



Computational Ecosystems

Tech-enabled communities to advance human values at scale

Haoqi Zhang

slides+readings: haoqizhang.com

How can we create scalable solutions to human problems and advance desired human values in the absence of a technology that can overcome real-world constraints?



Design, Technology, and Research (DTR)
Spring 2014



Design, Technology, and Research (DTR)
Winter 2016

How can
a single faculty mentor
train 20+ students

scale solutions

How can
a single faculty mentor
train 20+ students

scale solutions



to cultivate self-directed learners
and build new knowledge

**advance desired
human values**



How can
a single faculty mentor
train 20+ students

scale solutions

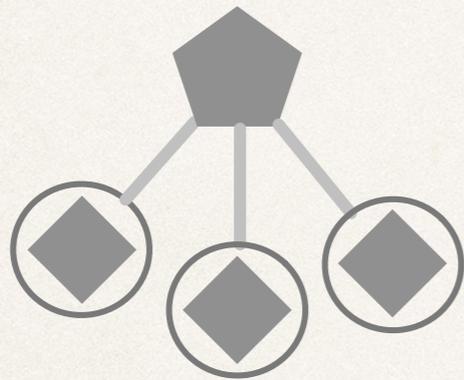
to cultivate self-directed learners
and build new knowledge
in the absence of a technology
that scales mentor time?

**advance desired
human values**

**address
real-world
constraints**

Best human solution

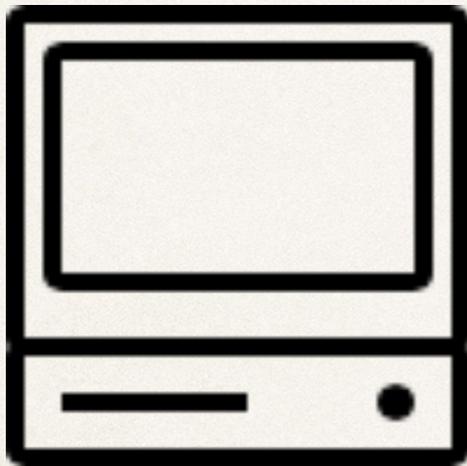
Apprenticeship



"apprenticeship requires a very small teacher-to-learner ratio that is not realistic in the large educational systems of modern economies."

[Collins & Kapur, 2005]

Best machine solution



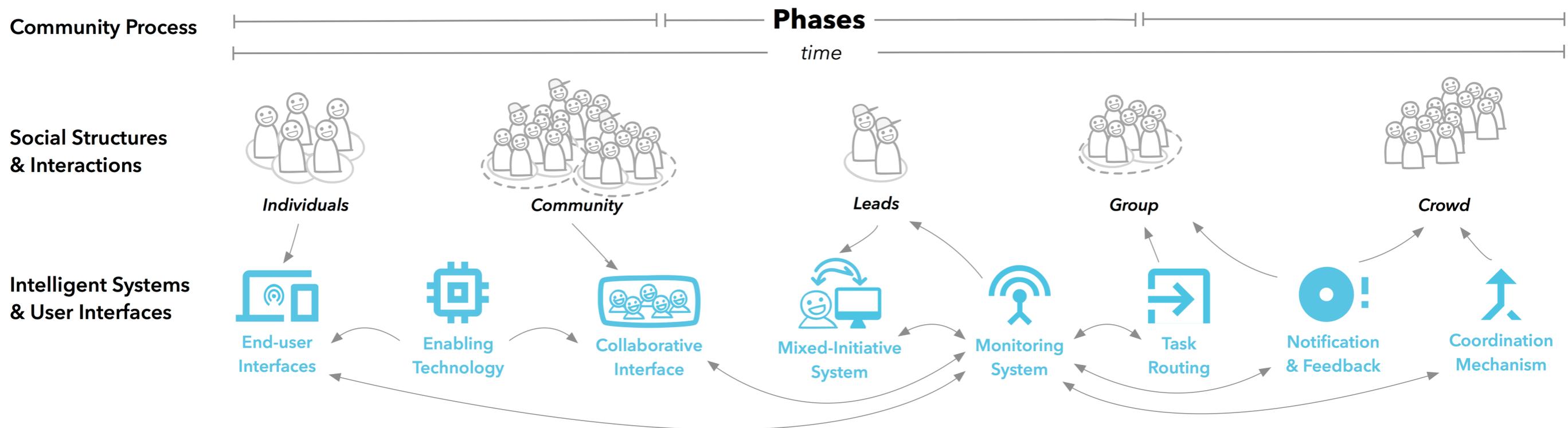
No AI technology can
replace the mentor in the
foreseeable future.

[Jarvela & Hadwin, 2013]

Options

- ❖ Wait for a technological silver bullet
- ❖ Compromise
- ❖ Or...?

Computational Ecosystems



A call for systems: having great components is not enough.



Atul Gawande

"...We've been obsessed in medicine with components. We want the best drugs, the best technologies, the best specialists, but we don't think too much about how it all comes together. It's a terrible design strategy actually."

TED 2012

A call for systems: having great components is not enough.



Atul Gawande

“Making systems work is the great task of our generation of physicians and scientists. I would go further to say that making systems work - whether in health care, education, climate change, and making a pathway out of poverty - is the great task of our generation as a whole.”

A call for systems thinking in AI

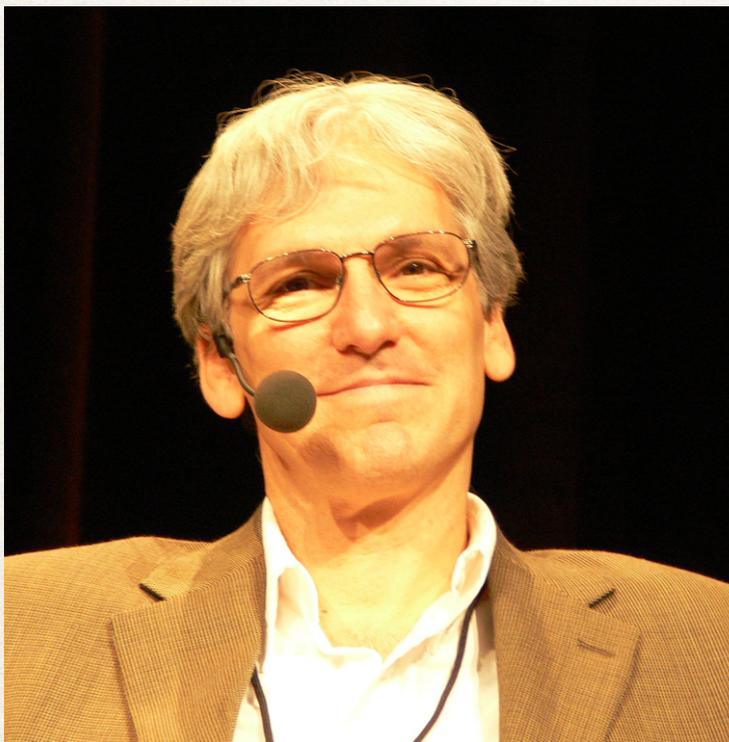


Eric Horvitz

"I'm pretty sure that the next leaps in AI will come from integrative systems, rather than wedges. [We need to] focus on building a system where the whole is greater than the parts."

TechRepublic, 2015

A call for systems thinking in HCI

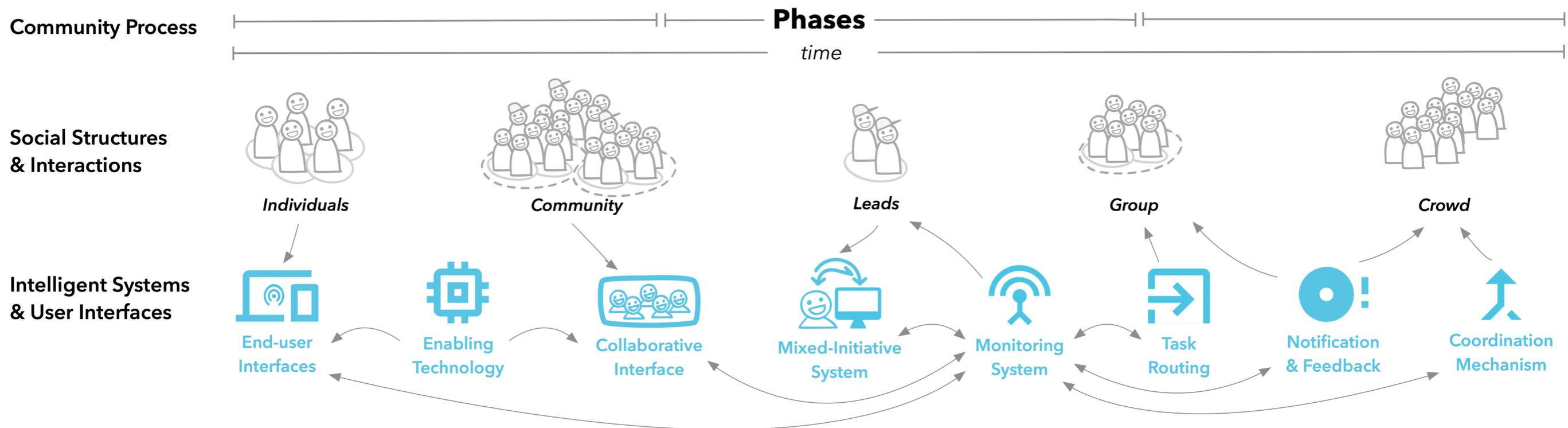


George Furnas

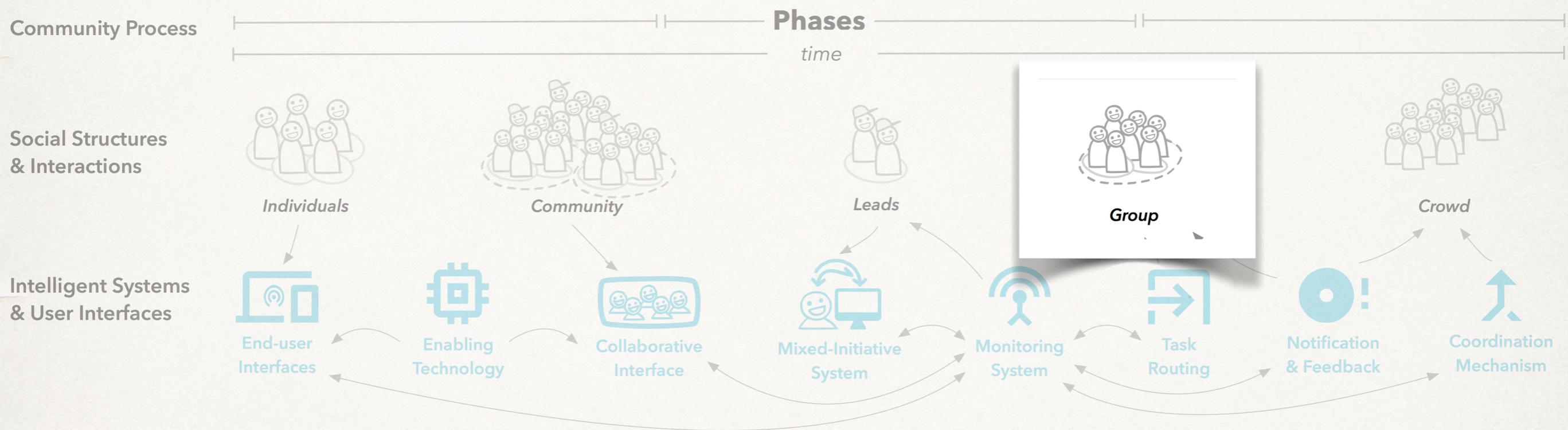
"It is likely that our designs will be more successful if we become more mindful of this bigger picture, [the mosaic of responsive, adaptive systems]."

*Future Design Mindful
of the MoRAS, 2000*

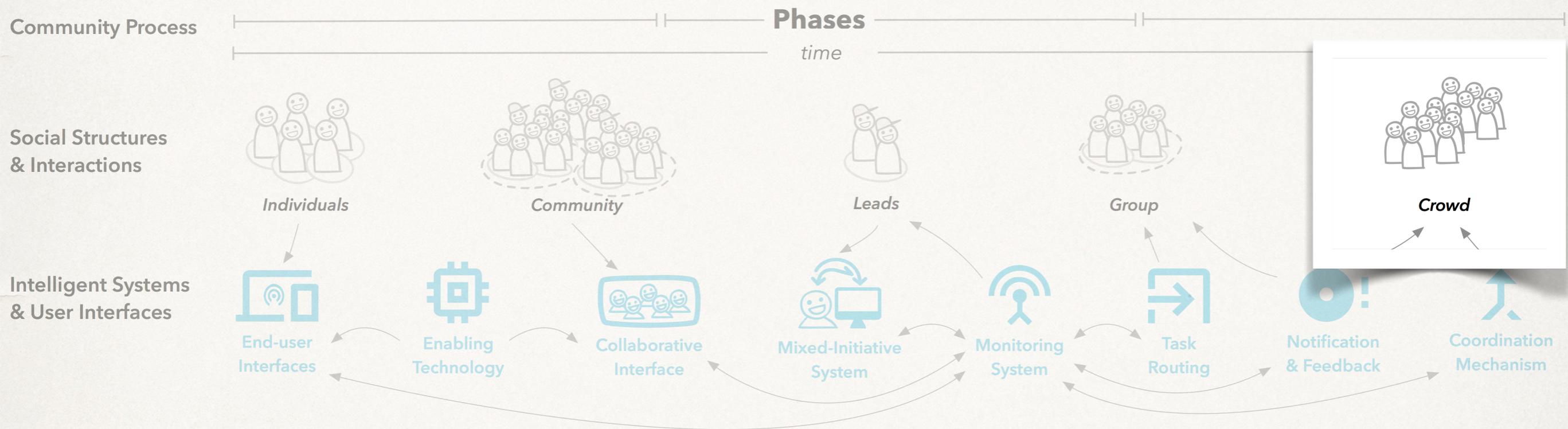
Advancing the approach...



Typically...



Typically...



Advancing the approach...

Community Process

Phases

Social Structures & Interactions



Individuals



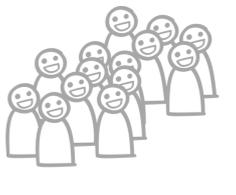
Community



Leads



Group



Crowd

Intelligent Systems & User Interfaces



End-user Interfaces



Enabling Technology



Collaborative Interface



Mixed-Initiative System



Monitoring System



Task Routing



Notification & Feedback



Coordination Mechanism

Typically...

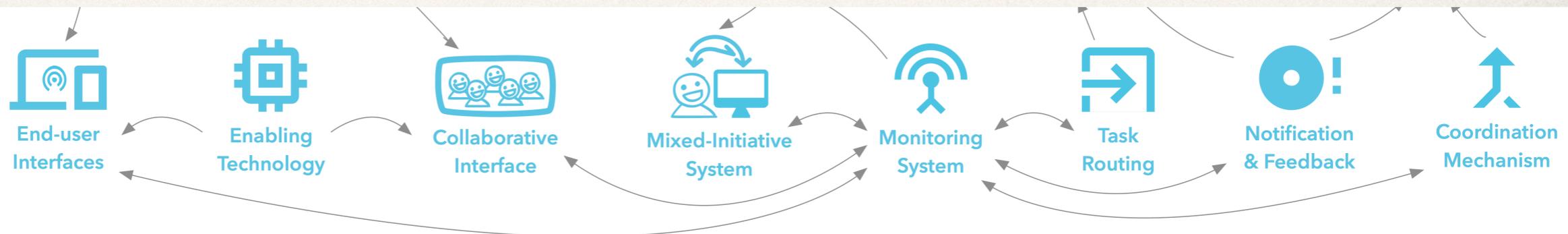
Community Process



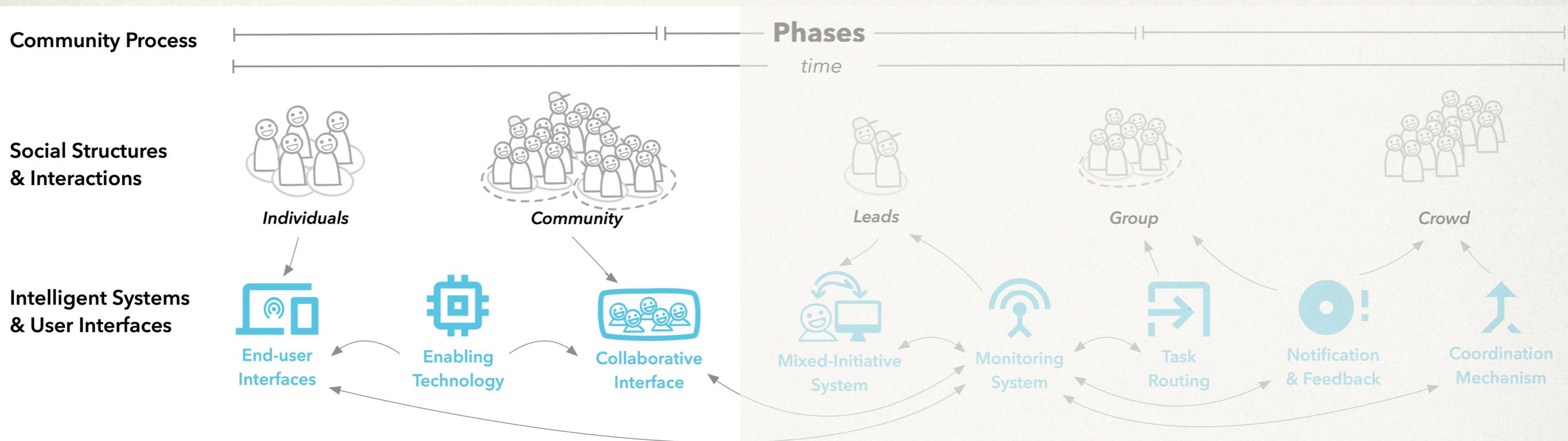
Social Structures & Interactions



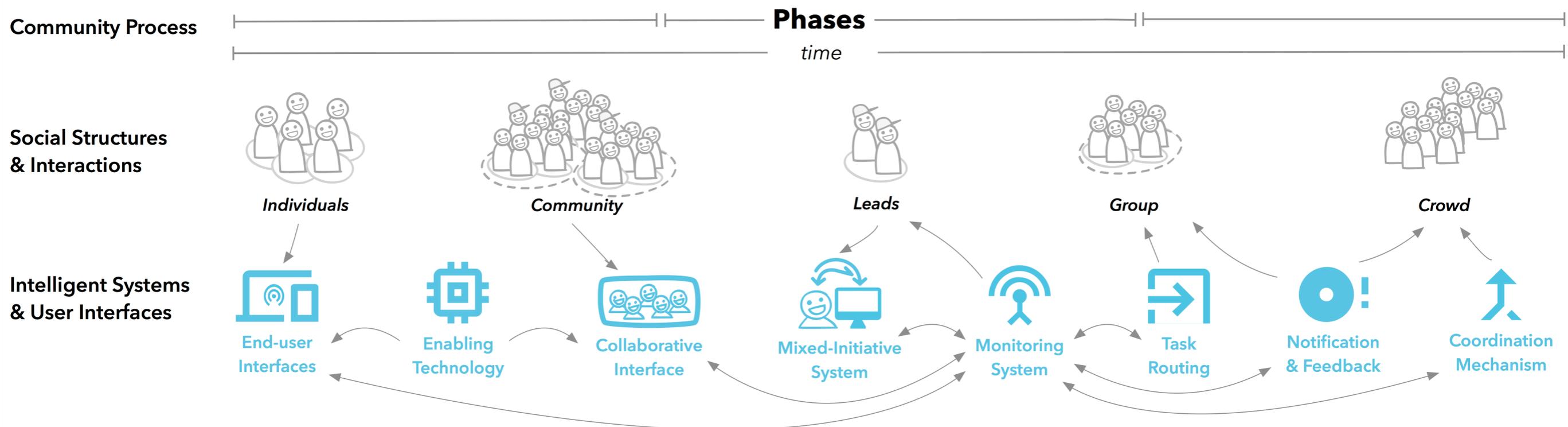
Intelligent Systems & User Interfaces



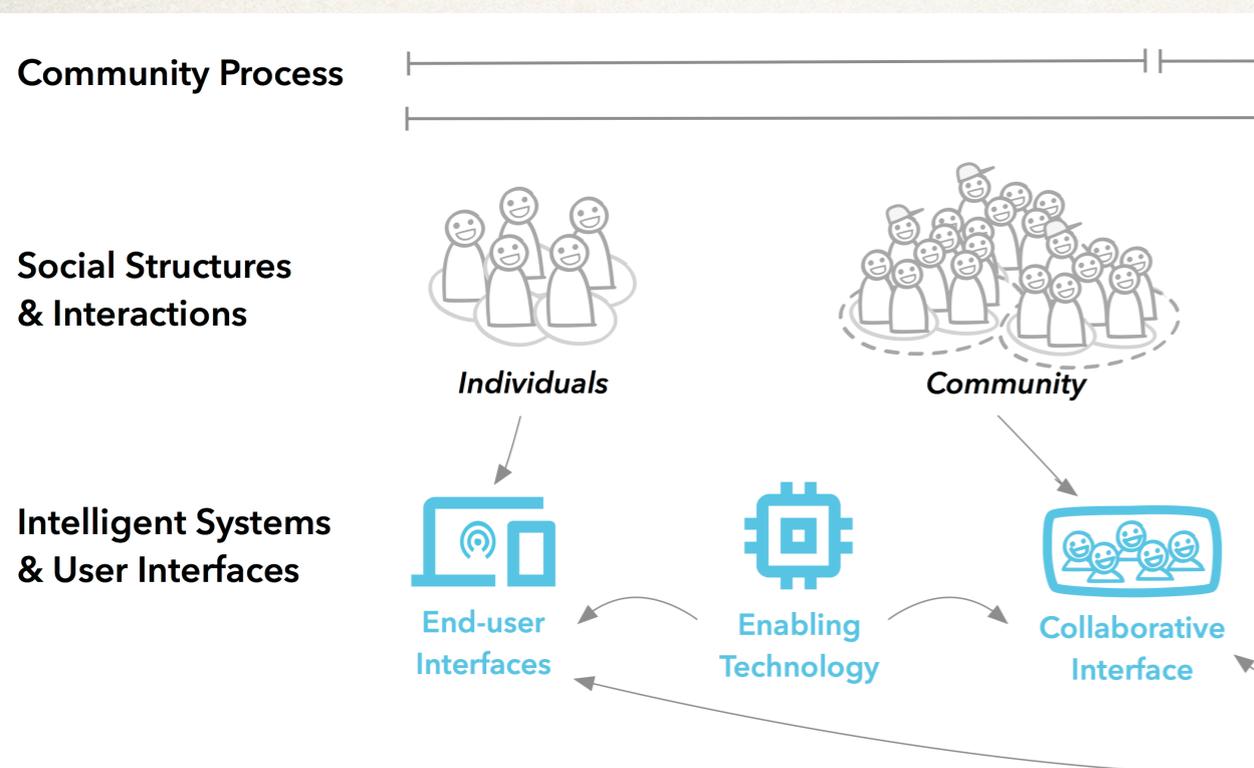
Advancing the approach...



Computational ecosystems are systems, designed as integrative solutions.



Computational ecosystems are systems, designed as integrative solutions



- ❖ **Computational thinking:** decompose and distribute problem solving to diverse people or machines across the ecosystem.
- ❖ **Ecological thinking:** create sustainable processes and interactions that support ecosystem members and proper ecosystem function.

Rest of the talk

- ❖ Two examples:
 - ❖ Community-based planning
 - ❖ Research training
- ❖ What's next in computational ecosystems
- ❖ (**Limited**) role of technology in advancing human values



Community-informed planning

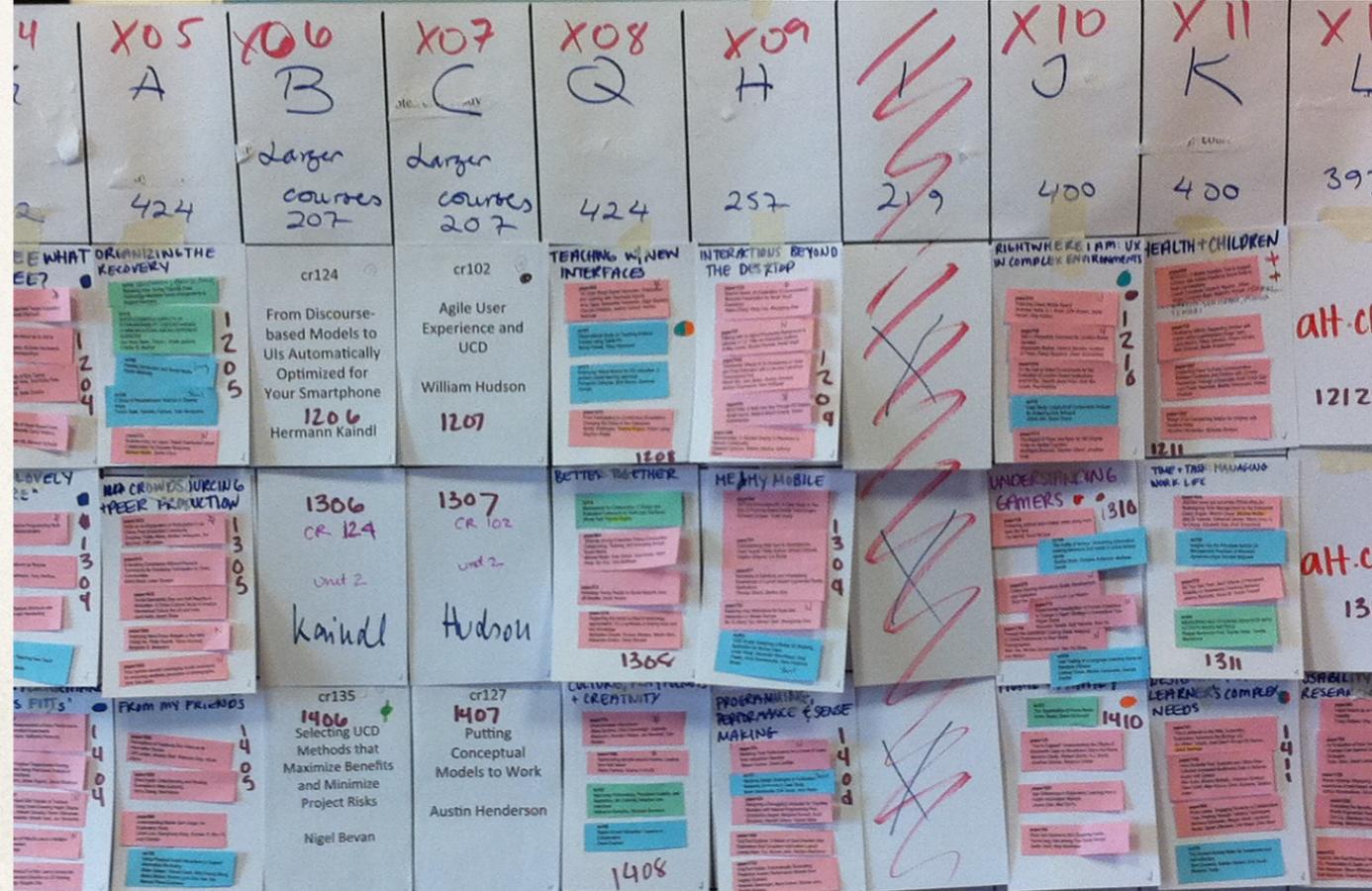
an inclusive process that scales and advances the goals of its members



	X01 D	X02 E	X03 F	X04 G	X05 A	X06 B	X07 C	X08 Q	X09 H	X10	X10 J	X11 K	X12 L	X13 M	X14 N	X15 O	P x10 S16s
Thursday	Award talks 2400	471 Inf. Tech. + Dev.	Panels 481	452	424	Larger courses 207	Larger courses 207	424	257	219	400	400	393	Smaller courses 47	Smaller courses 40	Smaller courses 70	
9:30-10:50	Award lecture 1201	TOUCH TEXT ENTRY 1202	Panel-110 "Material Interactions" - From Atoms & Bits to Entangled Practices 1203 Mark Redau	DO YOU SEE WHAT ORGANIZING THE EYE SEE? 1204	1205	cr124 From Discourse-based Models to UIs Automatically Optimized for Your Smartphone 1206 Hermann Kaindl	cr102 Agile User Experience and UCD William Hudson 1207	TEACHING W/ NEW INTERFACES 1208	INTERACTIONS BEYOND THE DESKTOP 1209	1210	RIGHT WHERE I AM: UX IN COMPLEX ENVIRONMENTS 1211	HEALTH + CHILDREN 1212 att.chi	cr125 Cognitive Crash Dummies: Predicting Performance from Early Prototypes Bonnie E. John 1213	cr147 Designing for Persuasion Aaron Marcus 1214	S16 1215	S16 1216	
11:30-12:50	Video 1301	BILLER IS BETTER: LARGE + MULTIPLE DISPLAY ENVIRONMENT 1302	Panel-116 Politics, Power, and Passion: Engaging U.S. Policymakers 1303 Janet Davis, Harry Housheer, Juan Pablo Hourcade, Jeff Johnson, Lou P. Nathan, Janice Tsai	"WHAT A LOVELY LECTURE" 1304	1305	1306 CR 124 Kaindl	1307 CR 102 Hudson	BETTER TOGETHER 1308	HEALTHY MOBILE 1309	1310	UNDERSTANDING GAMERS 1310	1311 att.chi 1312	CR 125 1313 Branin John	cr139 Methodology for Evaluating Experience of Mobile Applications Used in Different Contexts of Daily Life 1314 Katarzyna Wac	S16 1315	S16 1316	
14:30-15:50	1400	1401	Panel-101 How-to-guide: Collaborating with executives in a pro-design world 1403 Janine Lai, Chris Malow, Juan Pablo, Mark Redau, Craig Williams, Larry Tisdler	LIVES US FITS? 1404	1405	cr135 1406 Selecting UCD Methods that Maximize Benefits and Minimize Project Risks Nigel Bevan	cr127 1407 Putting Conceptual Models to Work Austin Henderson	1408	1409	1410	1410	1411	1412 S16	1413 S16	1414 CR 139 1415 S16	1416 S16	

Challenges for organizers

- ❖ Lack information about the diverse preferences, constraints and knowledge held by community members
- ❖ Lack tools for managing the complexity of planning.



Cobi: Community-informed planning

1. Engage the entire community in the planning process
2. Give organizers tools to manage the complexity of planning and resolve conflicts

1. Engage the entire community in the planning process

Committeesourcing

pn1171 (Paper)
Investigating the Long-Term Use of Exergames in the Home with Elderly Fallers
Stephen Uzor, Glasgow Caledonian University
Lynne Baillie, Glasgow Caledonian University

Abstract: Rehabilitation has been shown to significantly reduce the risk of fall... [\[more\]](#)

In Categories

- Older Adults (0)
- Motivation (1) +3
- Exergames (2) +1
- health and behavior change (1) +0
- Health Care (4) +1
- Home (2) +0
- User Studies (0)
- Rehabilitation (2) +1
- SC_Applications-V (28) +0

add a category +

make sessions

[Chilton et al.]

Authorsourcing

Your Paper: **A Pilot Study of Using Crowds in the Classroom**

1. Tell us your name: (as it appears in the paper)

2. We've identified 10 papers that may be similar to yours. Tell us how they would fit in a session with your paper:

Crowdfunding inside the Enterprise: Employee-Initiatives for Innovation and Collaboration [\[abstract\]](#)

- Great in same session
- Okay in same session
- Not sure if it should be in same session
- Should not be in same session

collect affinities

[Andre et al.]

Attendeesourcing

Monday, 11:00–12:20

▶ **Managing Social Media** [SCJ](#) [t](#) [e](#)

★ **recommended** [ux](#) [management](#)

Paper Room: Blue

▶ **Enhancing Access** [STJ](#) [t](#) [e](#)

★ **recommended** [HCI4D](#) [health](#) [ux](#) [design](#)

Paper Room: 242A

collect preferences

[Bhardwaj et al.]

Core idea: incentive chaining

pn1171 (Paper)
Investigating the Long-Term Use of Exergames in the Home with Elderly Fallers
Stephen Uzor, Glasgow Caledonian University
Lynne Baillie, Glasgow Caledonian University

Abstract: Rehabilitation has been shown to significantly reduce the risk of fall... [\(more\)](#)

In Categories

- Older Adults (0)
- Motivation (1) +3
- Exergames (2) +1
- health and behavior change (1) +0
- Health Care (4) +1
- Home (2) +0
- User Studies (0)
- Rehabilitation (2) +1
- SC_Applications-V (28) +0

add a category +

expert
categories

Your Paper: **A Pilot Study of Using Crowds in the Classroom**

1. Tell us your name: (as it appears in the paper)

2. We've identified 10 papers that may be similar to yours. Tell us how they would fit in a session with your paper:

Crowdfunding inside the Enterprise: Employee-Initiatives for Innovation and Collaboration [\[abstract\]](#)

- Great in same session
- Okay in same session
- Not sure if it should be in same session
- Should not be in same session

affinities
as seed

Monday, 11:00-12:20

Managing Social Media **SCJ**

recommended ux management

Paper Room: Blue

Enhancing Access **STJ**

recommended HCI4D health ux design

Paper Room: 242A

2. Help organizers resolve conflicts

pn1171 (Paper)
Investigating the Long-Term Use of Exergames in the Home with Elderly Fallers
Stephen Uzor, Glasgow Caledonian University
Lynne Baillie, Glasgow Caledonian University

Abstract: Rehabilitation has been shown to significantly reduce the risk of fall... [\(more\)](#)

In Categories

- Older Adults (0)
- Motivation (1) +3
- Exergames (2) +1
- health and behavior change (1) +0
- Health Care (4) +1
- Home (2) +0
- User Studies (0)
- Rehabilitation (2) +1
- SC_Applications-V (28) +0

add a category +

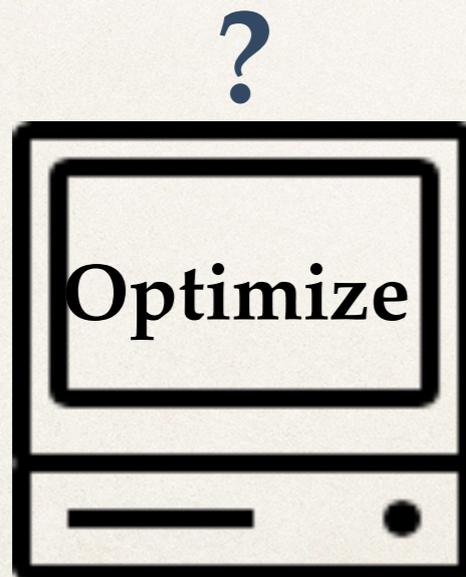
Your Paper: A Pilot Study of Using Crowds in the Classroom

1. Tell us your name: (as it appears in the paper)

2. We've identified 10 papers that may be similar to yours. Tell us how they would fit in a session with your paper:

Crowdfunding inside the Enterprise: Employee-Initiatives for Innovation and Collaboration [\[abstract\]](#)

- Great in same session
- Okay in same session
- Not sure if it should be in same session
- Should not be in same session



Monday, 11:00-12:20

▶ **Managing Social Media** SCJ

★ recommended ux management

Paper Room: Blue

▶ **Enhancing Access** STJ

★ recommended HCI4D health ux design

Paper Room: 242A

2. Help organizers resolve conflicts

pn1171 (Paper)
Investigating the Long-Term Use of Exergames in the Home with Elderly Fallers
Stephen Uzor, Glasgow Caledonian University
Lynne Baillie, Glasgow Caledonian University

Abstract: Rehabilitation has been shown to significantly reduce the risk of fall... [\(more\)](#)

In Categories

- Older Adults (0)
- Motivation (1) +3
- Exergames (2) +1
- health and behavior change (1) +0
- Health Care (4) +1
- Home (2) +0
- User Studies (0)
- Rehabilitation (2) +1
- SC_Applications-V (28) +0

add a category +

Your Paper: A Pilot Study of Using Crowds in the Classroom

1. Tell us your name: (as it appears in the paper)

2. We've identified 10 papers that may be similar to yours. Tell us how they would fit in a session with your paper:

Crowdfunding inside the Enterprise: Employee-Initiatives for Innovation and Collaboration [\[abstract\]](#)

- Great in same session
- Okay in same session
- Not sure if it should be in same session
- Should not be in same session



Monday, 11:00-12:20

▶ **Managing Social Media** SCJ

★ recommended ux management

Paper Room: Blue

▶ **Enhancing Access** STJ

★ recommended HCI4D health ux design

Paper Room: 242A

Core idea: Community-informed mixed-initiative interface [Kim et al]

Cobi Charles Carmichael

Select a session for scheduling options and more information.

Conflicts 121

High severity (63)

- papers of mutual interests in opposing sessions (37)
- authors with papers in opposing sessions (1)
- chairs with papers in opposing sessions (5)
- chairs with papers in their own sessions (19)

Medium severity (58)

- papers that don't fit well in the same session (48)
- topics of interest to a persona in opposing sessions (2)
- chairs who don't fit well in their session (1)
- chairs and their papers of interest in opposing sessions (7)

Preferences 343

View Options

- Conflict
- Preference
- Session Chair Conflict
- Session Chair Names
- Session Type
- Number of Papers
- Duration
- Best Paper
- Honorable Mention

Session Types

Personas

Communities

History 0

Unscheduled Sessions 8 | **Unscheduled Papers 15** | **Unscheduled Chairs 65**

used session 7

unused session 9

Design for the Home

Displays and Viewable

Performing on Stage

Sharing Secrets

Putting Things in Focus

Flights in my Hands

Penolinet Mobile Spatial

SeeSay and HearSay

Multinet: Reducing Interaction

The Secret Life of a Persona

Eric Paulos

Joonhwan Lee

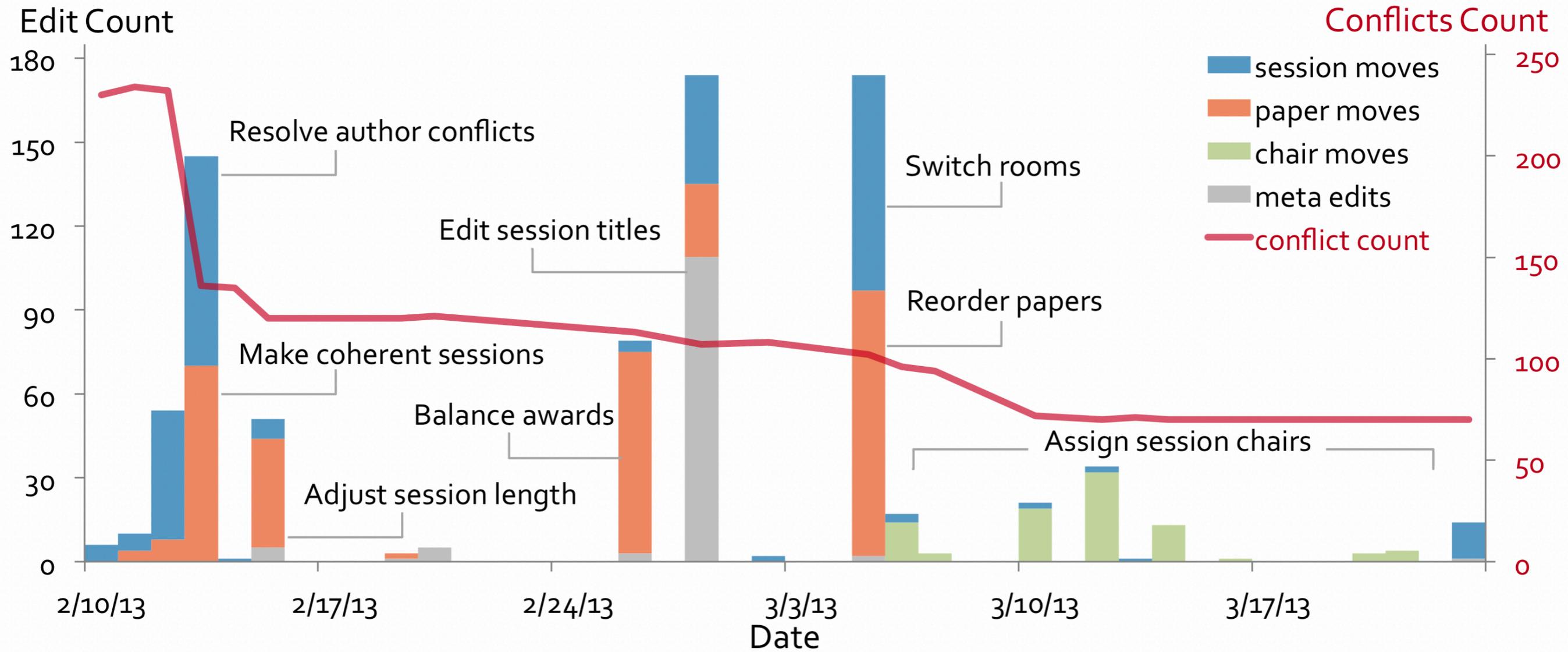
Myriam Lewkowicz

Kasper Hombæk

Tomer Moscovitch

Alexandre Bodin

Room/Time	Blue	Bordeaux	252B	352AB	Havane	241	342A	251	351	242A	242B	243	253	343	252A	361	362/363	221/221M
Mon 11:00-12:20	Navigating Data 2	Text Visualization 1	Call All Game Changers: BYOD (Bring Your Own Device)	Multitouch and Gestures 1	Lifetime Research Award	Power to the People: utilizing crowdsourcing 1	Design and Design Lessons	Learning 1	Touching Experiences: tangible	Content, Creation, and Health		User Interface Design and Adaptation for	Six Steps to Successful UX in an Agile	Rapid Design Labs—A Tool to Turbocharge	Body, Whys & Videotape: Applying	Designing Interactive Secure Systems	Human Computer Interaction for	Birds of a feather - session 1
Mon 14:00-15:20	Language 1	Gaze	Will Massive Online Open Courses		Enterprise and online communities	Hotkeys / Touch keyboards 2	Brain Interfaces 1	Design for the Classroom 1	Co-Design: involving perspective 1	Technologies for Life 1		Practical Statistics for User Experience	Agile User Experience and UCD 1/2	Rapid Design Labs—A Tool to Turbocharge	Speech-based Interaction: Myths		The Role of Engineering Work in CHI	Birds of a feather - session 2
Mon 16:00-17:20	Management of Knowledge and Collaboration 1	Video	Theory and Practice in UX Research	Table and Floors	Smart Tools for Smart Work Environments 2	Large and public Displays 1	Case Studies in Innovating UCD Process	unused session 8	Mobile 2: Vary Moving: reflection in 2	Nonkid Games 1		Practical Statistics for User Experience	Agile User Experience and UCD 2/2	Rapid Design Labs—A Tool to Turbocharge	Speech-based Interaction: Myths	unused session 2	Enhancing the Research Infrastructure	Birds of a feather - session 3
Tue 9:00-10:20	Classrooms 1	Social Face: creativity unleashed 1	CHI at the Baricades – an Activist	Interaction around Devices 2	Lifetime Practice Award	Gestures studies / empirical 2	Communities of practice 1	Embodied Interaction (and Thinking)	Evaluation Methods 1 2	Technologies for Life 2 2		User Experience Evaluation Methods –	Choice and Decision Making for HCI	Cognitive Crash Dummies: Predicting	Analyzing Social Media Data 1/2	SIG: NWI (Non-Visual Interaction) 2	Managing UX Teams	Birds of a feather - session 4
Tue 11:00-12:20	Crowds and activism	Visualization 1 1	Gamification @ Work	Mobile Gestures and Grasp 1	Invited talk - Don Norman	Creating and Authoring 2	Design Ideation Methods	Online Classrooms	Ethics	Impairment and Rehabilitation 1		User Experience Evaluation Methods –	Choice and Decision Making for HCI	Cognitive Crash Dummies: Predicting	Analyzing Social Media Data 2/2	Research-Practice Interaction:	Digital Art: Challenging Perspectives 1	Birds of a feather - session 5
Tue 14:00-15:20	cross-over work	Bodies Matter 1	UX Management: Current and	Multi-device Interaction	Design and Time: Long-term User 1	3D Us	Case Studies in Novel Settings	Game Design 1	HCI Ethics	Health, Information, and 3		Practical Statistics for User Experience	Expert Reviews – For Experts 1/2	Make This! Introduction to Electronics	Test Submission 1/2	Consumer Engagement in Health 2	Changing Perspectives on Sustainability 1	Birds of a feather - session 6
Tue 16:00-17:20	Energy / Sustainability 3	Interaction Design for Social	Is My Doctor Listening to Me? Impact of	Bendable, Flexible	Design Research, Paradigm and 1	Displays in public space 1	Case Study of Changing the Way We Work	Exergames, Inclusion 1	Food 3	The Clinical Setting 1		Practical Statistics for User Experience	Expert Reviews – For Experts 2/2	Make This! Introduction to Electronics	Test Submission 2/2	HCI with Sports	SIG NIME: Music, Technology, 1	Birds of a feather - session 7
Wed 9:00-10:20	Autism 2	Crowdsource Activism Volunteering	Exploring the Representation of Women	Touch 1	Social Impact Award	Shopping and Tagging 1	Place meets Engagement	Authentication	Automated Usability / Evaluation 1	Reflection and Evaluation 1		Sci-Fi and CHI in the Movies and Television	Interactive Walking in Virtual	Designing with and for Children in the 21st 1	Student Design Competition	unused session 4	CHI 2013 Human Work Interaction	Birds of a feather - session 8
Wed 11:00-12:20	Crime, Conflicts, and Revolution 1	How We Feel About Websites 1	Leveraging the Progress of Women in the	Haptics	Collaborative Technology: I share, you 1	Pointing and Fitts Law 1	Studies of the Use of Digital Artifacts 1	unused session 1	Evaluation Methods 2 1	Blindness and Design 1		Sci-Fi and CHI in the Movies and Television	Interactive Walking in Virtual	Designing with and for Children in the 21st	Student Research Competition		On Top of the User Experience Wave – How is 1	Birds of a feather - session 9



Outcomes

1. inclusive process that engaged 1500 community members in planning
2. reduced organizers' time from 100 hours to 5 hours
3. organizers produced better schedules by resolving 100+ previously hidden conflicts while also advancing other planning goals

Computational Ecosystem: Community-Informed Planning

- ❖ Collaborative planning across crowds, groups, and organizers
- ❖ Chain contributions across the ecosystem
- ❖ Mixed-initiative interfaces empower organizers to make informed decisions using community input, system recommendations, and their tacit knowledge



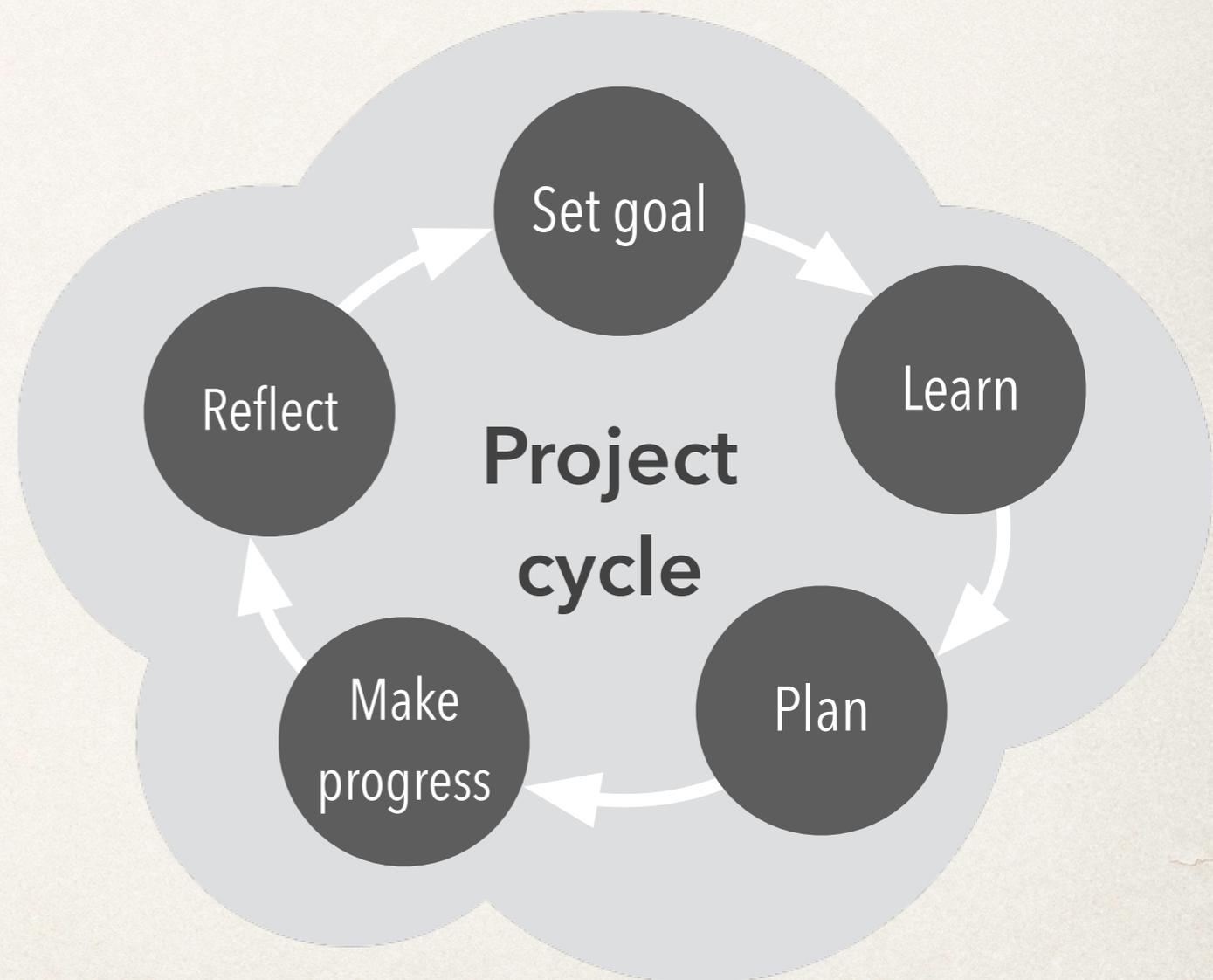
scale research training: cultivating self-directed learners

Students need regulation skills

- ❖ **Regulation skills:** cognitive, metacognitive, motivational, and emotional skills for reaching a goal [*Jarvela & Hadwin. 2013*]
- ❖ Independent research requires regulation skills including **planning** and **seeking help** to overcome challenges.
- ❖ Students lacking these skills are confined to rote tasks, or can struggle to make progress.

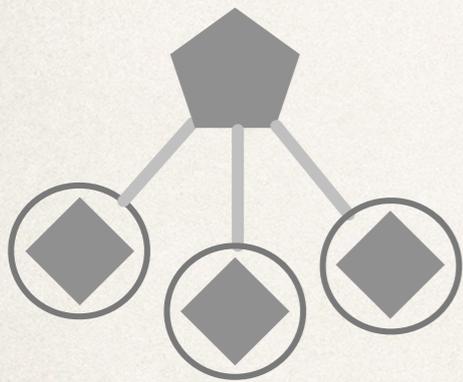
Agile Research Studio (ARS)

- ❖ Model for research training in a learning community
- ❖ All students, regardless of seniority, conduct independent research and receive authentic research practice.



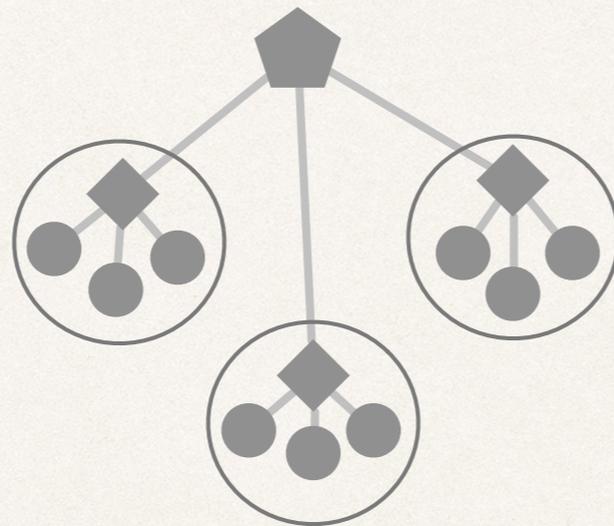
ARS scales faculty time

Apprenticeship



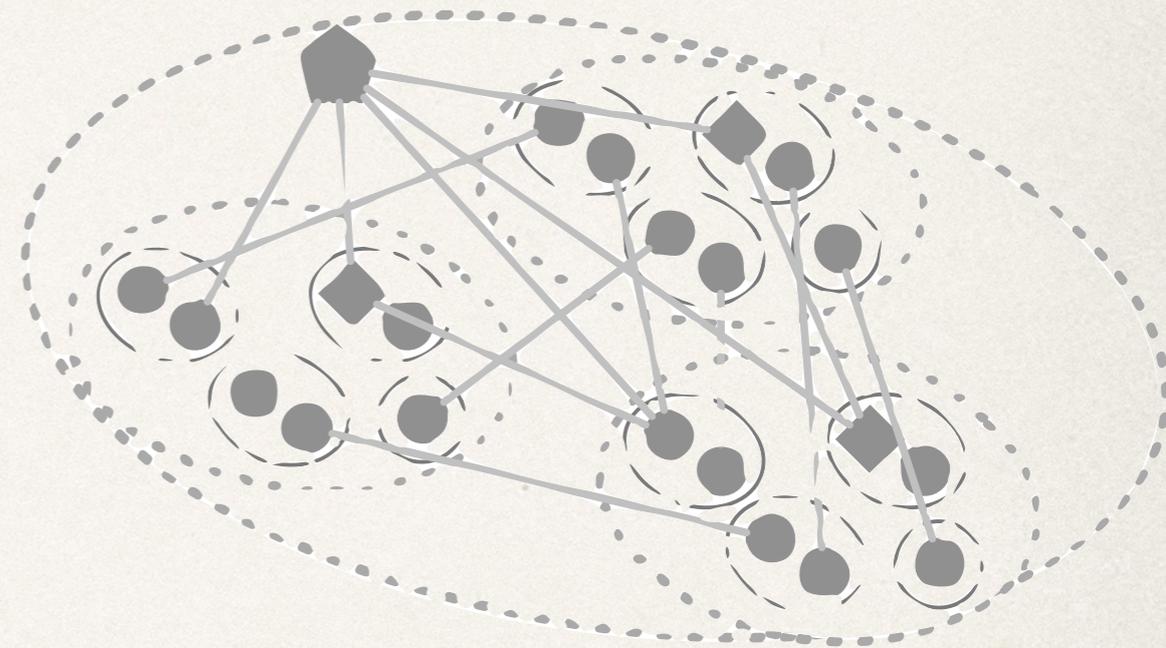
very small teacher
to student ratio
[Collins, 2005]

Hierarchical, 1:1:1



grad students are
novice mentors
[Shulman, 1986]

The ARS approach:
Dispersed Control

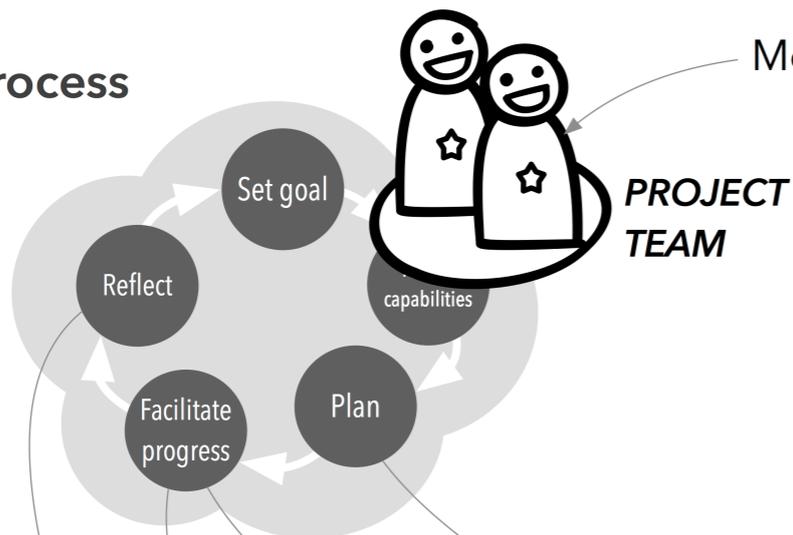


overcome 1:X
[Bain & Weston,
2012]

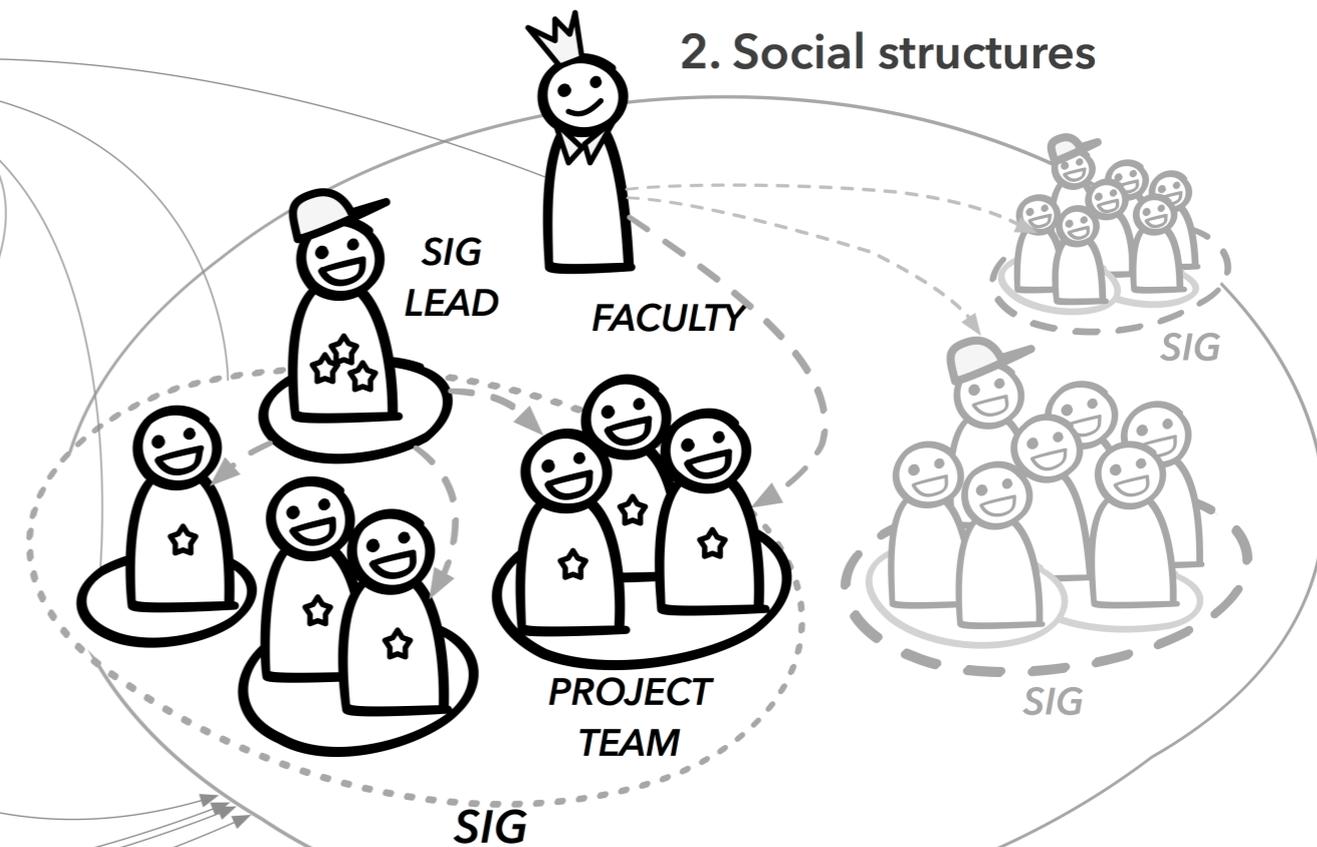
ARS is a computational ecosystem for developing regulation skills

AGILE RESEARCH STUDIO

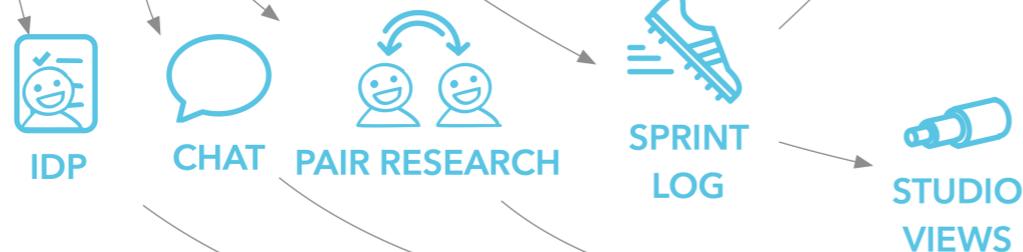
1. Agile Process



2. Social structures



3. Virtual Studio Tools



[Z., Easterday, Gerber , Rees Lewis, Maliakal]

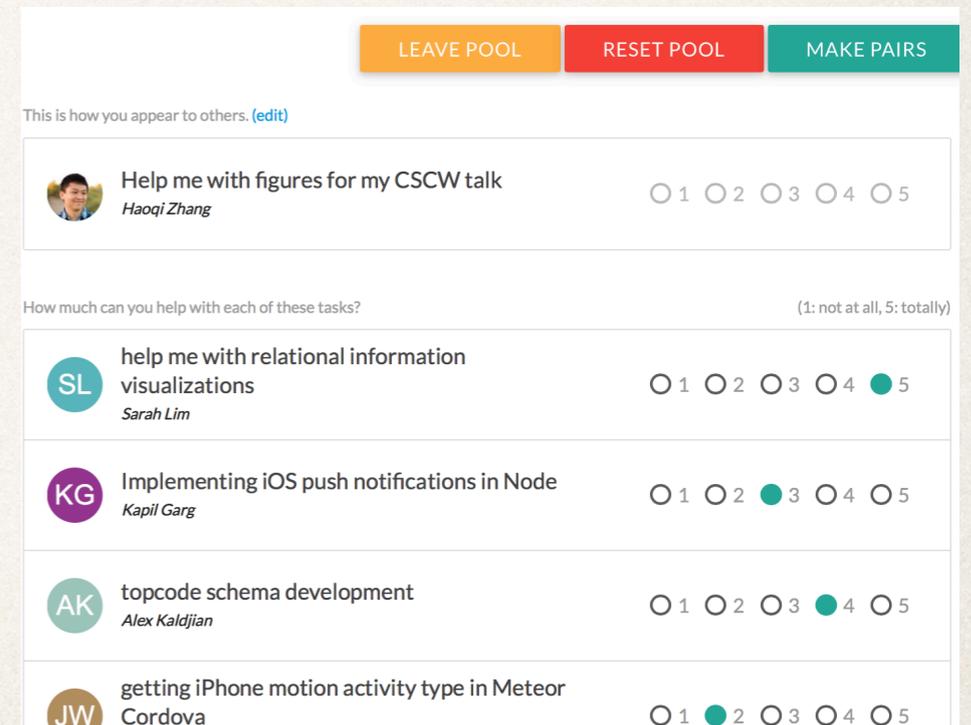
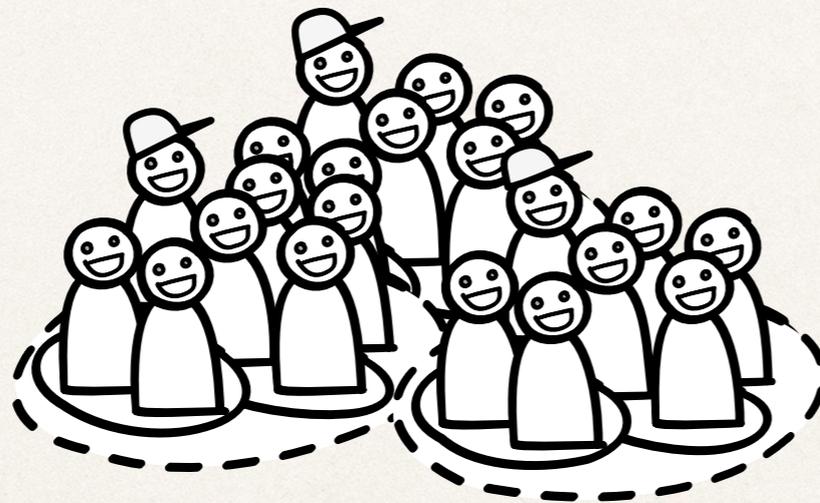
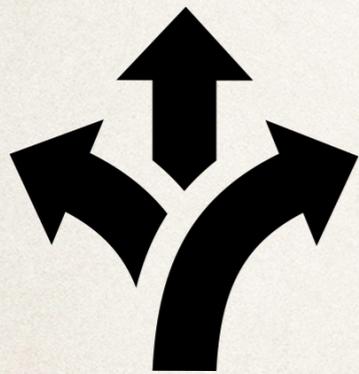


ARS: Help & Collaboration

Process:
Distributed help

Social structure:
Studio meeting

Studio tool:
Pair research



LEAVE POOL RESET POOL MAKE PAIRS

This is how you appear to others. [\(edit\)](#)

 Help me with figures for my CSCW talk ○ 1 ○ 2 ○ 3 ○ 4 ○ 5
Haoqi Zhang

How much can you help with each of these tasks? (1: not at all, 5: totally)

 help me with relational information visualizations ○ 1 ○ 2 ○ 3 ○ 4 ● 5 <i>Sarah Lim</i>
 Implementing iOS push notifications in Node ○ 1 ○ 2 ● 3 ○ 4 ○ 5 <i>Kapil Garg</i>
 topcode schema development ○ 1 ○ 2 ○ 3 ● 4 ○ 5 <i>Alex Kaldjian</i>
 getting iPhone motion activity type in Meteor ○ 1 ● 2 ○ 3 ○ 4 ○ 5 <i>Cordova</i>

[Miller, Z., Gilbert, Gerber]

Welcome to Delta Lab, Haoqi Zhang.

What do you need help with?

ENTER POOL

Some cool things your group has been working on:

- 10
- 23
- 25
- citations
- proxy
- baseline
- outside
- stand
- pretend
- spectator
- weeklife
- every
- day
- Figure
- rebuttal
- CSSJSHTML
- accept
- installing
- ffmpeg
- onto

Distributed help is not one tool...



help-ios
help-javascript
help-job-search
help-paper-questions
proj-rppt
🔒 sig-ars
🔒 sig-breaking-bounds
🔒 sig-collective-exp

Jennie 🐰 📱 10:50 AM

💖 Mentorship heartbeat for week 3! 💖 As a reminder you should:
- After first SIG meeting: have a 15-30min 1:1 to debrief what happened, share reactions, and adjust the mentee's sprint plan for the upcoming week
- Anytime: sit down together for 15 minutes to set personal goals for DTR together (both mentor and mentee)

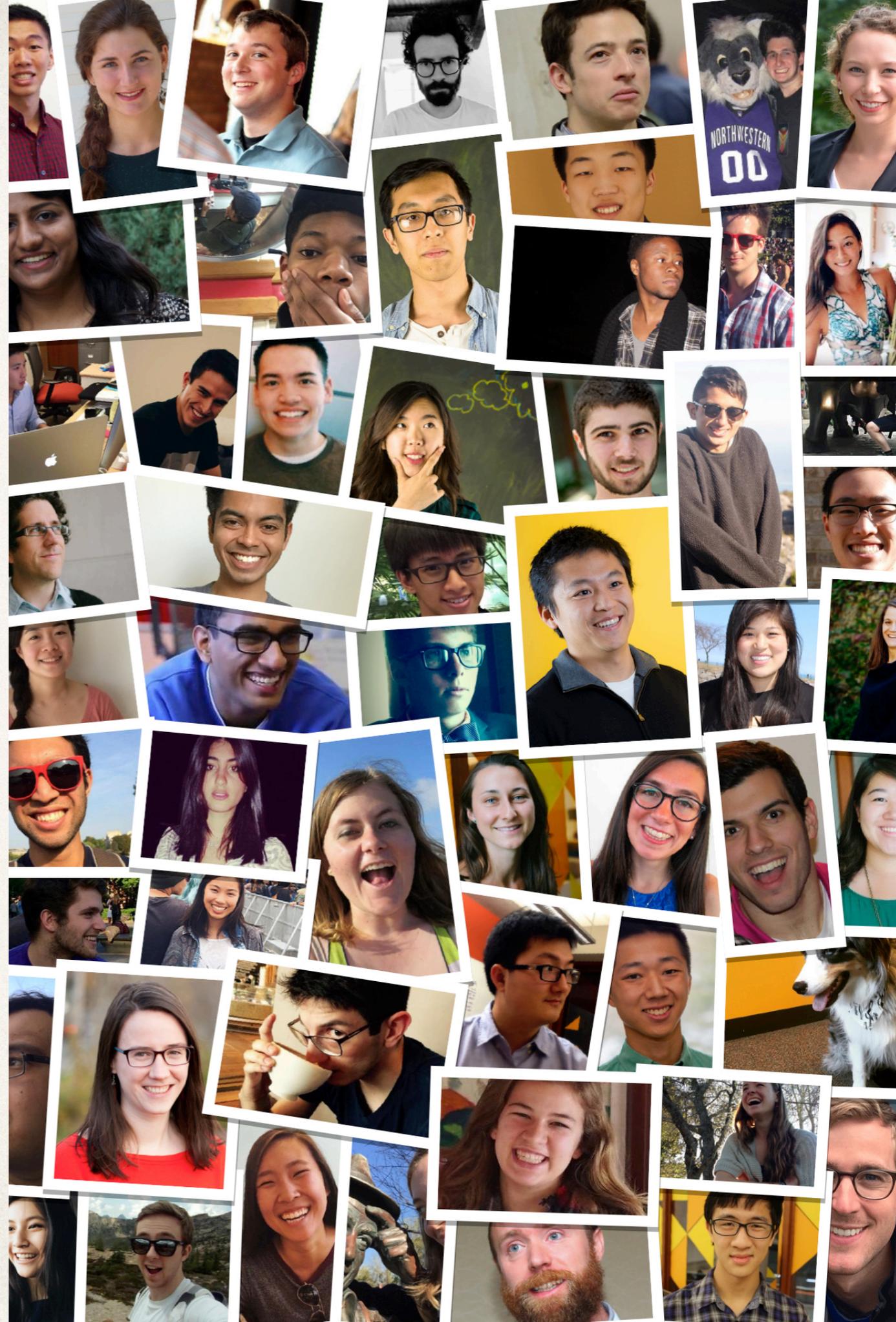


What did you learn about collaboration, teamwork, and helping/receiving help this quarter?

I learned that it's important to collaborate on things that aren't obvious blockers, because a lot of the best ideas and confirmation or rejection of my own ideas that I received this quarter was just from other people watching me or commenting on stuff I was doing, even though I wasn't "stuck" per se. I also learned that asking research-related questions mid week is way better than just trying to muddle through until SIG...

Outcomes (8 yrs)

- ❖ 120 students (108U, 12G), 40% women
- ❖ 53 student-led research projects
- ❖ 56 undergrad research grants
- ❖ 20+ publications at major conferences and 6 winners at major student research competitions
- ❖ ~40% placement at Apple, Google, Microsoft and Facebook
- ❖ 85% of students stayed in DTR for 2+ quarters; most continue till graduation.

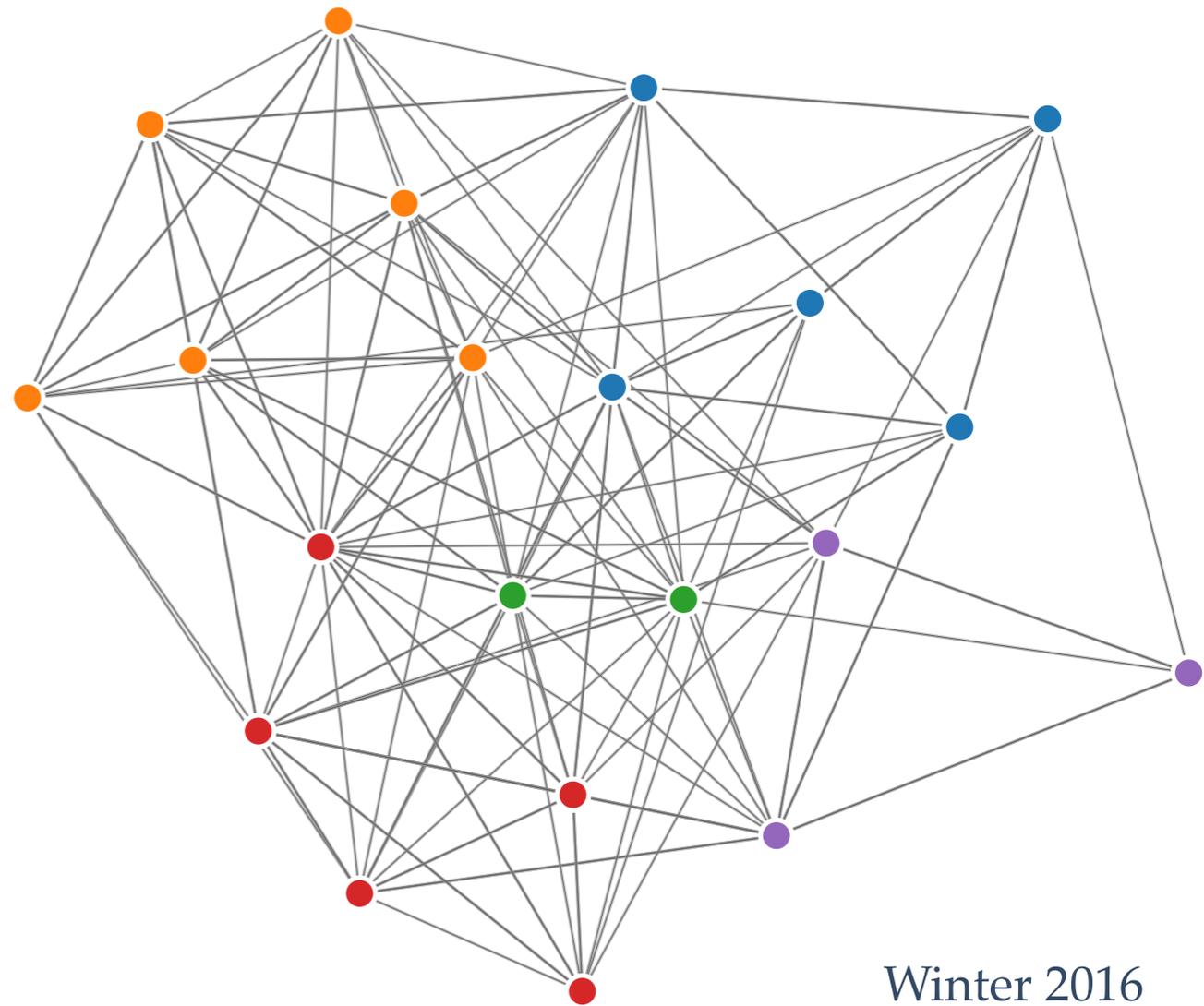


Planning Strategies

- ❖ building at the fidelity appropriate for the current stage of research
- ❖ prioritizing important features and research questions
- ❖ sequencing tasks
- ❖ moving on despite uncertainty or imperfect knowledge.

Help & Help-seeking

- ❖ Students helped more than a third of their studio each quarter
- ❖ *"I can ask for help and that everyone asks for help and it doesn't make them stupid to need help."*



Thanks so much for

teaching me how to

advocate for myself &

my ideas, embrace failure &

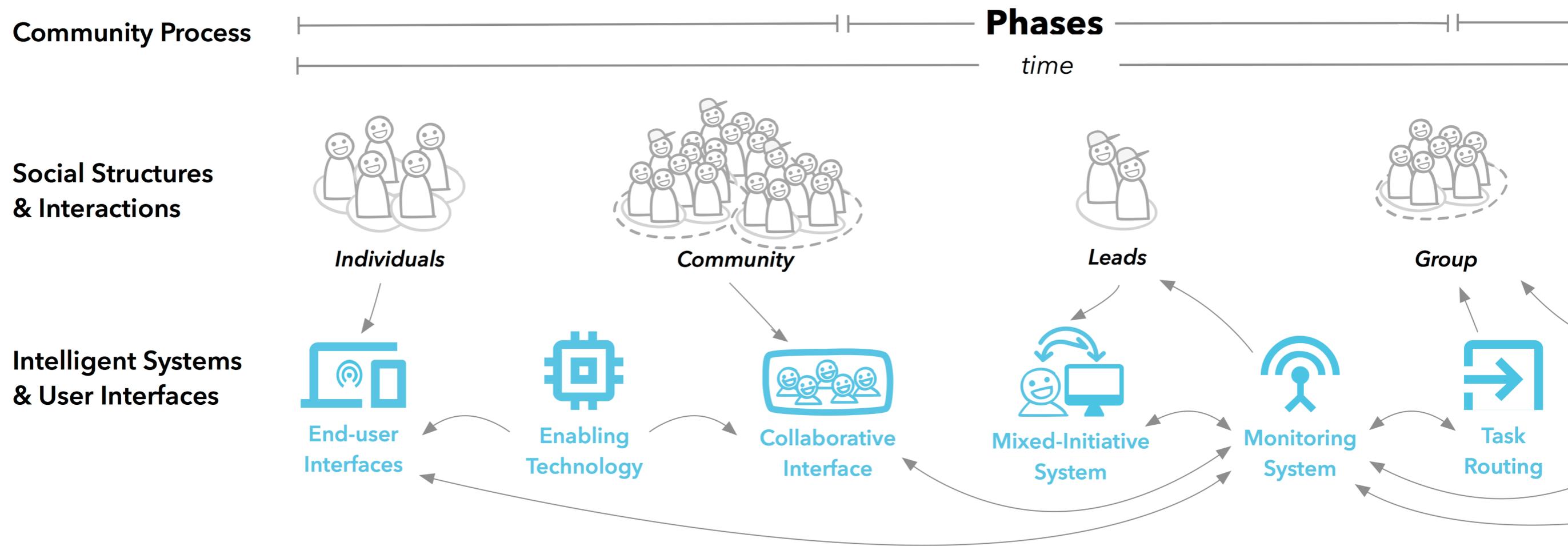
inexperience & search for

truth rather than bullshit.

Computational Ecosystem: Agile Research Studios

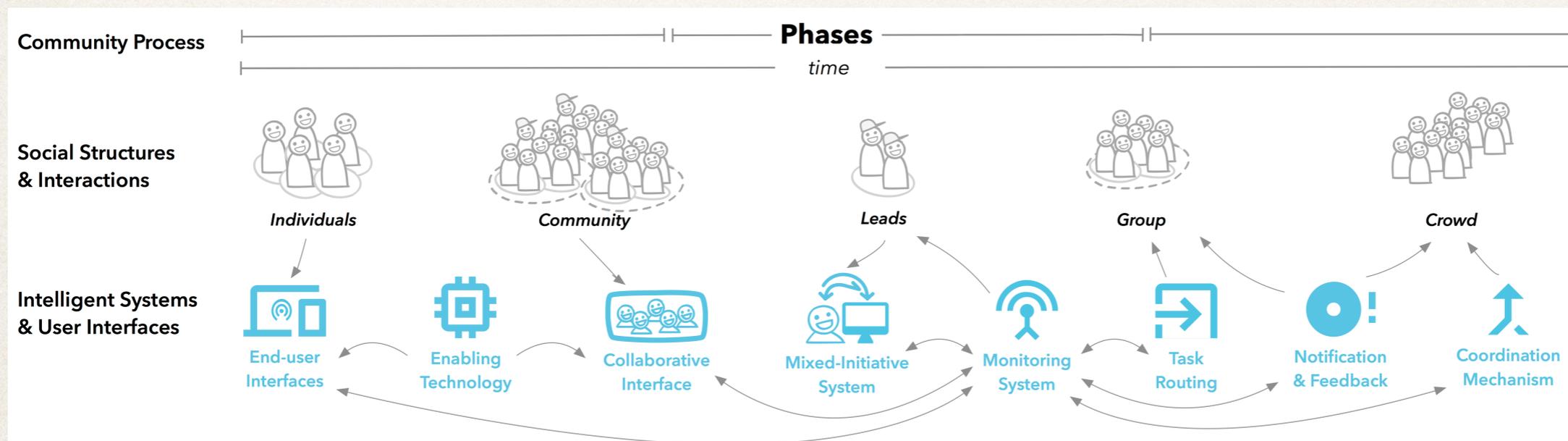
- ❖ Develop regulation skills for research planning and help-seeking across ecosystem interactions
- ❖ Extends the scale and capacity of a community to produce and learn

What's next



Preview #1:

Ecosystem-level intelligence



- ❖ Enabling technology for coordinating activities across ecosystem components and subsystems

Example: Networked Orchestration Technologies

[Garg et al]

SOAP Notes for John

Need	Last Discussed	Status
Seeking help when stuck	2 weeks ago	In-Progress
Research plan went over time; didn't seek help	N/A	Ineffective (new)

S - Subjective

- worked on building prototype
- was not able to finish all research tasks

O - Objective

- has 2 prototyping tasks (saving feature and interface) not completed due to bugs
- [script] research plan went well over allocated time

A - Assessment

- student got stuck on a bug, and tried to power through it vs. asking for help
- strategy: when stuck for more than 30 mins, ask for help

P - Plan for follow-up

- [script] prompt John to get tech help during the community-wide meeting this week

Triggered scripts

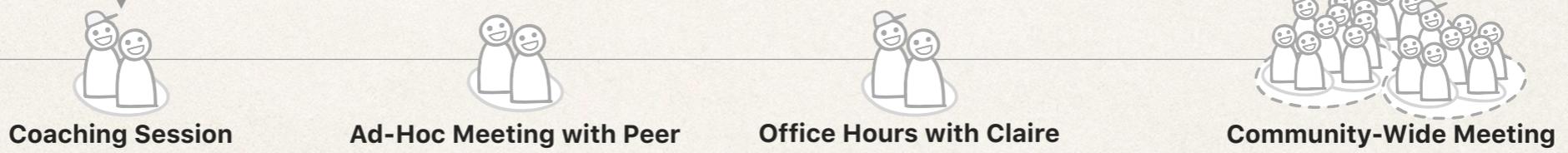
New script to track



Slack - #project-script-interfaces

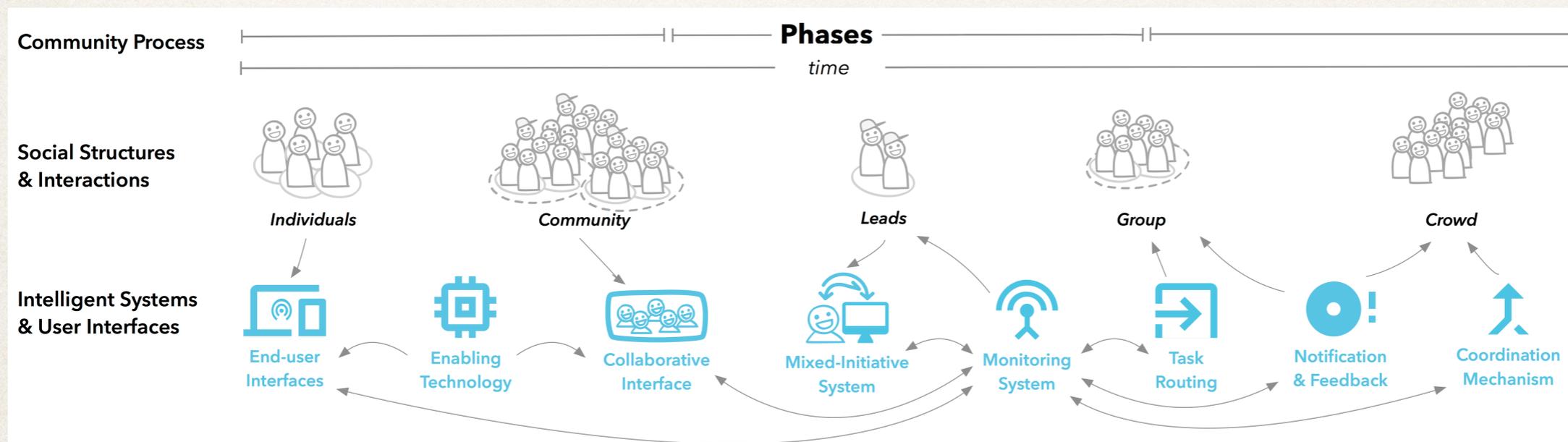
Orchestration Bot now

Hey John! Today's community-wide meeting would be a great opportunity to get help on your software bug, if it's still unresolved.



Preview #2:

Interactional intelligence



- ❖ Enabling technology for recognizing and facilitating situations for human interactions

Example: Opportunistic Collective Experiences

[Louie et al]

Puddle Feet 1



Grocery Buddies 2

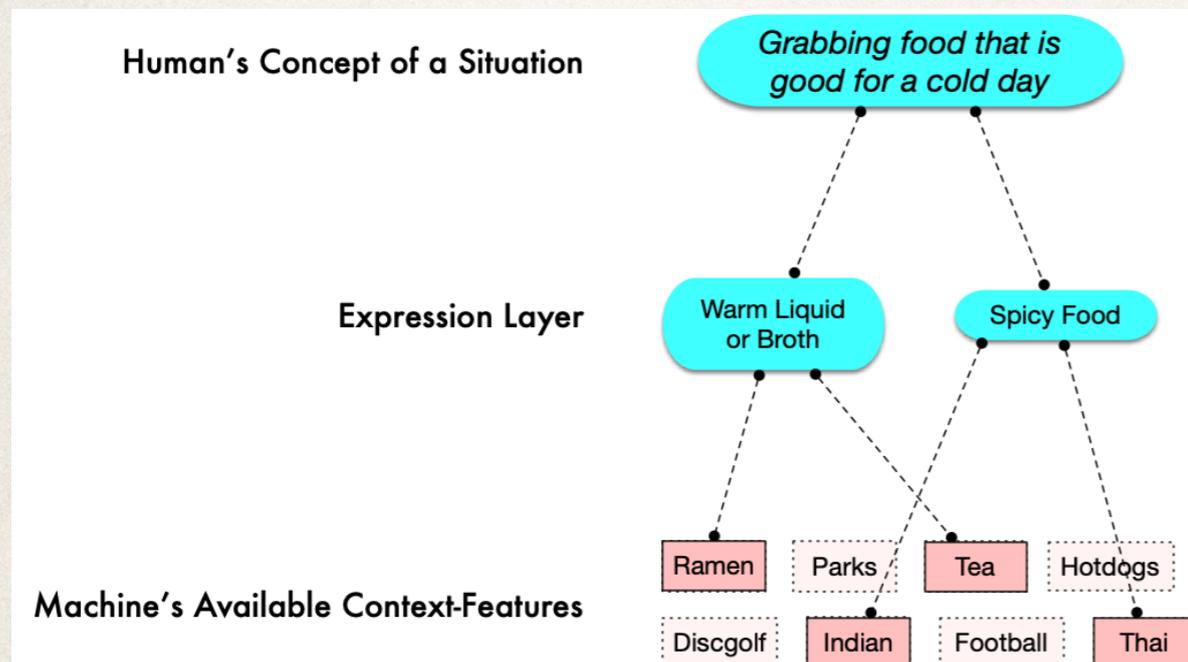


Example: Opportunistic Collective Experiences

[Louie et al]

Expression tools for defining interactional opportunities

Execution engines aware of interactional resources



Ecosystem-level thinking

- ❖ Computational ecosystems consider jointly the design of human processes, interaction structures, and intelligent systems.
- ❖ Beyond designing the ecosystem, we need ecosystem-level and interactional intelligence that support ecosystem members and proper ecosystem function.
- ❖ Such ecosystem-level thinking ~~will be~~ **is** increasingly critical for devising scalable solutions to address a diverse range of human concerns

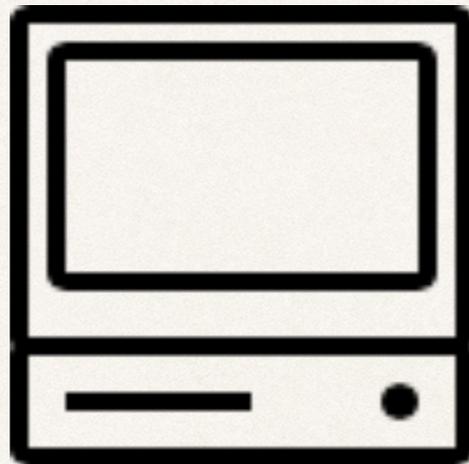
(Limited) role of technology in advancing human values at scale



- ❖ Digital computers are insufficient for advancing human values
- ❖ Scaling amplifies compromises

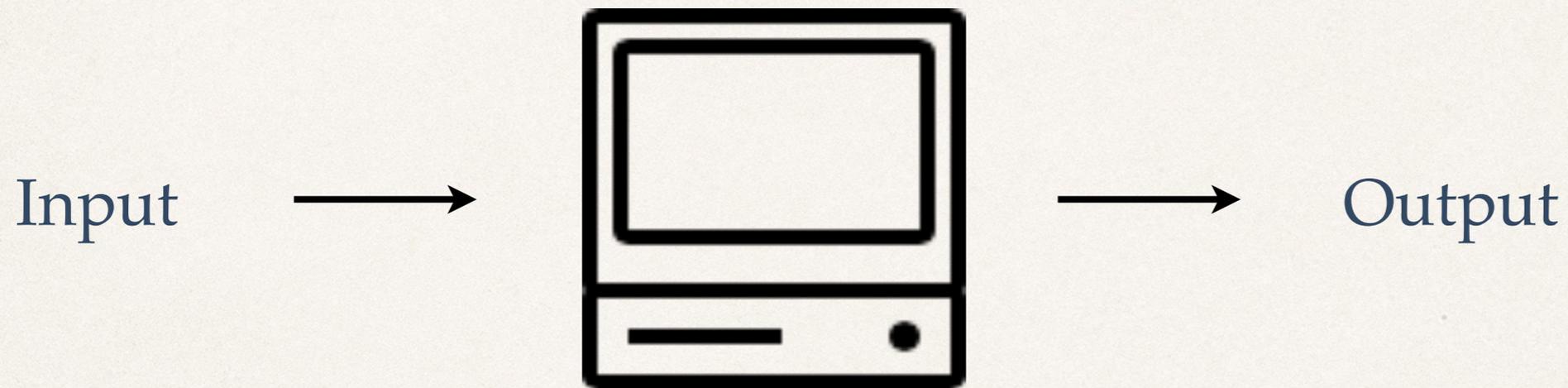
Understand the limitations of the digital computers

Input



Output

Understand the limitations of the digital computers



Computers reliably produce
desired consequential outcomes

But there is more to advancing human value than achieving desired outcomes

“This suggests a certain diagnosis of the **modern mania** that perceives the point of a life’s work in some set of **listable achievements**, the point of parenting in the **production of children with some desired set of characteristics and capacities**, and the point of intimate relationships in some **status** to whose production and stabilization the participants ought to commit themselves. This outlook is a formula for **indefinitely postponing the good life** by dint of a ceaseless, determined pursuit of its static simulacrum...”

Talbot Brewer
Retrieval of Ethics

Example: fostering self-direction

Interviews with:

- ❖ Child Development Experts
- ❖ Therapists and Counselors
- ❖ Yoga and Meditation Teachers
- ❖ Art/Music/Dance Teachers
- ❖ Entrepreneurship coaches
- ❖ Intimacy Coaches
- ❖ ...

To be authentic without alienating other people.

To be open to other people's influence and to be open to discovering things about ourselves.

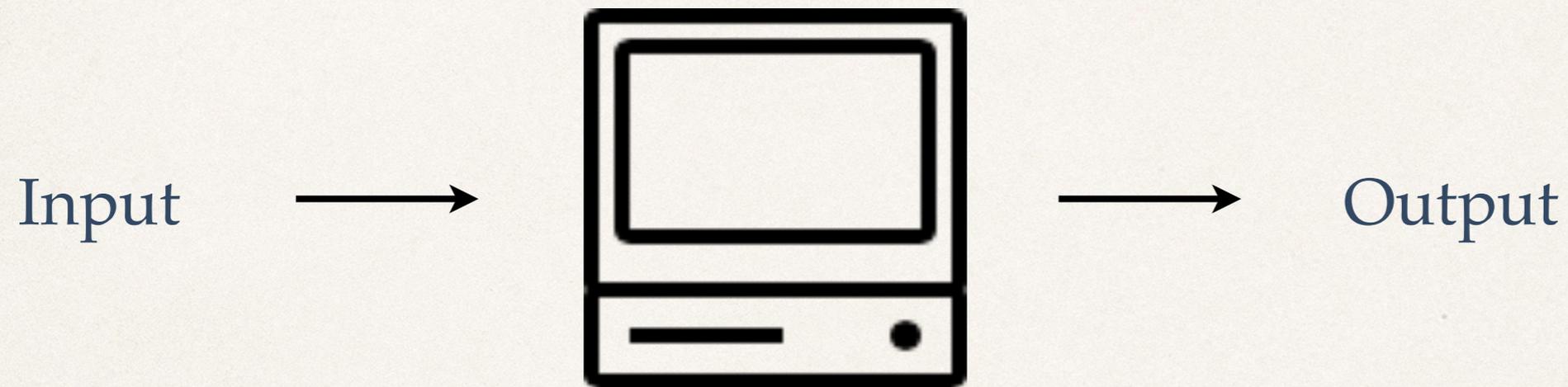
To persist under peer pressure to continue on a lonely act.

To erase the shame from social messaging and not shove our feelings down.

To stop pretending.

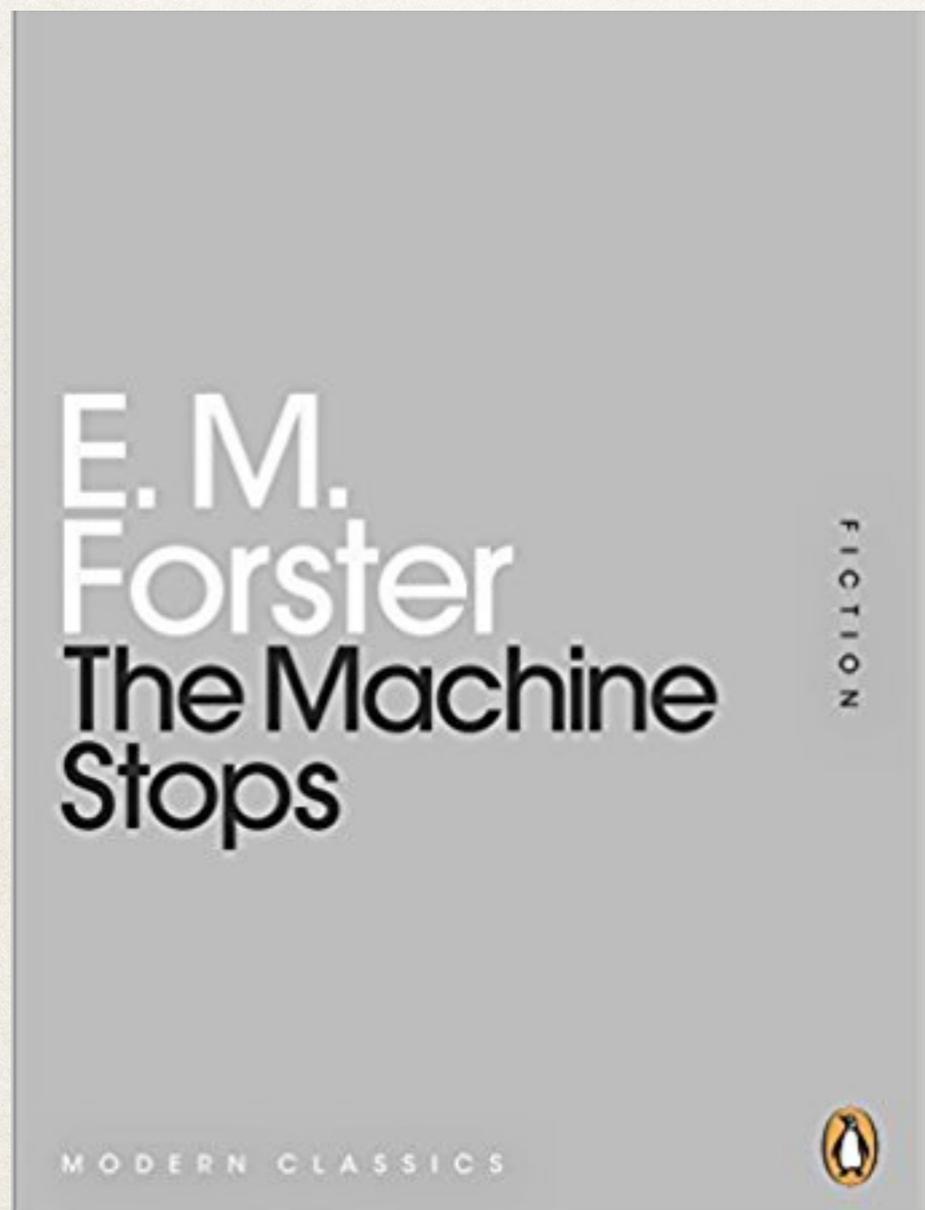
...

Claim: input-output machines, used to condition and produce desired outcomes, can never be the in-all-and-end-all for advancing human values



Computers encode consequentialist thinking

Scaling amplifies compromise

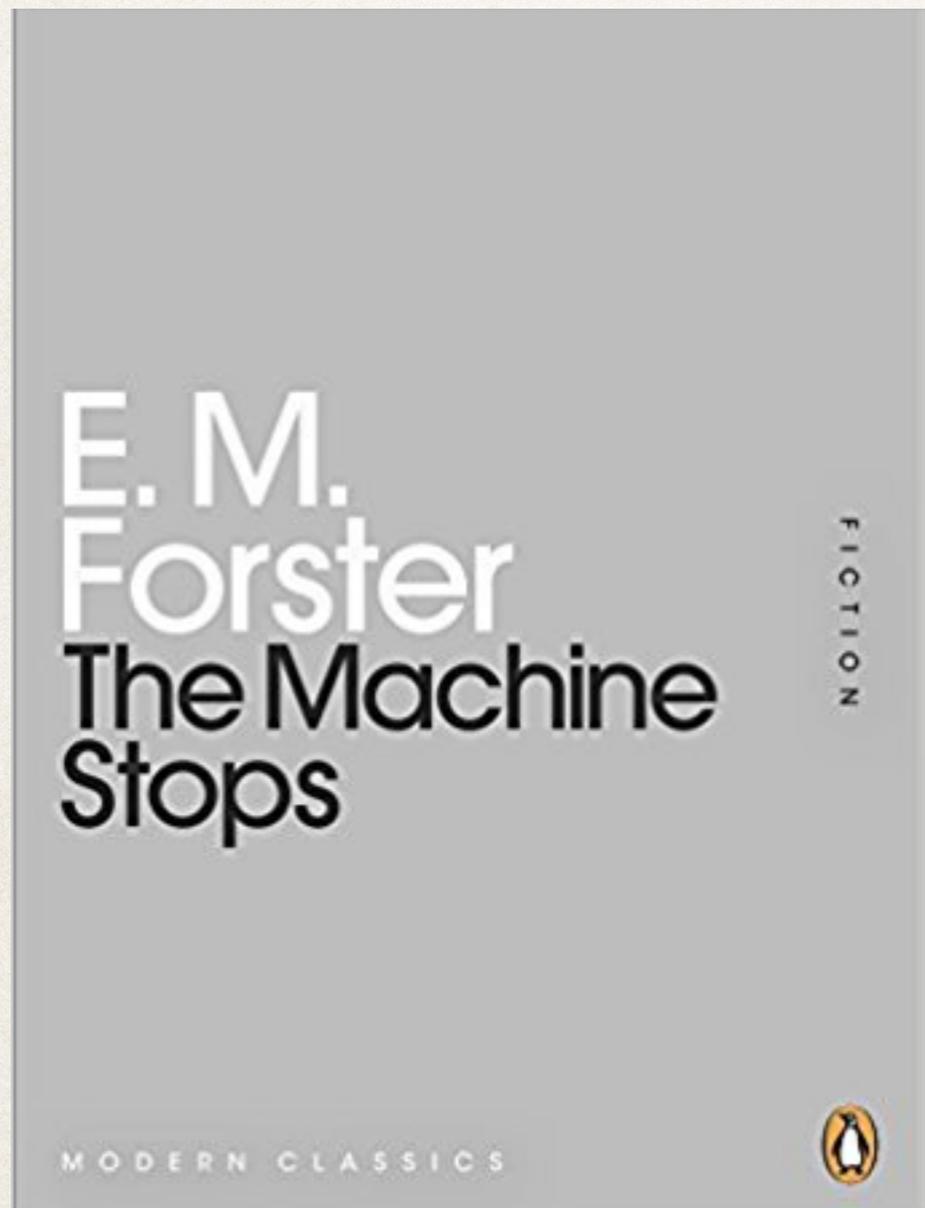


"Something 'good enough' had long since been accepted by our race."

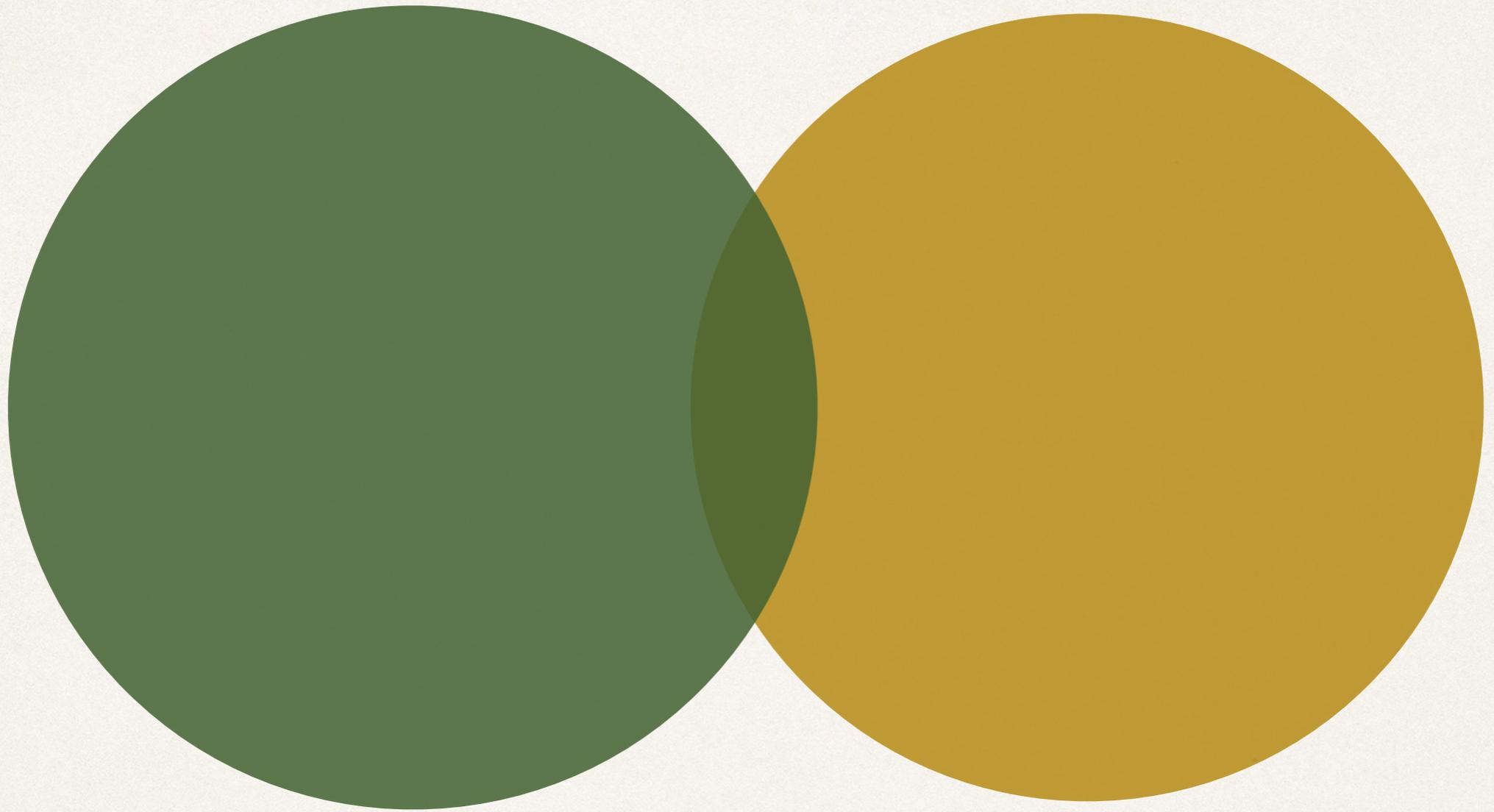
"That the Machine may progress, that the Machine may progress, that the Machine may progress eternally."

The Machine Stops, 1909

The hopes that are in my mind

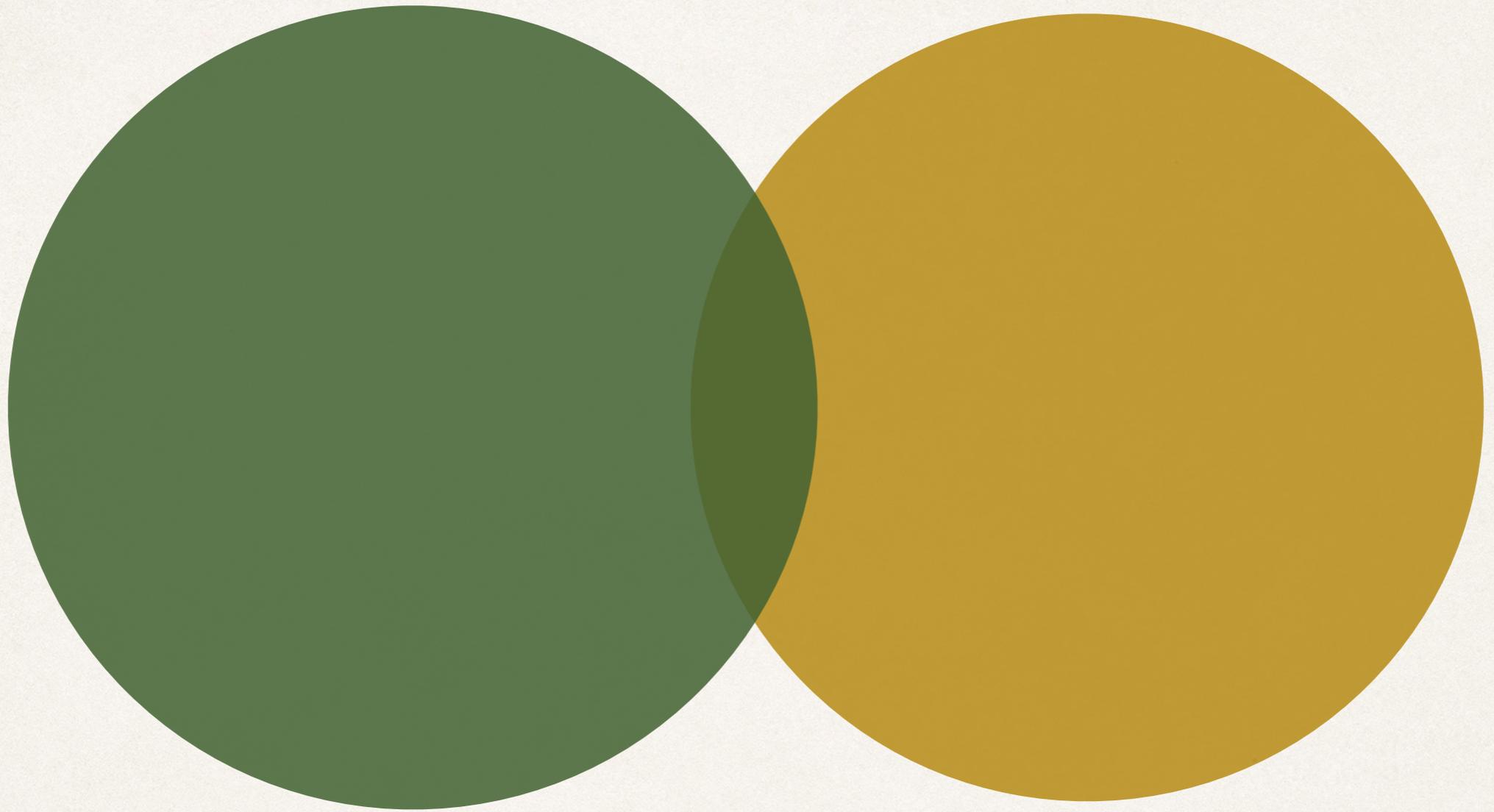


"The Machine is much, but it is not everything. I see something like you in this plate, but I do not see you. I hear something like you through this telephone, but I do not hear you. That is why I want you to come. Pay me a visit, so that we can meet face to face, and talk about the hopes that are in my mind."

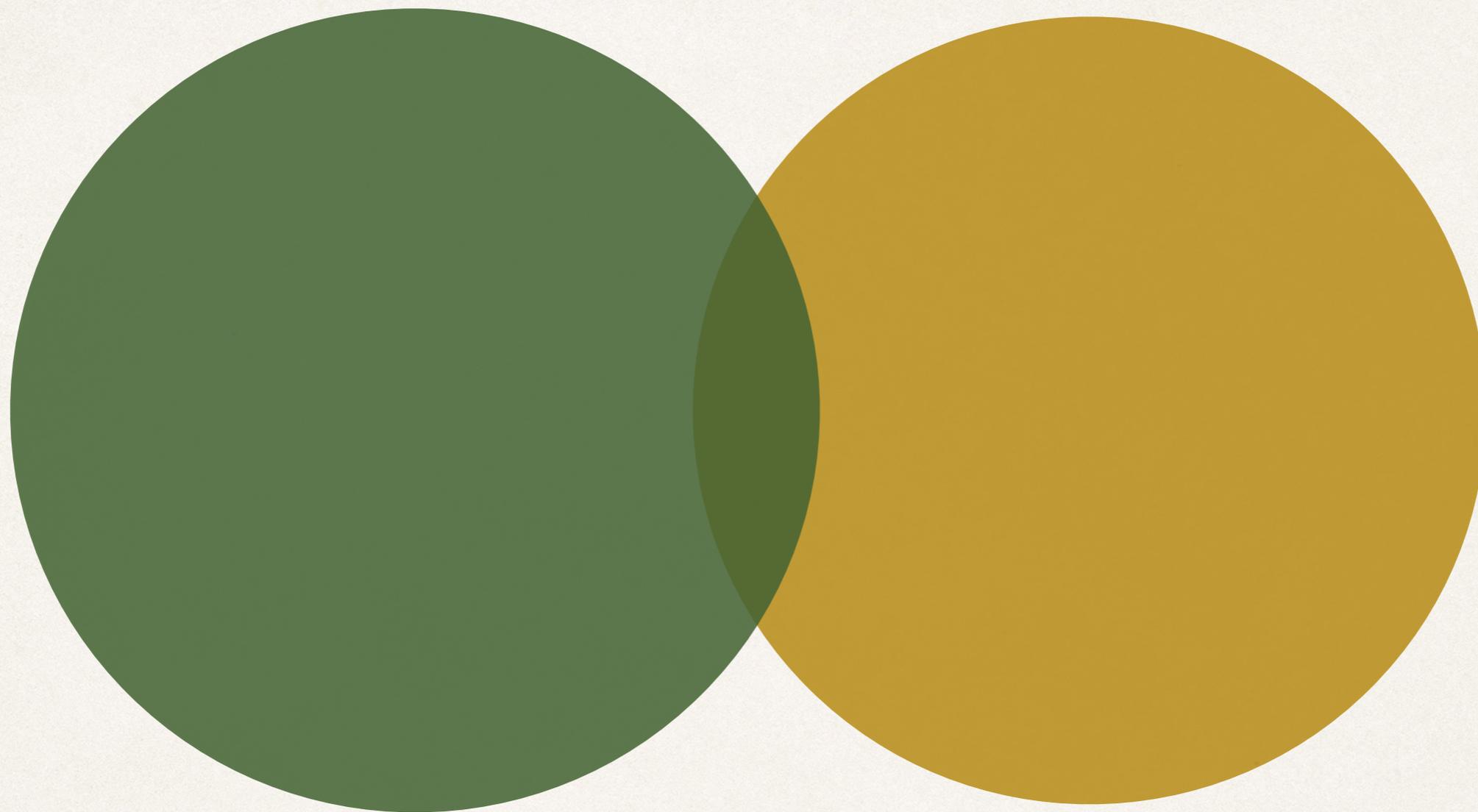


**Values you wish
to scale**

**Technological
solutions**



**“Technological
values”**

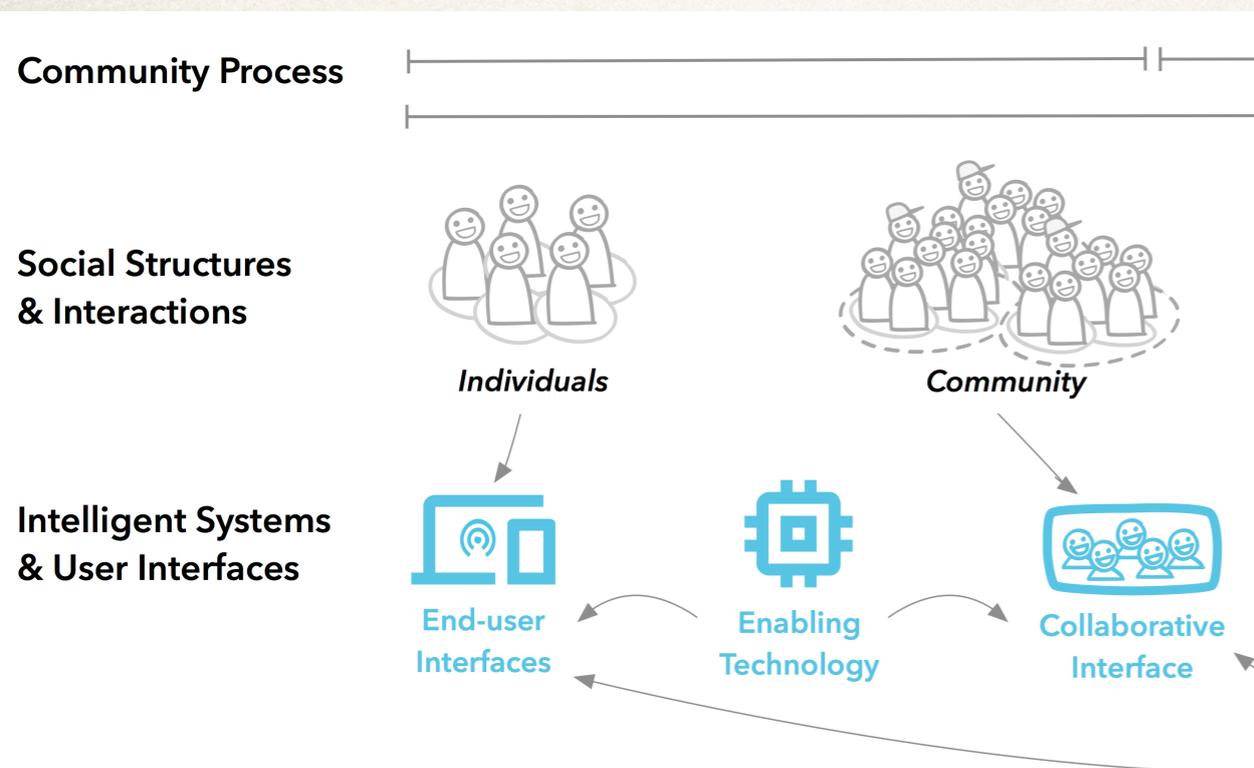


Values you wish to scale

Mindful of values.

Accept the limits of technology.

Learn to scale.



❖ **Ecological thinking:** create sustainable processes and interactions that support ecosystem members and proper ecosystem function.

❖ **Computational thinking:** decompose and distribute problem solving to diverse people or machines across the ecosystem

Cobi

Community Informed Planning



Paul André
CMU



Anant Bhardwaj
MIT



Lydia Chilton
UW



Juho Kim
MIT



Steven Dow
CMU



David Karger
MIT



Rob Miller
MIT



Haoqi Zhang
Northwestern

DTR

Agile Research Studios



Leesha Maliakal

Molly Pribble
Issac Miller
Neha Sharma
Aimee van den Berg
Ariella Silver
Dan Rees Lewis
Bomani McClendon
Sameer Srivastava
Maggie Lou
Natalie Ghidali
Olivia Gallagher
Sehmon Burnam
Shankar Salwan
Victoria Cabales
Zev Stravitz
Nneoma Oradiegwu
Matt Easterday
Liz Gerber

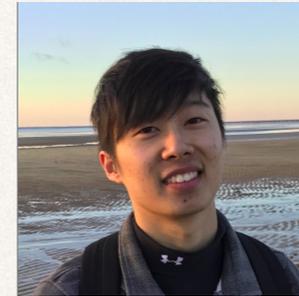
Networked Orchestration Technologies



Kapil Garg

Hang Yin
Jason Friedman
Sydney Smith
Ariella Silver
Caryl Henry
Charlotte Jones
Josh Klein
Kieran Bondy
Mason Lin
Richard Huang
Tommy McHugh
Vishal Giridhar
Darren Gergle

Opportunistic Collective Experiences



Ryan Louie

Cindy Hu
Parveen Dhanoa
Richard Lam
Yvan Chu
Kevin Cheng
Allison Sun
Amy Yang
David Lee
Eunice Lee
Gabriel Caniglia
Gino Wang
Grace Wainaina
Jennie Werner
Shannon Nachreiner
Jenny Chang
Kevin Chen
Mary Truong
Mason Lin
Matthew Wang
Navin Gopaul
Nina Cong
Ryan Jeon
Ryan Madden
Sanfeng Wang
Suzy Lee
Zachary Cmiel
Darren Gergle

Delta Lab



thank you



DELTA LAB

Haoqi Zhang

@hqz

agileresearch.io

pairresearch.io

forward.movie

dtr.northwestern.edu

delta.northwestern.edu

slides+readings: haoqizhang.com

References

System-level thinking

- ❖ Atul Gawande. How do we heal medicine? TED, 2012.
- ❖ Hope Reese. Mastery of AI has been 'harder than expected' and 'future is uncertain,' says Microsoft's AI chief. TechRepublic, 2015.
- ❖ George Furnas. Future design mindful of the MoRAS. Human-Computer Interaction 15.2 (2000): 205-261.
- ❖ [See also: Bryk, Gomez, Grunow, LeMahieu. Learning to Improve: How America's Schools Can Get Better at Getting Better. Harvard Education Publishing, 2015]

References

Community-Informed Planning

- ❖ Lydia Chilton, Juho Kim, Paul André, Felicia Cordeiro, James Landay, Dan Weld, Steven P. Dow, Robert C. Miller, Haoqi Zhang. Frenzy: Collaborative Data Organization for Creating Conference Sessions. In Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI 2014), 1255-1264.
- ❖ Paul André, Haoqi Zhang, Juho Kim, Lydia B. Chilton, Steven P. Dow, and Robert C. Miller. Community clustering: Leveraging an academic crowd to form coherent conference sessions. HCOMP 2013.
- ❖ Anant Bhardwaj, Juho Kim, Steven P. Dow, David Karger, Sam Madden, Robert C. Miller, Haoqi Zhang. Attendee-sourcing: Exploring the Design Space of Community-Informed Conference Scheduling. HCOMP 2014.
- ❖ Haoqi Zhang, Edith Law, Robert C. Miller, Krzysztof Z. Gajos, David C. Parkes, and Eric Horvitz. Human Computation Tasks with Global Constraints. In Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI '12), pp. 217-226, 2012.
- ❖ Juho Kim, Haoqi Zhang, Paul André, Lydia B. Chilton, Wendy Mackay, Michel Beaudouin-Lafon, Robert C. Miller, and Steven P. Dow. Cobi: A Community-Informed Conference Scheduling Tool. In Proceedings of the 26th Annual ACM symposium on User Interface Software and Technology (UIST 2013), 173-182.
- ❖ Cobi: Communitysourcing Large Scale Conference Scheduling. <http://projectcobi.com>.

References

Agile Research Studios

- ❖ Allan Collins and Manu Kapur. Cognitive apprenticeship. In R. K. Sawyer (Ed.) Cambridge Handbook of the Learning Sciences (2nd Edition). Cambridge University Press, 2014.
- ❖ Sanna Jarvela and Allyson F. Hadwin. New frontiers: Regulating learning in CSCL. *Educational Psychologist* 48, 1 (2013), 25-39.
- ❖ Lee Shulman. Those who understand: Knowledge growth in teaching. *Educational researcher* 15.2 (1986): 4-14.
- ❖ Alan Bain and Mark Weston. 2012. *The learning edge: What technology can do to educate all children*. Teachers College Press.
- ❖ Robert C. Miller, Haoqi Zhang, Eric Gilbert, and Elizabeth Gerber. Pair Research: Matching People for Collaboration, Learning, and Productivity. Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '14), 2014.
- ❖ Haoqi Zhang, Matthew W. Easterday, Elizabeth Gerber, Daniel Rees Lewis, and Leesha Maliakal. Agile Research Studios: Orchestrating Communities of Practice to Advance Research Training at Scale. Proceedings of the 20th ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW 2017), 220-232.
- ❖ Agile Research University: Supporting Authentic Research Experiences at Scale. <http://agileresearch.io>
- ❖ Forward: A Story About Learning and Growth. <http://forward.movie>, 2020.

References

Computational ecosystem preview

- ❖ Kapil Garg, Darren Gergle, and Haoqi Zhang. Understanding the Practices and Challenges of Networked Orchestration in Research Communities of Practice. CSCW 2022.
- ❖ Ryan Louie, Kapil Garg, Jennie Werner, Allison Sun, Darren Gergle, and Haoqi Zhang. Opportunistic Collective Experiences: Identifying Shared Situations and Structuring Shared Activities at Distance. CSCW 2020.
- ❖ Ryan Louie, Darren Gergle, and Haoqi Zhang. Affinder: Expressing Concepts of Situations that Afford Activities using Context-Detectors. CHI 2022.

References

Technology's role in advancing human values at scale

- ❖ EM Forster. *The Machine Stops*. feedbooks, 1909.
- ❖ Talbot Brewer. *Retrieval of Ethics*. Oxford University Press, 2009.
- ❖ [See also: Nicholas Carr. *The Shallows: What the Internet is doing to our brains*. WW Norton & Company, 2011]
- ❖ [See also: Batya Friedman and Peter H. Kahn. Human values, ethics, and design. *The human-computer interaction handbook* (2003): 1177-1201]