte

- Assistant Professor (tenure track) in Software Engineering at Tampere University, Finland.
- Funding from Academy of Finland and Ulla Tuominen foundation.
- Her research interests lie with data-driven software development, utilizing AI and meta-heuristics for software engineering problems, software design, software project management, and social aspects of software development
- PI representative for Software Engineering on the Tampere University research platform CNESS (Climate Neutral Energy Systems and Society).
- Published over 35 peer-reviewed papers in software engineering.
- Chairperson of the board at Finnish Society for Computer Science since 2021.



# Background

- Increasing burnout and exhaustion, and diminishing well-being at work, particularly among expert fields and in the ICT sector
- People feel overburdened with tasks they don't have enough time to do, tasks that may be too challenging considering their skills, or not challenging enough to be motivating in the long run.

# Our goals

- Mine software repositories for indicators of motivation
  - Contribution of the present study, indicators based on literature
- Map indicators to build a model of motivation
  - Partially done in the present study, proposing initial results for future work
- Model of motivation can be used to quickly recognize drops in motivational levels
  - Future work, long-term goal

# Measurable motivational factors

- Factors and metrics based on literature (Beecham et al. (2008), Sharp et al. (2009))
- Technically challenging work → Complexity metric
- Risk of delay → Risk estimation metric
- Emotions → Sentiment and emotion analysis tools
- Collaboration → Collaboration metric

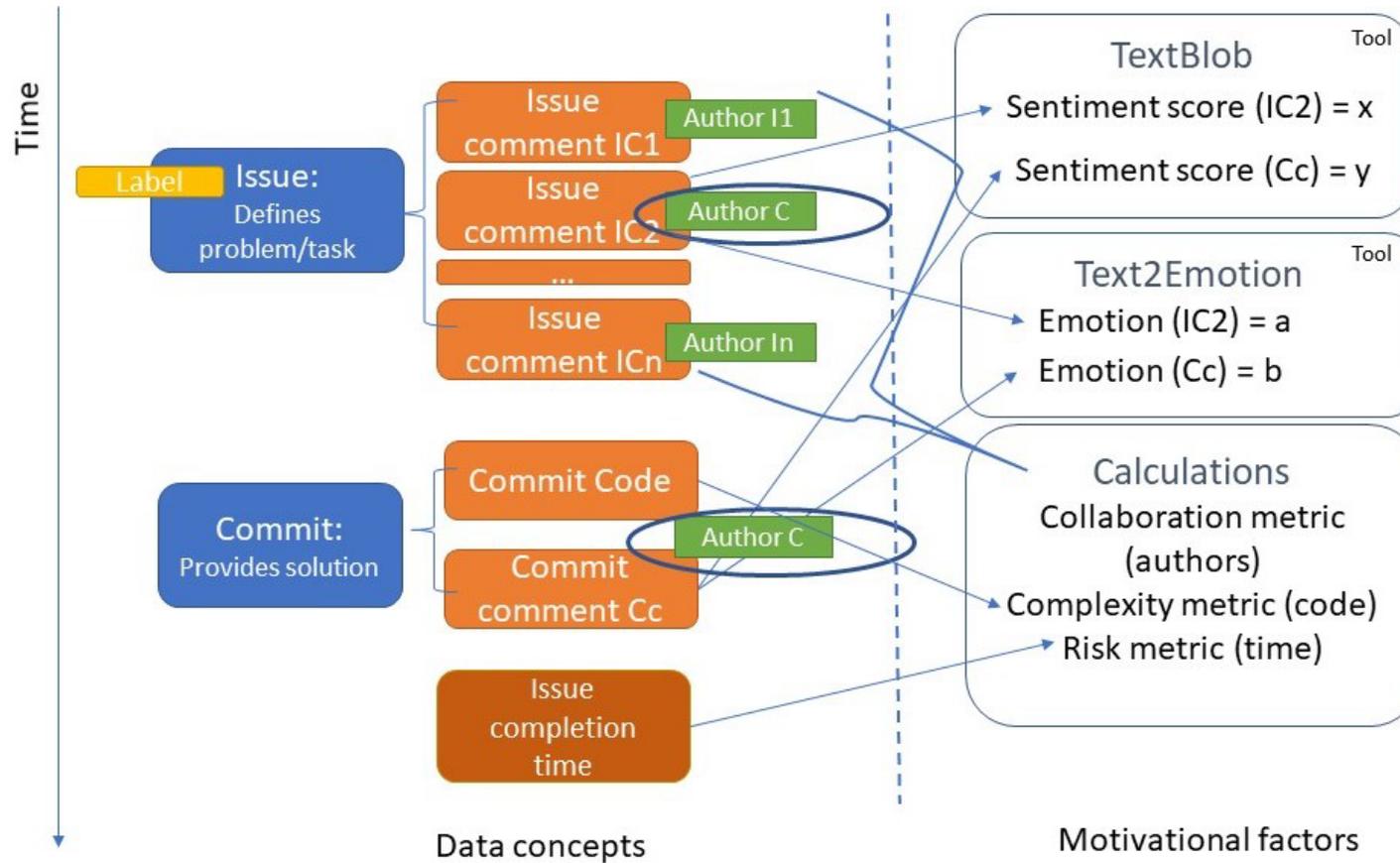
TABLE I  
METRICS FOR MOTIVATIONAL FACTORS.

Motivational factor	Related data	Formula
Technically challenging work (Complexity of tasks)	Number of files, number of files changed, number of lines changed	$C_i = nL * nF$ (1), $C_i$ = Complexity of an issue at code level $nL$ = Number of changed lines (in commit) $nF$ = Number of changed files (in commit)
Participation/ Involvement/ Working with others	Information on assignee, commenter, commit author	$CS = CL - ML$ (2), $CS$ = Collaboration Score, $CL$ = Number of collaborators, $ML$ = Number of mentions
Risk/Risk related to project delivery time	Completion time of issues	$R_i$ = High, if $Ct_i > Avg(Ct)$ $R_i$ = Low, if $Ct_i < Avg(Ct)$ (3), $R_i$ = Risk of an issue, $Ct_i$ = Completion time of an issue

# Data

- 26 000 + issue comments, 5000 + commit comments
- Filtered to include those issue comments made by the actual developer of the issue
  - We wanted to focus on the emotions of the actual developer as we utilized metrics concerning the commit, i.e., task
- Dataset of 1069 records (issue comment + commit comment of a commit made to resolve an issue)

# Process



# Results

TABLE II  
EMOTIONS BY COMPLEXITY

Emotion	Source	Complexity category	Count	Percentage (per complexity category)
Happy	Issue	High	47	40,5%
		Low	458	48,2%
	Commit comment	High	77	66,4%
		Low	479	50,4%
Sad	Issue	High	27	23,3%
		Low	200	21%
	Commit comment	High	8	6,9%
		Low	89	9,3%
Surprise	Issue	High	13	11,2%
		Low	50	5,3%
	Commit comment	High	-	
		Low	-	
Fear	Issue	High	27	23,3%
		Low	220	23,2%
	Commit comment	High	4	3,4%
		Low	88	9,3%
Angry	Issue	High	2	1,7%
		Low	22	23,2%
	Commit comment	High	26	22,4%
		Low	265	27,9%

TABLE III  
EMOTIONS CATEGORIZED BY RISK LEVEL

Emotion	Source	Risk level	Count	Percentage
Happy	Issue	High	131	49,4%
		Low	377	46,9%
	Commit comment	High	166	62,7%
		Low	391	48,6%
Sad	Issue	High	55	20,8%
		Low	172	21,4%
	Commit comment	High	9	3,4%
		Low	88	10,9%
Surprise	Issue	High	20	7,5%
		Low	43	5,3%
	Commit comment	High	-	
		Low	-	
Fear	Issue	High	54	20,4%
		Low	193	24,0%
	Commit comment	High	21	8,0%
		Low	73	9,1%
Angry	Issue	High	5	1,9%
		Low	19	2,4%
	Commit comment	High	67	25,3%
		Low	224	27,9%

# Conclusions

- The risk of missing a deadline, i.e., the time it takes to complete a task, was shown to influence the emotions of developers (statistical significance). → Emotion is an indicator of motivation, we could ponder on what exactly is the motivational effect of the deadline.
- The level of complexity using our categorization between high and low complexity was not found significant
  - There were indications that a more fine-grained view of complexity could produce significant results.
- More work needed to further refine other and more precise metrics

# References

- H. Sharp, N. Baddoo, S. Beecham, T. Hall, and H. Robinson, “Models of motivation in software engineering,” *Information and Software Technology*, vol. 51, pp. 219–233, 2009.
- S. Beecham, N. Baddoo, T. Hall, H. Robinson, and H. Sharp, “Motivation in software engineering: A systematic literature review,” *Information and Software Technology*, vol. 50, pp. 860–878, 2008.