Socio-Technical Work-Rate Increase Associates With Changes in Work Patterns in Online Projects

Farhana Sarker       Bogdan Vasilescu       Kelly Blincoe       Vladimir Filkov
@b_vasilescu          @KellyBlincoe        @vlfilkov
High workload

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High work-rate, high stress

- GitHub is like being onstage
  (Dabbish et al. 2012), (Marlow et al. 2013)

- Communication overload causes stress and reduces productivity
  (Reinke and Chamorro-Premuzic 2014), (Kalman and Rafaeli 2011), (Reinecke et al. 2017)

- Social pressure to respond quickly is associated with burnout and anxiety
  (Reinecke et al. 2017)

- Multi-tasking common, causes stress
  (Vasilescu et al., 2016), (Mark et al., 2008)
Social workload

Prevalence of high work-rates
Perceived Causes and Impacts of Stress
Effects of increased workload on developers’ work patterns

Data mining + Developer Survey

Sample:
- 57K+ developers
- 10+ years of activity
- 150K+ repositories
Developer survey

Pilot Survey
45 Responses (13%)
Open-ended Questions

Survey
465 Responses (23%)
Likert-scale questions

What causes you work-related stress?

______________________________
______________________________

deadlines

______________________________
______________________________

My work-related stress is caused by deadlines.

☐ Strongly disagree
☐ Somewhat disagree
☐ Neither agree nor disagree
☐ Somewhat agree
☐ Strongly agree
Findings

Socio-Technical Work-Rate Increase Associates With Changes in Work Patterns in Online Projects

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Abstract—Software developers work on a variety of tasks ranging from the technical, e.g., writing code, to the social, e.g., participating in issue resolution discussions. The amount of work developers perform per week (their work-rate) also varies and depends on project needs and developer schedules. Prior work has shown that while moderate levels of increased technical work and multitasking lead to higher productivity, beyond a certain threshold, they can lead to lowered performance.

Here, we study how increases in the short-term work-rate along both the technical and social dimensions are associated with changes in developers' work patterns, in particular communication sentiment, technical productivity, and social productivity. We surveyed active and prolific developers on GitHub to understand the causes and impacts of increased work-rates. Guided by the responses, we developed regression models to study how communication and committing patterns change with increased work-rates and fit those models to large-scale data gathered from traces left by thousands of GitHub developers. From our survey and models, we find that most developers do experience work-rate-increase related changes in behavior. Most notably:

- Traditional lines-per-day measures of work aggregate, to an extent, the work-rate of technical tasks. While coordination tasks figure in these too, his association is not simple to

Fig. 1. Example number of commits per week for a prolific developer.
High work-rates common

Prevalence of high work-rates

[Graphs showing scatter plots with data points and trend lines indicating the number of commits and comments over weeks from 2012 to 2016.]
Causes of workplace stress

- Time pressure / too much work
- Deadlines
- Working on many things in parallel
- Unclear or unrealistic requirements
- Co-workers or manager
- Performance / quality pressure
- Communication issues
- Unfulfilling work
- Culture or language barriers

Perceived Causes and Impacts of Stress
Impacts of stress

- I work outside of my normal business hours
- the number of hours I work
- my communications are terse
- my communications are negative
- I stop working on the project
- I am productive
- I communicate
- I produce high quality code

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Senti4SD
(Cafelato et al., 2018)
Empirical Study

Effects of increased workload on developers’ work patterns
Multitasking dimensions

1. Projects per day

Working sequentially vs. Within-day multi-tasking

(Vasilescu et al., 2016)
Multitasking dimensions

Mostly on one project vs. Evenly on all projects

Percent Comments: 0% 20% 40% 60% 80% 100%

Project A B C D

High focus

Low focus

(Vasilescu et al., 2016)
Multitasking Dimensions

Repetitive day-to-day vs. Changing focus each day

(Vasilescu et al., 2016), (Xuan et al., 2014)
Statistical Analysis

Responses
• Lines of code added
• Comments
• Sentiment

Controls
• Total projects
• Time since first commit
• Company affiliation
• ...

Sample:
• 57K+ developers
• 10+ years of activity
• 150K+ repositories
Effects: Weekly comments

Company affiliation

Day-to-day focus (less predictable) vs.
Effects: Lines of Code added

High levels of comments per day vs. Focused commenting

Day-to-day focus (repeatability)

Higher LOC added
Effects: Negative sentiment

- Higher than normal levels of commenting
- Commenting on many more projects than usual
- Committing on many more days per week than usual
Effects: Negative sentiment

- High levels of commenting
- Commenting on many more projects than usual
- Committing on many more days per week than usual

Thanks!

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