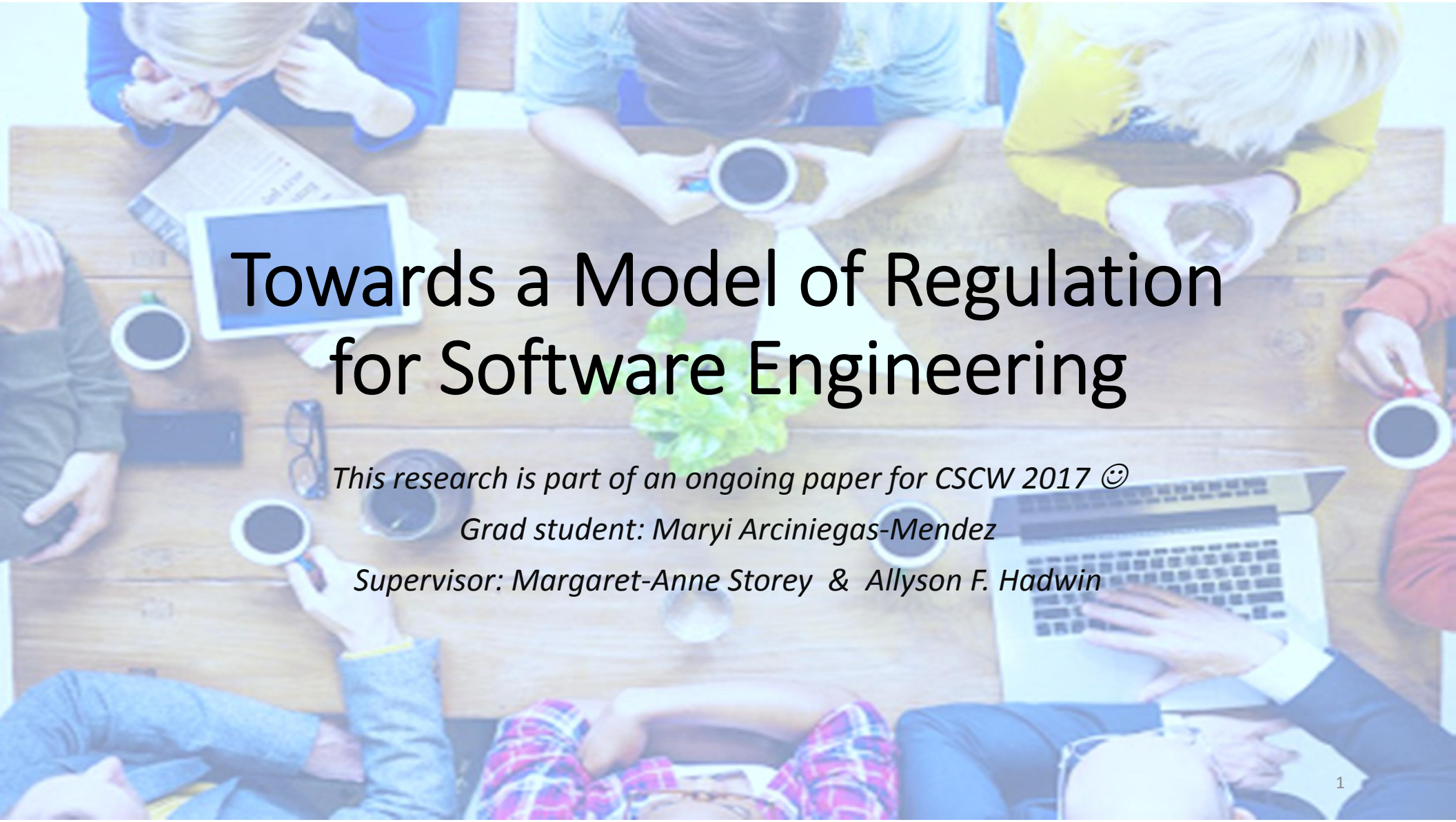

Towards a Model of Regulation for Software Engineering

This research is part of an ongoing paper for CSCW 2017 ☺

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Collaboration in Software engineering

Collaboration in Software engineering

Participatory culture

Participatory culture

⇩

Communities of Practice

⇩

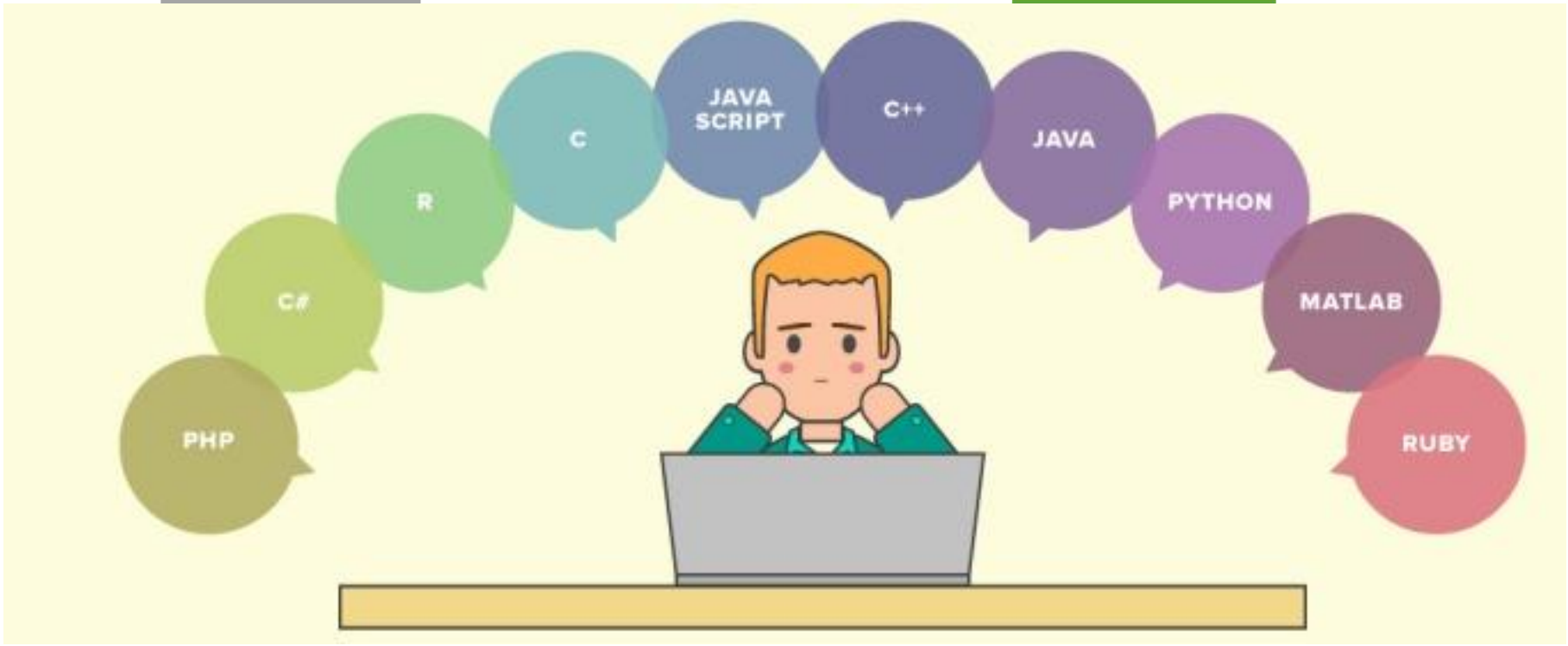
Knowledge Building Community

Software development practices, tools and resources.

Traditional

Traditional

Now



How to understand collaboration in Software Engineering (SE)?


Models and frameworks of collaboration.

Models were developed before the development community embraced socially enabled channels and tools!

Not consideration for …

Social era

Participatory culture

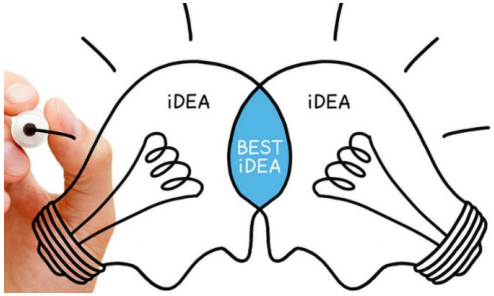
⇩

Communities of Practice

⇩

Knowledge Building Community

What is collaboration?



- An activity where different people get together to produce something better than any participant could either conceive or produce alone Johnson1989

How can we describe how collaboration happen?

Models of Collaboration

Technology-centric approaches

- **Time-space matrix**, original by Johansen. Improved by Grudin and Dix et al.
- **Classification of tools**: based on their support (e.g., design) by Cook and similarly Martignoni , and based on their approach (e.g., model-based, process support) by Whitehead.

Collaboration-centric approaches

- **3C Model** – 3 principles for collaboration by Ellis et al. Later improved by Gerosa et al.
- **Awareness**: Gutwin et al. and DeSouza and Redmiles.
- **Types of work** by Robillard and Robillard.
- **Factors that affect collaboration** by Patel et al.
- **Dimensions of collaboration** by Lee and Paine
- **Needs of developers** by Sarma et al.
- **Coordination in soft. dev.,** Continuous coordination (CC) by Van Der Hoek.

Models of Collaboration

Collaboration-centric approaches

Global software development

- **Coordination aspects** by Wiredu
- **CC theory adaptation** by Redmiles et al.
- **Factors that affect communication** by Dafoulas et al.
- **Recommendation** by Olson and Olson

Open-software

- **List of informalisms key to OSS** by Scachhi
- **Principles of collaboration** by Augustin et al.
- **CC theory adaptation** by Crowston et al.

- **Agile manifesto & its methods..** Scrum, eXtreme programming, Crystal….
- **Personal Software Process & Team Software Process.**

Community of SE → Knowledge building community

Developers and participants of the SE community → Active learners

So, let's consider collaboration from the learning science domain

Learning Science

Theory of regulation

- Regulation: strategic decisions in the face of challenges.

Hac

All concepts from the learner's perspective

- 3 types of regulation: self-, co- and socially shared regulated learning.
- 4 regulatory processes: task understanding, goal setting, enacting and large-scale adaptation.

Learning Science

- Concept of regulation
- Hadwin's work on types of regulation and processes.

Particularities of collaboration in SE.

The Model of Regulation

Framework for prescribing productive collaborations in modern collaborative software development.

Building the model

Adaptation of vocabulary and Case Study on Neo4j community:

- **Phase I**: Exploratory -Analyzed the 10 most recent 'conversations' from each communication tool. 10 issues from GitHub, 10 discussions from GoogleGrou from StackOverflow. Total of 30 'conve

Particularities of collaboration in SE.

- **Phase II**: Analyzed each communication tool until saturation. That is, all themes of conversations were considered in the model. We analyzed 242 issues from GitHub, 105 discussions from GoogleGroups, 216 posts with the tag Neo4j from StackOverflow. Total of 563 'conversations'. Also, we conducted 3 interviews.

Learning Science

- Concept of regulation
- Hadwin's work on types of regulation and processes.

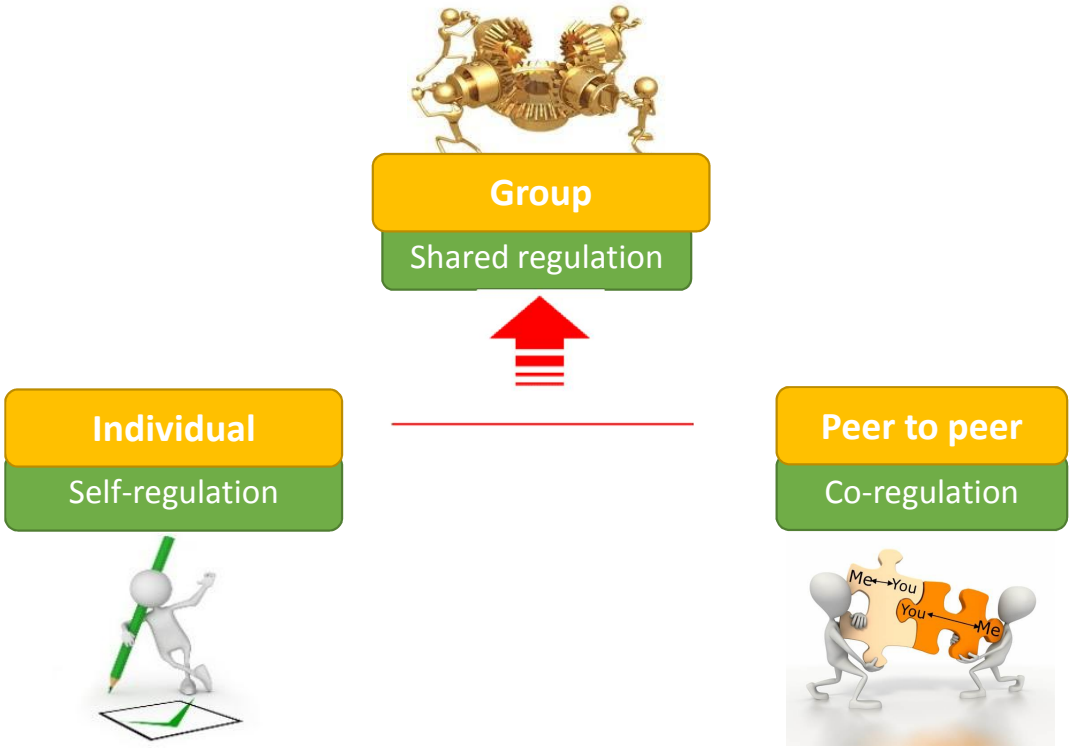
Particularities of collaboration in SE.

Case study on Neo4J community

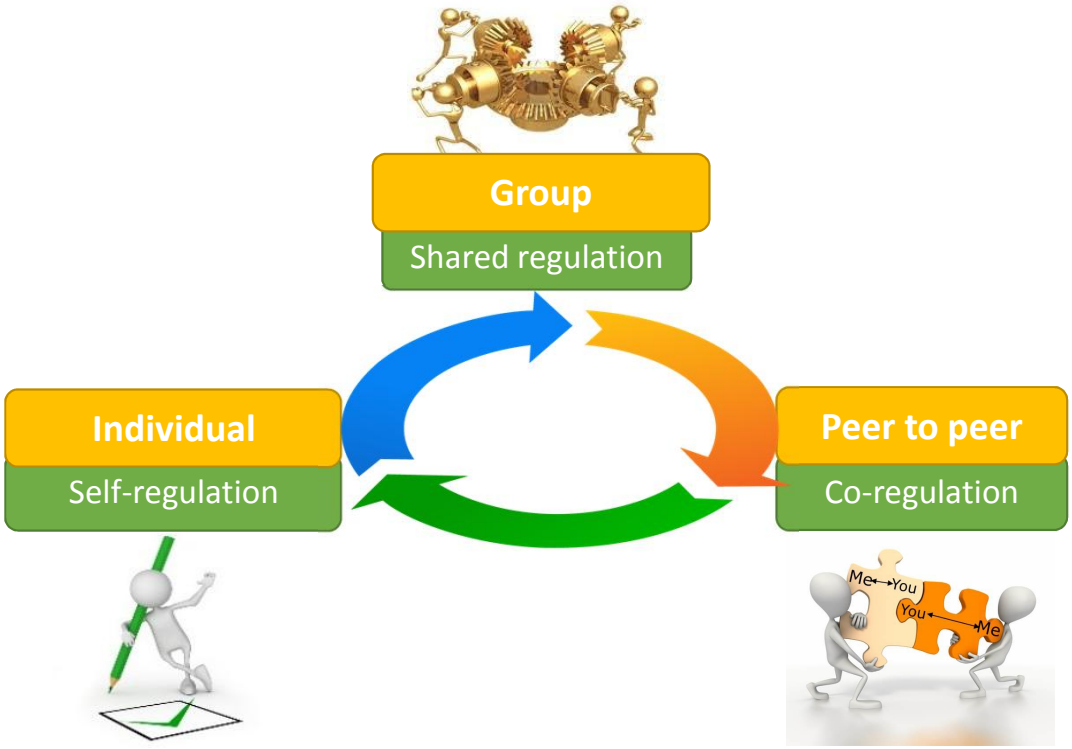
The Model of Regulation

Framework for prescribing productive collaborations in modern collaborative software development.

Model of Regulation – Types of regulation



Model of Regulation – Types of regulation

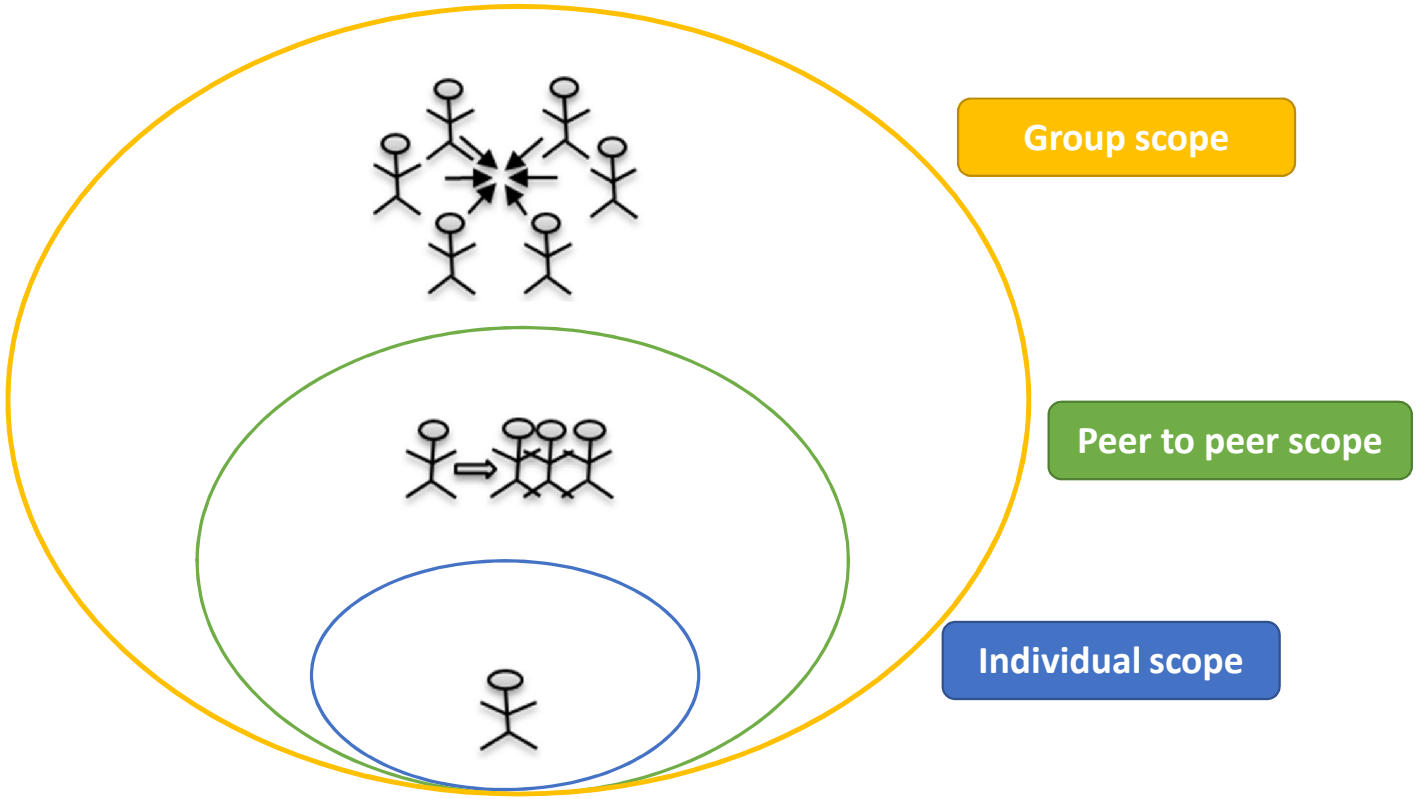


Model of regulation

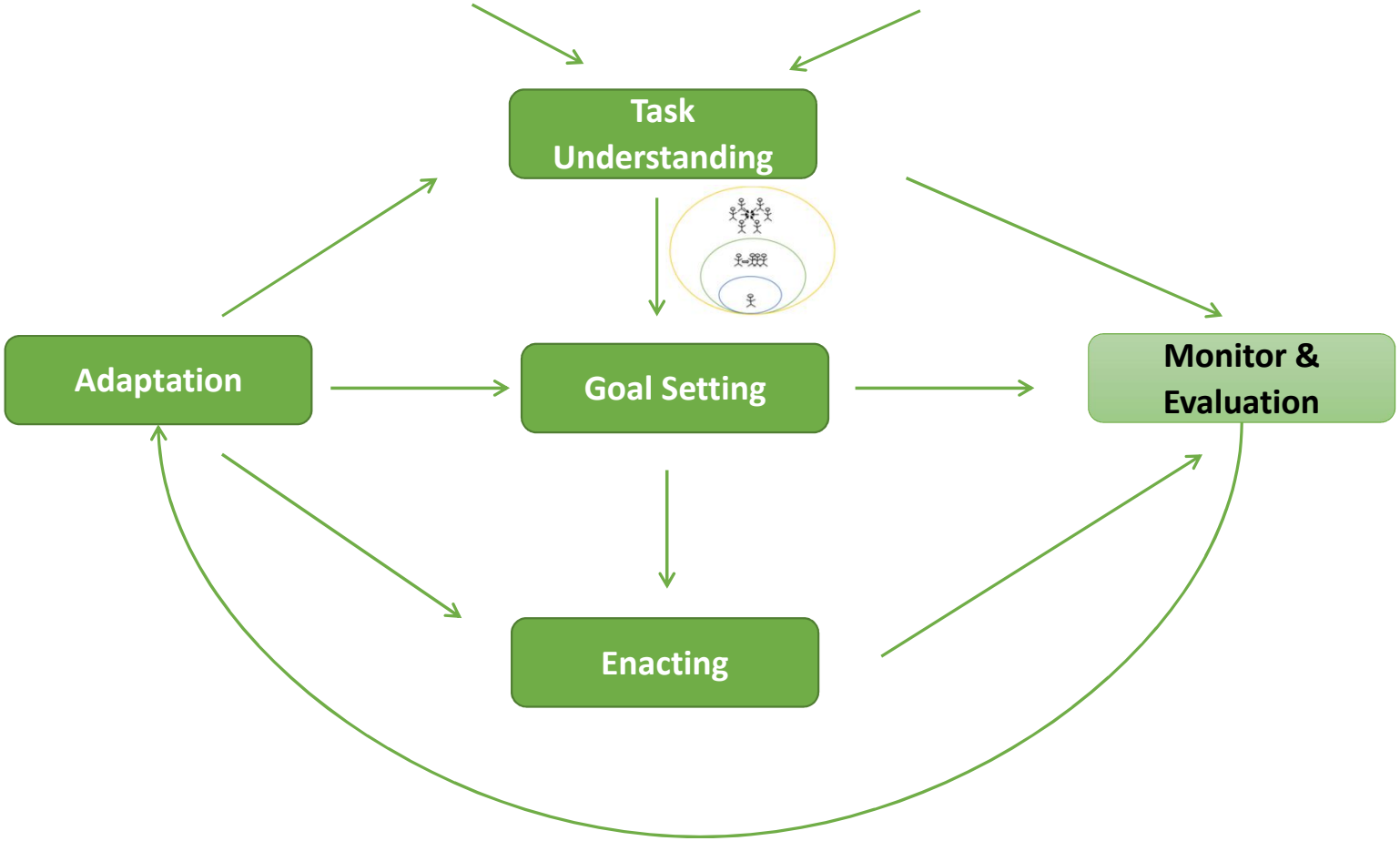
Co-regulation:

Shared-regulation:

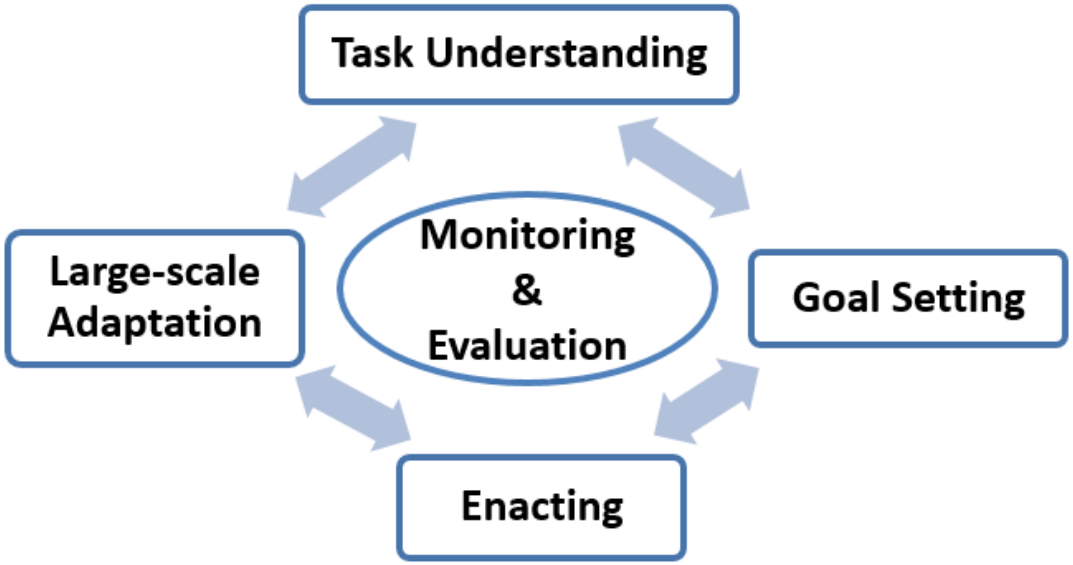
Model of Regulation – Scope of regulation



Model of Regulation – Processes of regulation



Model of Regulation – Processes of regulation



Model of regulation

- Task knowledge
- Self knowledge
- Goals and plans
- Strategy knowledge and use
- Motivation and emotions

	Self-regulation	Co-regulation	Shared- regulation
	ersonal ds.	"You perspective" Individual hold goals/standards for each other.	"We perspective" Collective goals/standards.
Example	I don't understand why I'm getting this error, it looks like a bug. I'll check on the documentation how this feature should work or I'll ask someone else.	Looks like you and I have different ideas about the project requirement, why don't we discuss about that?	Let's be clear about what we have to do… Does everyone agree on using Slack for internal communications?

How can we use the Model of Regulation for our benefit?

The Model of Regulation in Action

We created an instrument to profile collaboration in software engineering teams.

- Phase I: We draw questions based on the model and iterated over the questionnaire until the it was ‘applicable’.

- Phase II: We conducted interview pilots to refine the instrument. Then we test the instrument with 2 interviews.

The instrument – part 1

Task Understanding	**Unifying perceptions about the project/task at hand. Project comprehension or understandings include: requirements, purpose, scope, social context, and roles and responsibilities of participants with respect to the task.**
Self-regulation: Individual	Do you take the time to understand the task at hand and the project within its particular context? *Where Is it documented?*
Co-regulation: Peer to peer	Do you discuss your project comprehension with other team members and search for alignment of ideas? *Where are those discussions documented?*
Shared-regulation: Group	Does the group hold discussions and reach agreement about the project understanding? *Is the result of group discussions documented and available to all members? Where is it?*
Goal Setting	**Stablishment of a work plan, which includes goals, task standards (e.g., deadlines, product quality), resource allocation, strategies, methods and tools to support collaboration and task performance.**
Self-regulation: Individual	Do you define a personal work plan? *Where Is it documented?*
Co-regulation: Peer to peer	Do you assist other team members to define or improve their personal work plans? *Is the outcome of these conversations documented? Where?*
Shared-regulation: Group	As a group, Do you define and agree on a group work plan? *Does the group document the agreement about the work plan and make it available for all members? Where?*
Enacting	**Follow the plan while providing support for motivational engagement**
	Plan execution
Self-regulation: Individual	Do you follow your personal work plan?
Co-regulation: Peer to peer	Do you support other team members to execute their work plans?
Shared-regulation: Group	Does the group follow the work plan as defined? i.e., the group effectively uses collaboration strategies, methods and computer-based tools as selected in the work plan.
	Motivational engagement
Self-regulation: Individual	Do you implement strategies to stay motivated and engaged in the face of challenges?
Co-regulation: Peer to peer	Do you help other team members to stay motivated and engaged during plan execution?
Shared-regulation: Group	As a group, Do you discuss and agree on strategies for staying motivated and engaged in challenging situations?

The instrument - part 2

Monitor and Evaluation	**Tracking and assessment of project comprehension and the work plan**
	Monitor and evaluation of outcomes against expected results and work plan
Self-regulation: Individual	Do you monitor and evaluate whether the outcome of your work is aligned with your project comprehension and the work plan? *Where are the results of your evaluation documented?*
Co-regulation: Peer to peer	Do you help other team members to monitor and evaluate whether the outcome of their work is aligned with the project comprehension and with the work plan? *Is the result of these conversations documented? Where?*
Shared-regulation: Group	As a group, do you hold discussions to monitor and evaluate whether the outcome of the work is aligned with the project comprehension and the work plan? *Where Is the outcome of discussions documented and available for all members?*
	Monitor and evaluation of changes in project comprehension or in the work plan. i.e., Verify that the project requirements are still the same, check that your responsibilities with respect to the project have not changed.
Self-regulation: Individual	Do you monitor and evaluate changes in your project understanding and in your work plan? *Where did you document the changes detected (if any)?*
Co-regulation: Peer to peer	Do you assist other team members to monitor and evaluate changes in the project understanding and in the work plan? *Where is the result of this evaluation documented?*
Shared-regulation: Group	Does the group hold discussions to monitor and evaluate changes in the project understanding and in the work plan? *Where are these discussions documented and available for all members?*
Adaptation	**Refining the work plan based on partial outcomes or changes in the project understanding**
Self-regulation: Individual	Do you adapt your work plan when the outcome was not as expected or when your project comprehension changed? *Where did you document the changes to the original plan and the reasons behind those?*
Co-regulation: Peer to peer	Do you assist other team members to adapt their work plan when the outcome was not as expected or when their project understanding changed? *Where did you document the discussions about these adaptations?*
Shared-regulation: Group	As a group, do you adapt your work plan when the outcome was not as expected or when the group project comprehension changed? *Where did you document the modifications to the original plan and the reasons behind those?*

Preliminary results –Interview one

- P1 has been doing a CO-OP for the last seven months, where she has been working as a developer and an UX designer.

- All development related tasks are collaborative, also, the work setting is completely virtual.

Preliminary results – Collaborative profile one

Task Understanding:

- Extra challenges associated with being in a virtual environment.. ``*there is* ***no way to you can just pop over the cubicule*** *and say like: 'hey, what are you working on?' That sketch isn't right, you need to be doing this, this and this other thing''*.
- Further..``*we are even more at* ***risk of going into our own little boxes*** *and working on something and then coming back and showing it to someone else and not being what other people expected at all.''*

Preliminary results – Collaborative profile one

Task Understanding:

- Kick-off meetings to discuss and reach agreement about every new task. …``*to be able to contribute and help with the team work,* ***understanding the task ahead of time is crucial****.''*. However, this is not an explicit requirement .

- Shortly after starting working on the task, P1's team goes to a videocall to ensure initial team's understanding still holds.

Preliminary results – Collaborative profile one

Task Understanding – tool support:

- *Individual level*: Mainly personal notes in the form of representative charts or notes.
- *Peer to peer* and *group level*: being in a virtual team require members to heavily rely on tools for communication.
  - Slack for direct or group discussions, which is a form of documentation for tasks and project agreements.
  - If the matter of discussion gets complicated to hold via text, the group would jump into a videocall by HangOuts, in which case technical documentation is updated or created after the call and agreements are reported in a follow-up email.

Preliminary results – Collaborative profile one

Goal Setting:

- Daily stand-up meetings. In preparation for the stand-up, P1 creates her daily report, however, P1 ensures that is already a personal habit to make notes, to-do lists and create reminders for pending tasks.

Preliminary results – Collaborative profile one

Goal Setting – tool support:

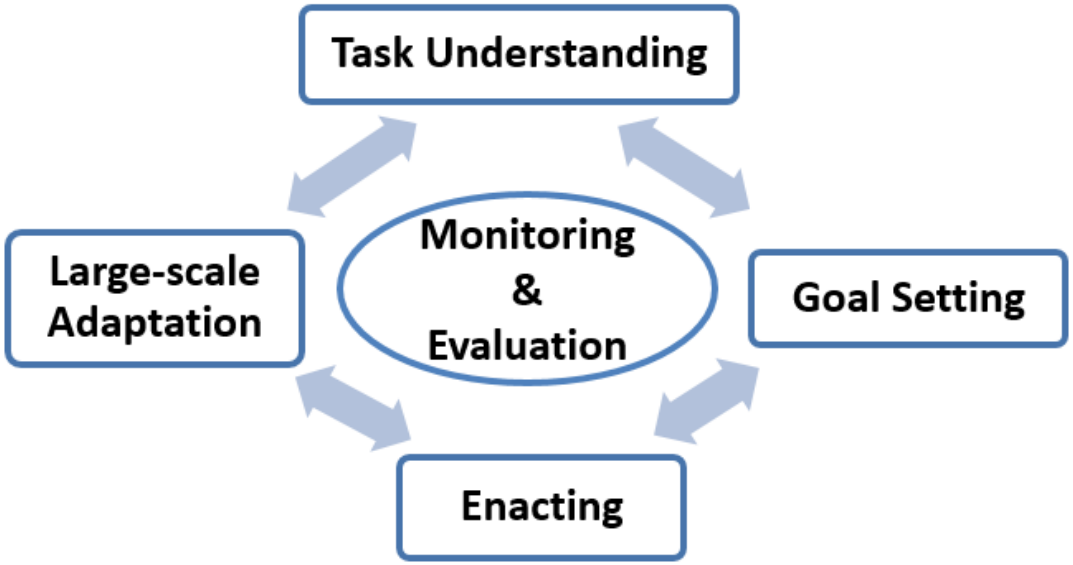
- *Individual level*: P1 uses hand-writing notes on her notebook, Wonderlist and features of Slack bot.
- *Peer to peer level*: Slack allows P1 to check on everybody else's planning and automatically have a record of the conversation. These checking specially happen when there are work dependencies.

Preliminary results – Collaborative profile one

Goal Setting – tool support:

- *Group level*: conversations are conducted on Slack or Hangouts and for documentation, the same rules as for Task understanding apply.

Model of Regulation – Process of regulation



Preliminary results – Collaborative profile one

Enacting & tool support:

- The goal is to **do everything reported in the stand-up meeting**, however, it is not unusual to find unexpected problems.
- Specific Slack channel ‘help-request'...``*to report issues if we are stuck and we're having troubles with the task we said we were going to complete that day''*.

Preliminary results – Collaborative profile one

Enacting & tool support *-Motivation and engagement*

- big concern when you are in a virtual team… however ...``***feeling everybody wants to help you*** *is what make it good...[]... Knowing that you're not given a task and sent alone to a room helps a lot to motivation''*.
- The team must hold long virtual meetings (sometimes over three hours), in which case being engaged is the big issue. ``We are all in a video call and it's hard to see who really is''.

Preliminary results – Collaborative profile one

Enacting & tool support -*Motivation and engagement*

- If it's detected someone has been quite for a while, somebody would prompt a question for the person as a way to help him/her stay connected with the conversation. **They never agreed on that practice.

Preliminary results – Collaborative profile one

Monitor and Evaluation:

- Blurry scope of the project... ``*It's weird because no one knows anything, not even how the project is going to look like in even a month.''*
- The team focuses on tracking and assessment of very low level tasks by ``*breaking down really small.''*

Preliminary results – Collaborative profile one

Monitor and Evaluation –tool support:

- Monitoring critical Slack channels
- The size of the project is an issue.. ``*there are many things going on and the project is big''*. So, P1 and the other product designers of the team **strategically offload some things between each other**.

``*When talking to the three of us you can probably get a good idea of what the entire picture of the project is.''*

Preliminary results – Collaborative profile one

Adaptation:

- Once the whole team has reached an agreement, a new plan is created.
- Because the requirements are constantly changing (even in matter of hours) so does the team's task understanding.
- Issues with traceability blocks by some project managers.

Conclusions

- There is no other model that presents collaboration from this perspective: strategic decisions –Regulation-
- The Model of Regulation provides the vocabulary to talk about collaboration:

"[the model] provides a **common language**… often we find that a common language is what's needed to have a constructive conversation. Once you build a language you can **start talking about how to move from one step to the other** and how improving what we're doing in one step… We have a way to **verbalize it formally**"[P2].

Conclusions

- “[about the scopes of regulation] it **removes the ability to kinda escape ownership of the work**: ‘I don’t really know my work plan, but my group’s got it figured it out’ ” [P2]

- P1 commented a couple days after the interview she had started to think about the issues she was having with her teammates in terms of the model.

Conclusions

- The model can help to **improve the development of collaborative tools**.

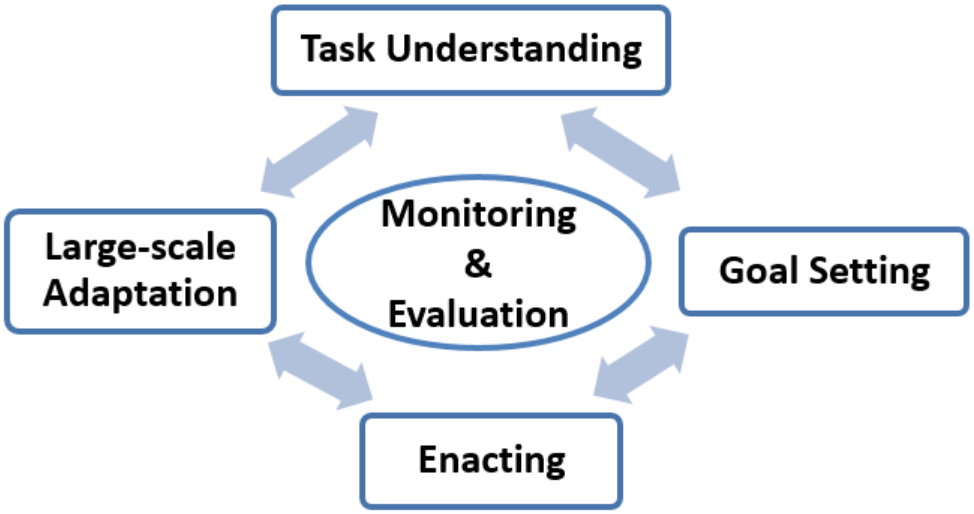
- Also, the model can provide a foundation to **develop theories about ideal combinations of tools** for collaborative tasks.

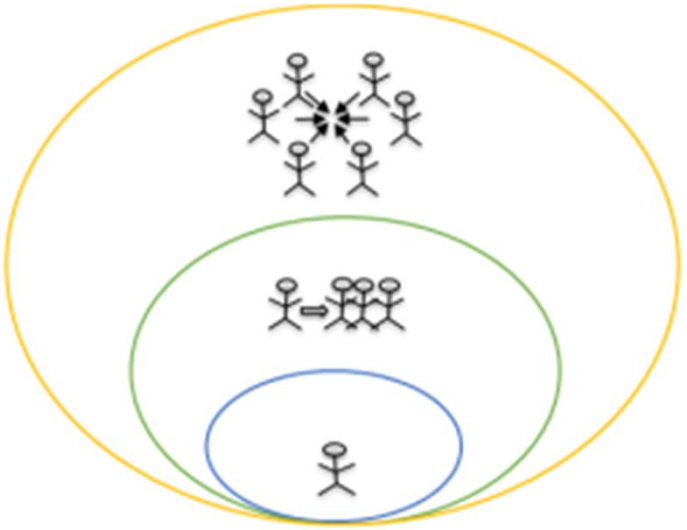
Conclusions

- All collaboration experiences are different. The instrument can help to get a **profile of the collaborative culture and the tool support** used on each setting.

- The instrument allows to get important information to **facilitate traceability** of collaborative practices.

Questions?


Task Understanding
Goal Setting
Enacting
Large-scale Adaptation
Monitoring & Evaluation



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