

Computational Ecosystems

Tech-enabled communities to advance human values

Haoqi Zhang

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Delta Lab | Design, Technology, and Research (DTR) | Northwestern University

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

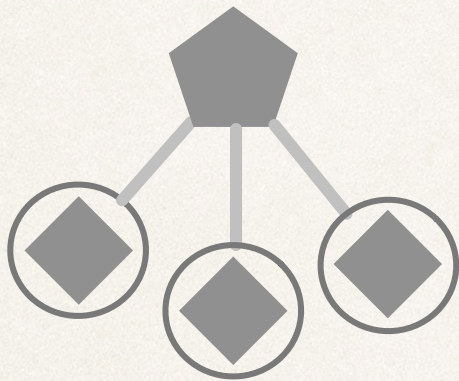
scale solutions

**advance desired
human values**

**address
real-world
constraints**

Best human solution

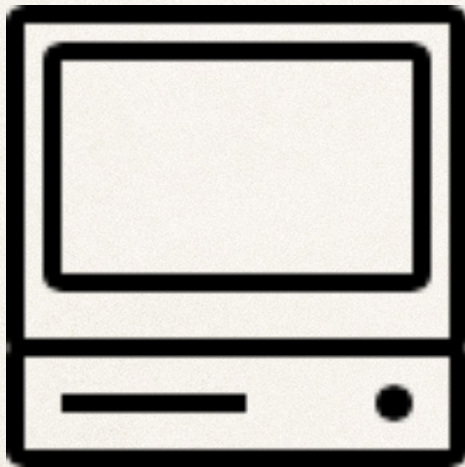
Apprenticeship



"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



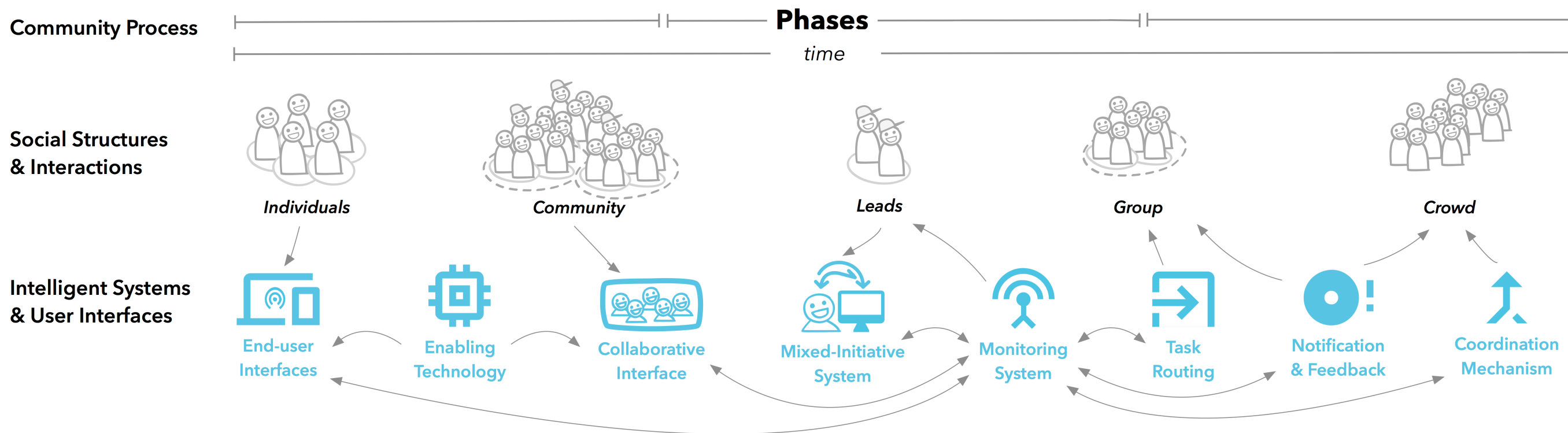
No AI technology can
replace the mentor in the
foreseeable future.

[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

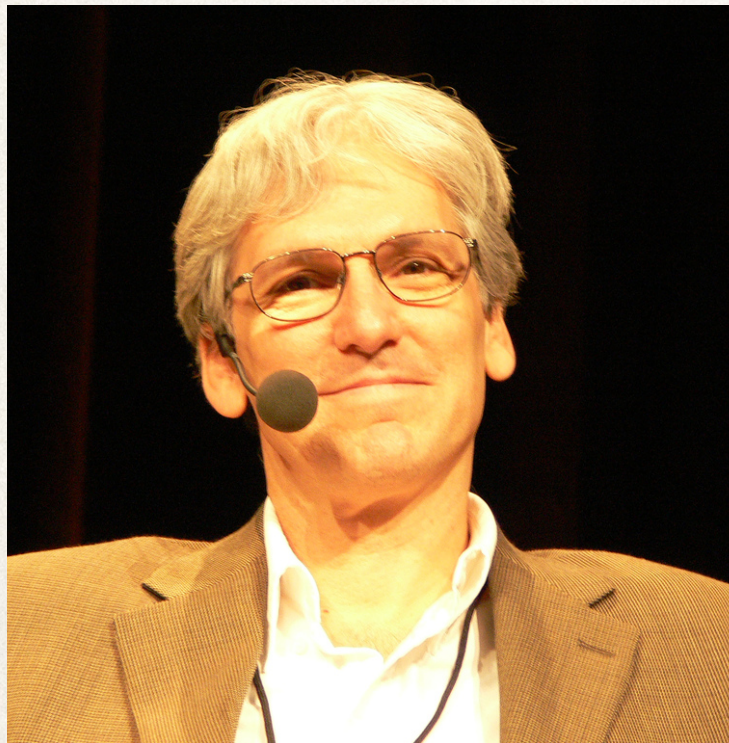


Eric Horvitz

"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

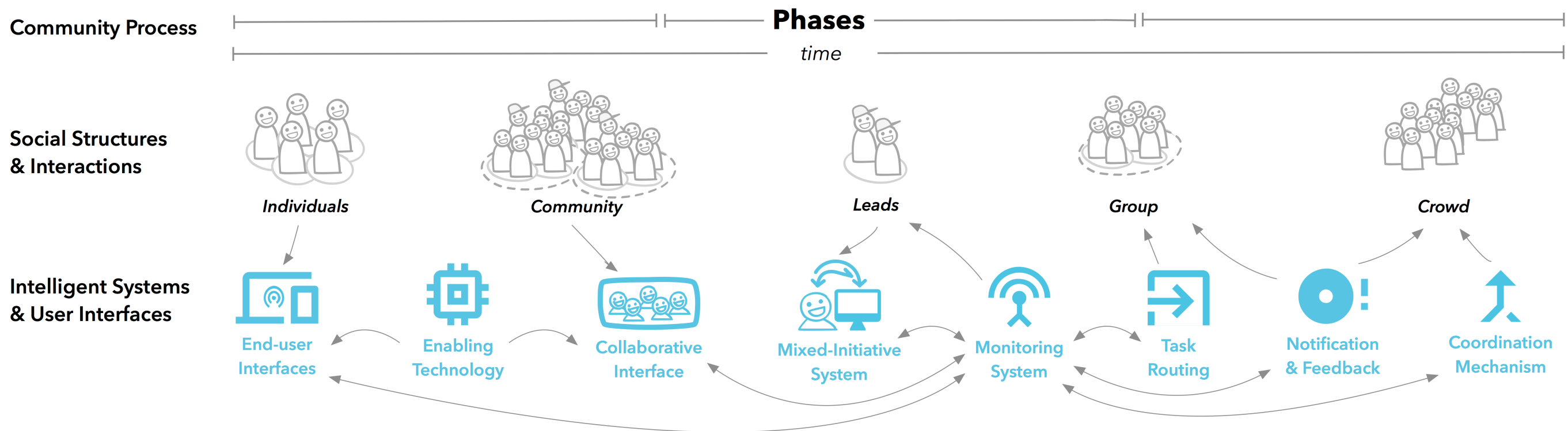


George Furnas

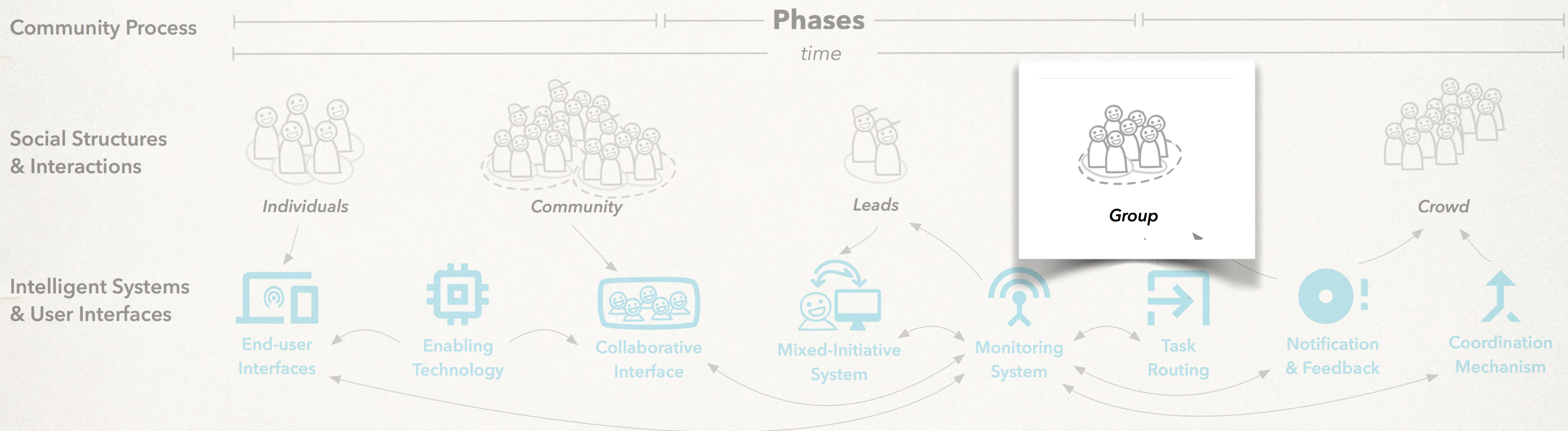
"It is likely that our designs will be more successful if we become more mindful of this bigger picture, [the mosaic of responsive, adaptive systems]."

*Future Design Mindful
of the MoRAS, 2000*

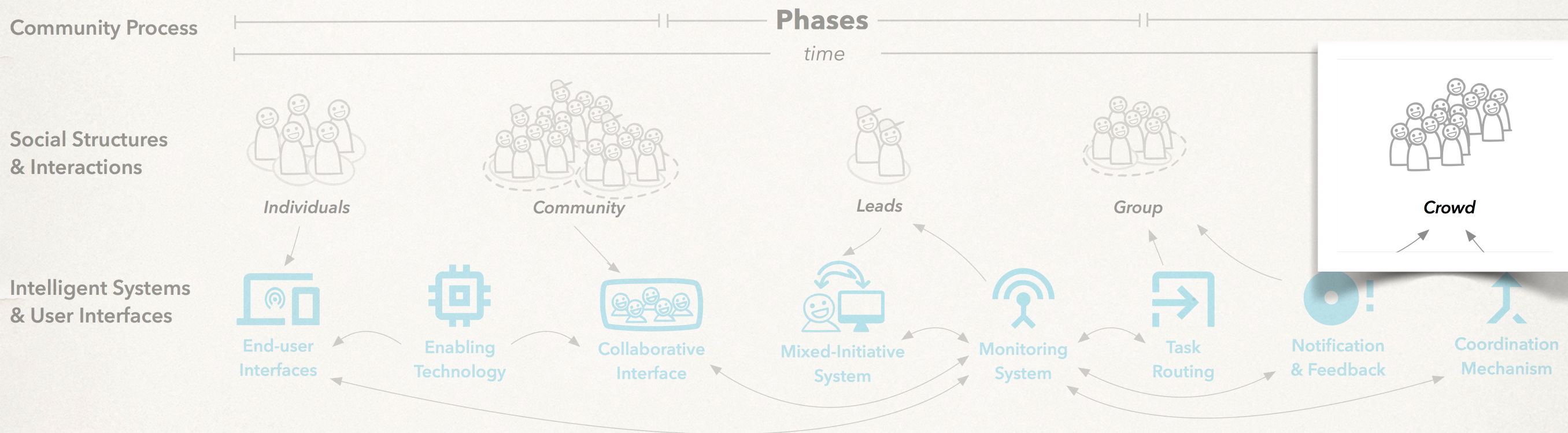
Advancing the approach...



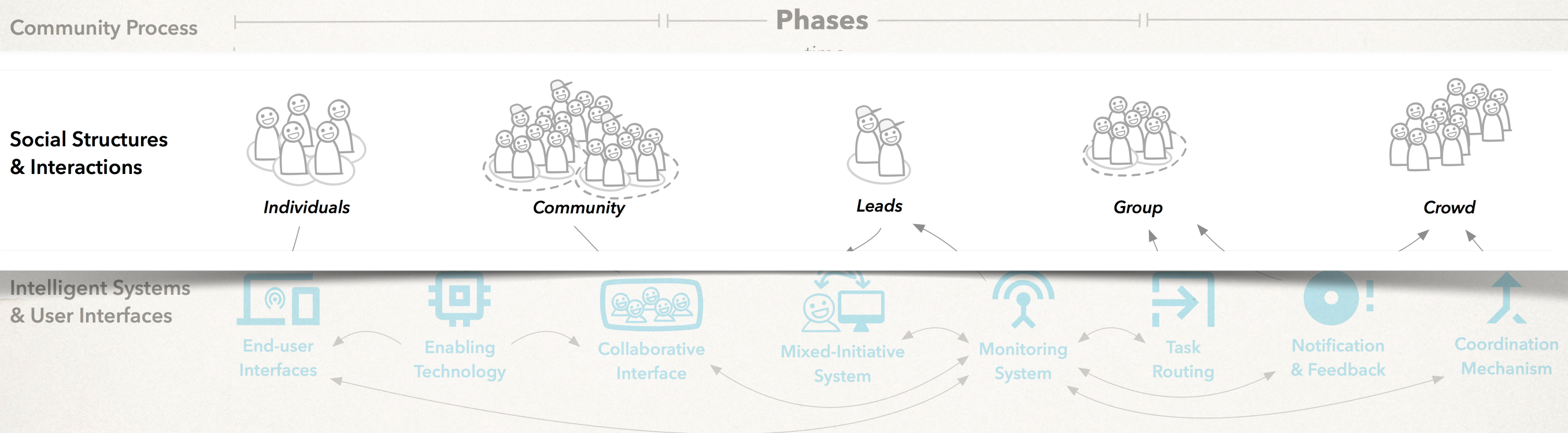
Typically...



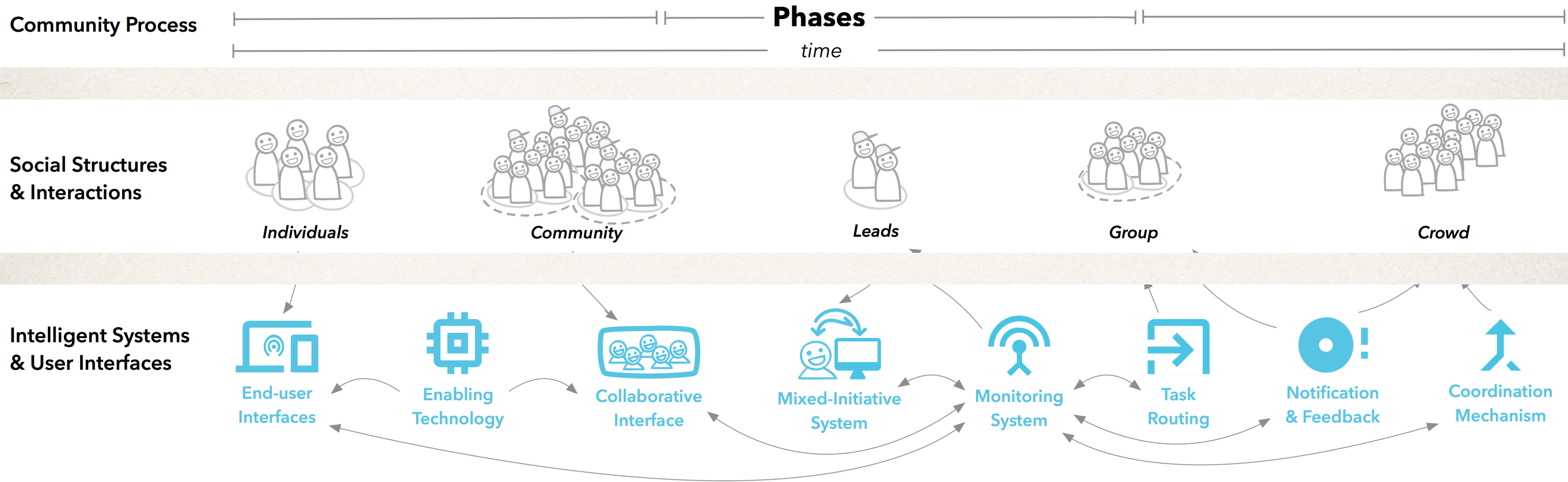
Typically...



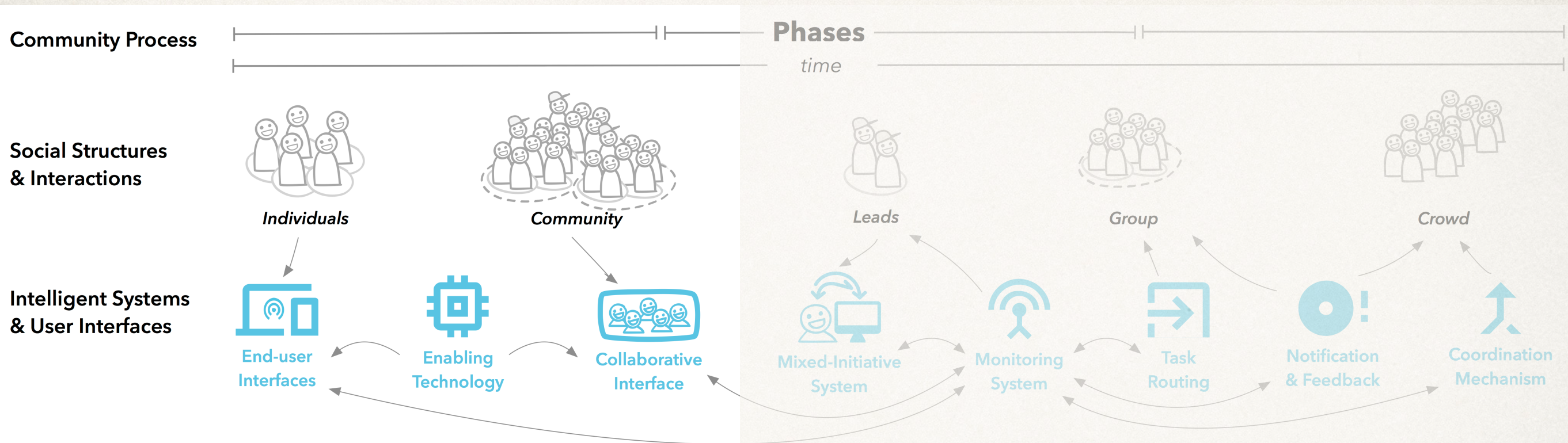
Advancing the approach...



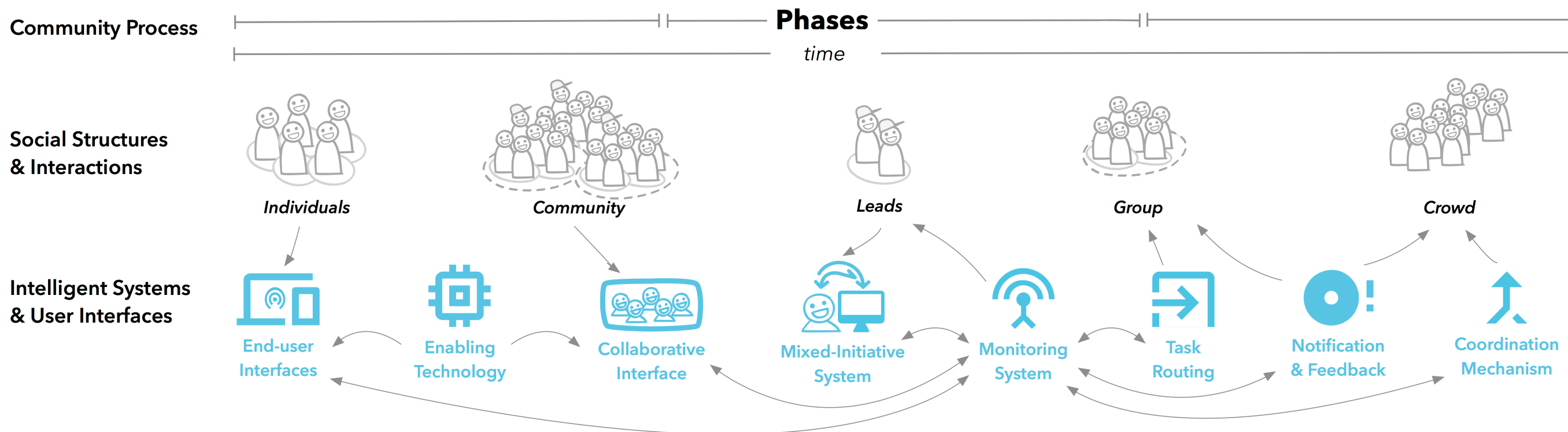
Typically...



Advancing the approach...

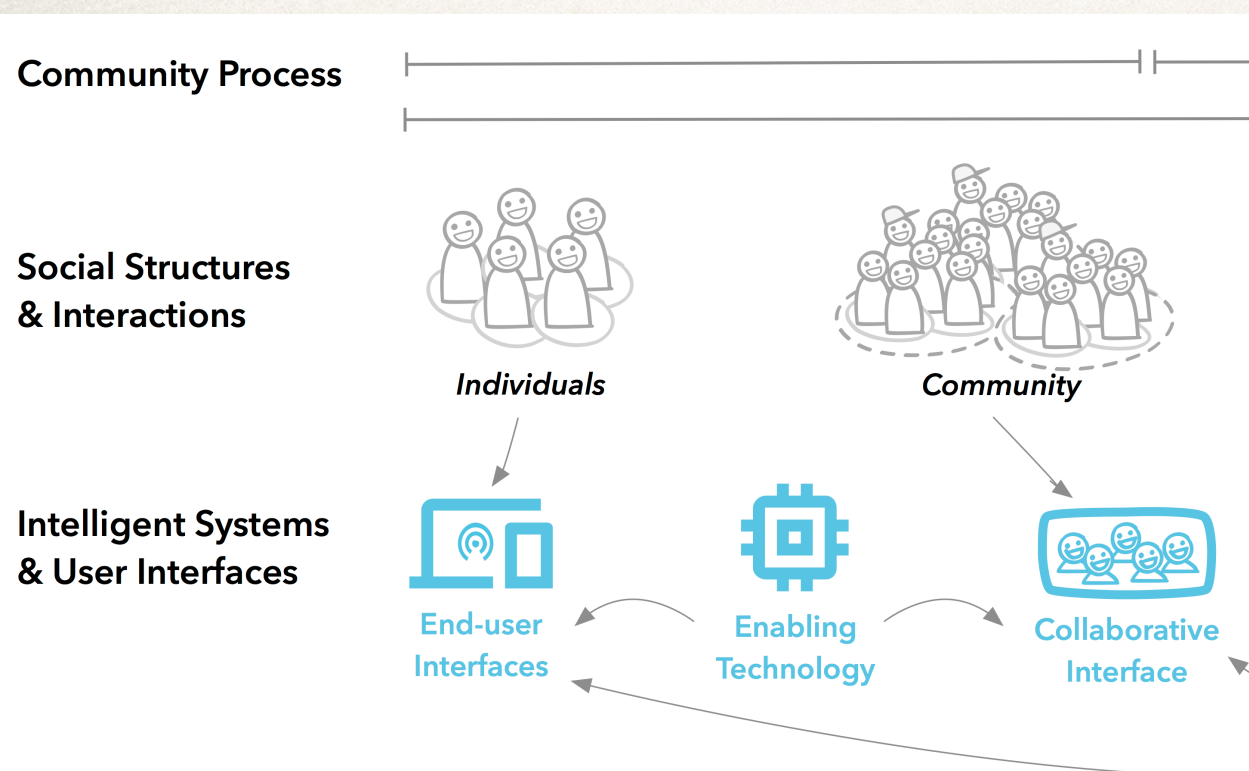


Computational ecosystems are systems, designed as integrative solutions.



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
- ❖ Our latest work in computational ecosystems
 - ❖ Supporting human practices
 - ❖ Supporting human experiences
- ❖ Role of computational ecosystems in advancing human values



Community-informed planning

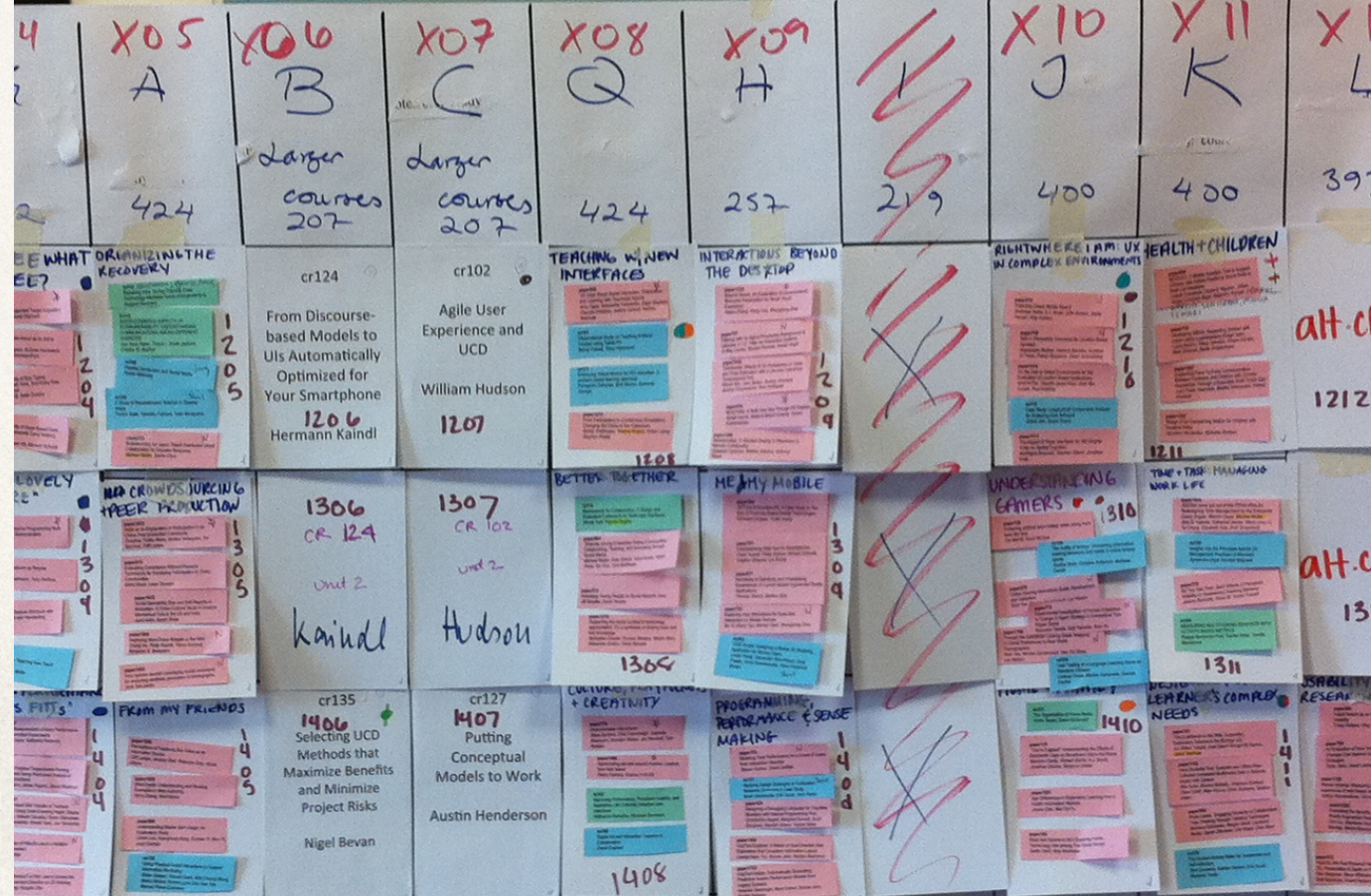
an inclusive process that scales and advances the goals of its members



	X01 D	X02 E	X03 F	X04 G	X05 A	X06 B	X07 C	X08 Q	X09 H	1	X10 J	X11 K	X12 L	X13 M	X14 N	X15 O	P X16 S16s
Thursday	Award talks 2400	4+ Inf. Tech. + Dev.	Panels 481	452	424	Larger courses 207	Larger courses 207	424	257	219	400	400	393	Smaller courses 42	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 Sallweil Wilberg (MIT), Daniela Rosner, Anna Tsing (MIT), Paul Dourish, Pete Dourish, Tobias Kohnke	DO YOU SEE WHAT ORGANIZING THE EYE SEE? 1204 1205	cr124 From Discourse- based Models to UIs Automatically Optimized for Your Smartphone 1206 Hermann Kaibel	cr102 Agile User Experience and UCD 1207 William Hudson	TEACHING WITH NEW INTERFACE 1208	INTERACTIONS BEYOND THE DESKTOP 1209	1210	1211	RIGHT WHERE I AM: UX IN COMPLEX ENVIRONMENTS 1212	HEALTH + CHILDREN 1213	alt.chi 1212	cr125 Cognitive Crash Dummies: Predicting Performance from Early Prototypes 1213 Bonnie E. John	cr147 Designing for Persuasion 1214 Aaron Marcus	516 1215	516 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 Houshner, Juan Pablo Houshner, Jeff Johnson, Lisa P. Nathan, Janice Tsal	"WHAT A LOVELY LECTURE" 1304 1305	1306 CR 124 Kaibel	1307 CR 102 Hudson	BETTER TOGETHER 1308	HEALTHY MOBILE 1309	1310	1311	UNDERSTANDING GAMERS 1312	TIME + TASK MANAGEMENT 1313	alt.chi 1312	CR 125 UNDER 2 Brenn John 1313	cr139 Methodology for Evaluating Experience of Mobile Applications Used in Different Contexts of Daily Life 1314 Katarzyna Wac	516 1315	516 1316
14:30-15:50	1400	1401	Panel-101 How-to-guide: Collaborating with executives in a pro-design world 1402	1403	cr135 1406 Selecting UCD Methods that Maximize Benefits and Minimize Project Risks 1407 Nigel Bevan	cr127 1407 Putting Conceptual Models to Work 1408 Austin Henderson	1409	1410	1411	1412	1413	1414	1415	1416	1417	1418	1419

Challenges for organizers

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

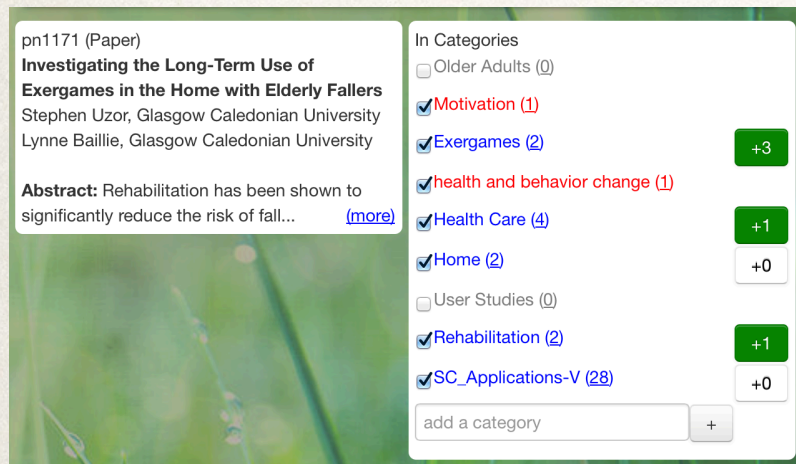


Cobi: Community-informed planning

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

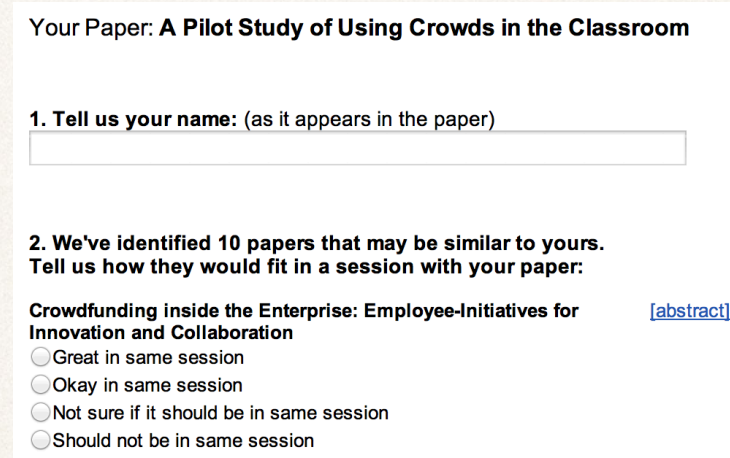
- ☐ Older Adults (0)
- ☒ Motivation (1) +3
- ☒ Exergames (2) +3
- ☒ health and behavior change (1) +1
- ☒ Health Care (4) +1
- ☒ Home (2) +0
- ☐ User Studies (0)
- ☒ Rehabilitation (2) +1
- ☒ SC_Applications-V (28) +0

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:

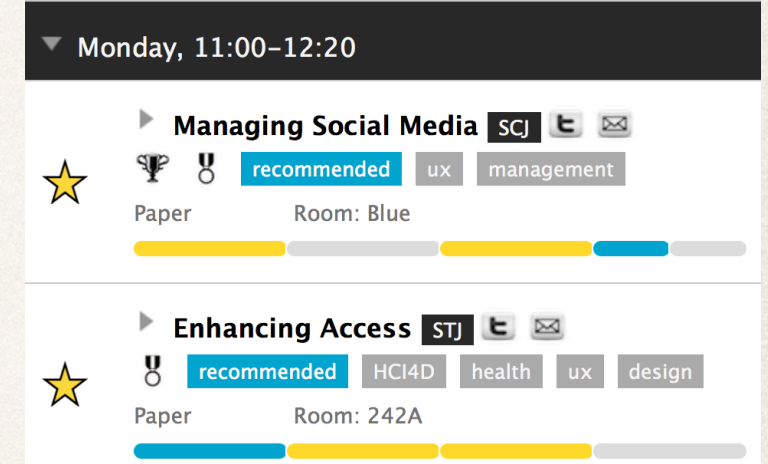
Crowdfunding inside the Enterprise: Employee-Initiatives for Innovation and Collaboration [\[abstract\]](#)

- ☐ 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

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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

expert
categories

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

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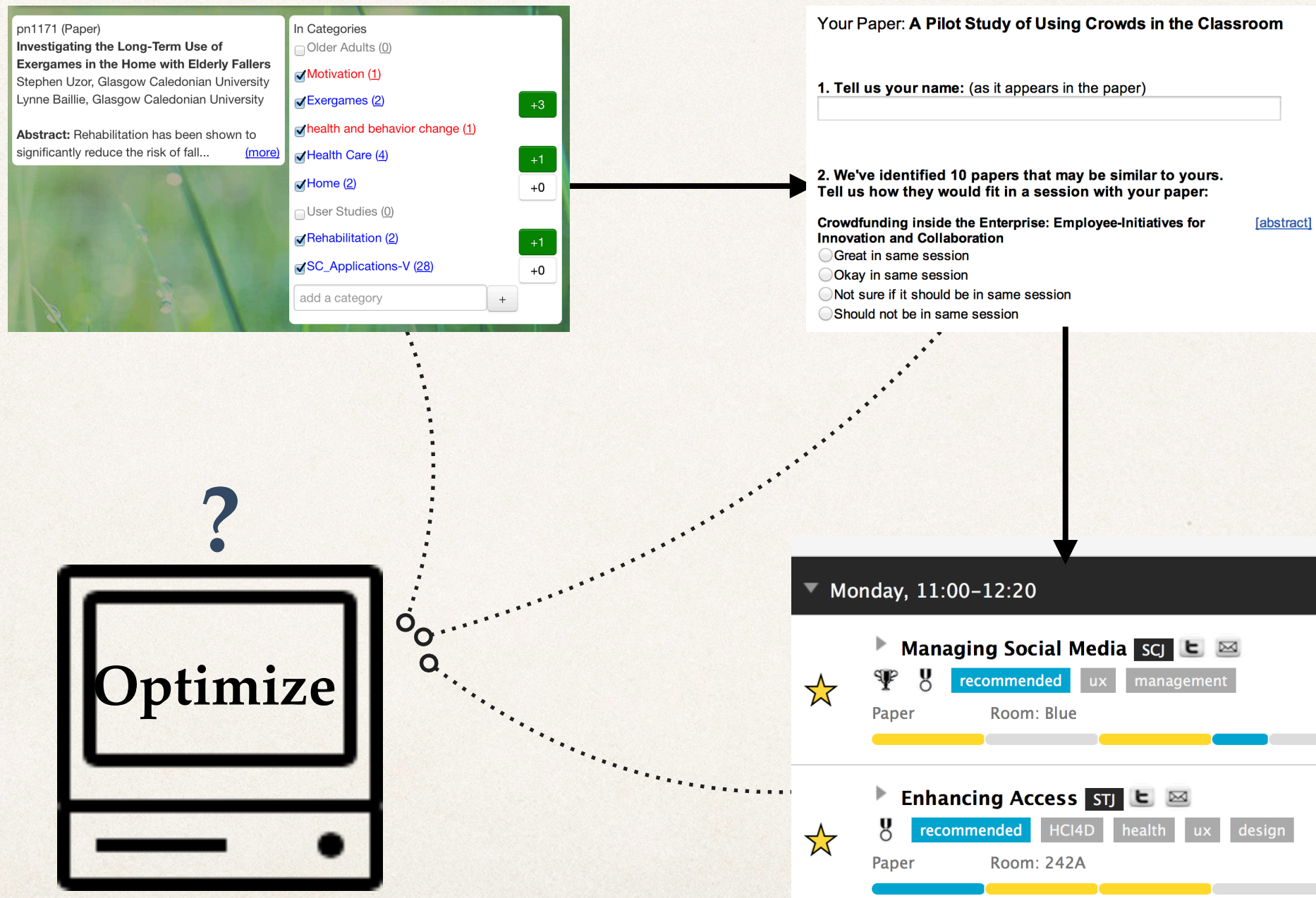
affinities
as seed

▼ 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



Core idea: Community-informed mixed-initiative interface

[Kim et al]

Cobi

search by session / paper / author name

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

unused session 7	unused session 9	Design for the Home	Displays and Wearable	Performing on Stage	Sharing Secrets
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Unscheduled Papers 15

Putting Things in Focus	Flights in my Hands	Penolinet Mobile Spatial	SeeSay and HearSay	Multinet: Reducing Interaction	The Secret Life of a Persona
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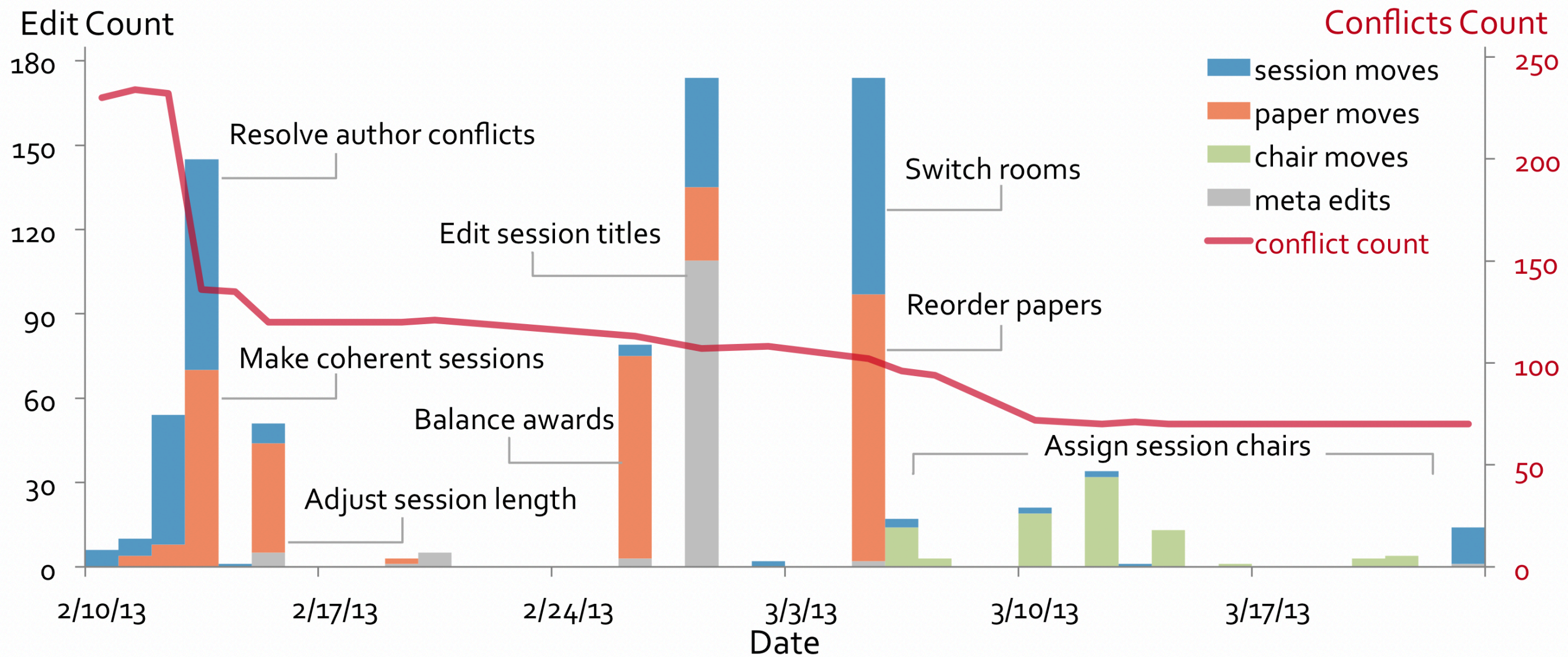
Unscheduled Chairs 65

Eric Paulos	Joonhwan Lee	Myriam Lewkowicz	Kasper Hombæk	Tomer Moscovitch	Alexandre Bodan
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Room/Time	Blue	Bordeaux	252B	352AB	Havana	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) 1	Multitouch and Gestures 1	Lifetime Research Award 1	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	Ilumin Interfaces	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) 2	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 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 1	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	3D Us 1	Case Studies in Novel Settings	Game Design 1	HCI Ethics 1	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	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	Crowdsourcing 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	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	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

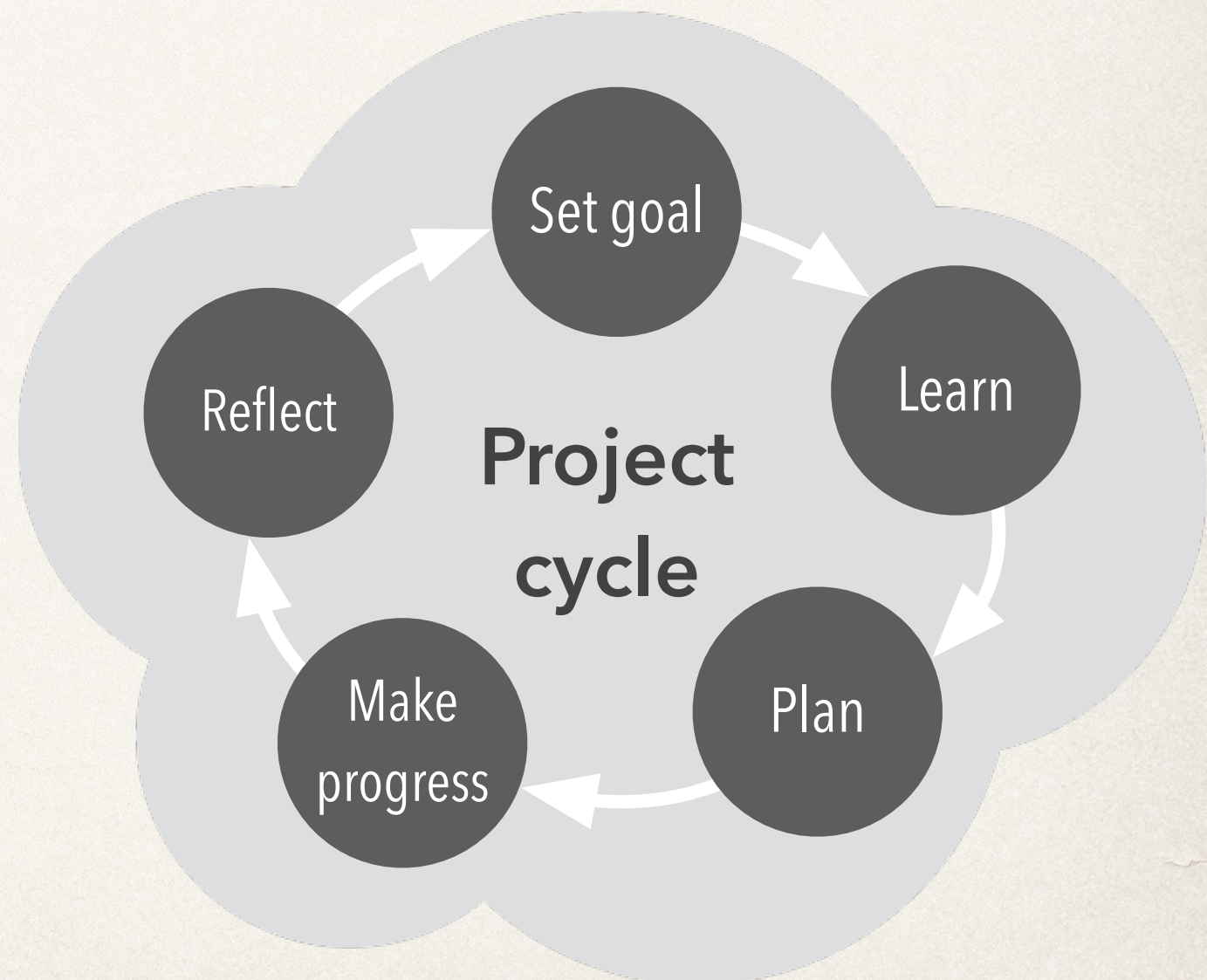
Students need regulation skills

- ❖ **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)

[Z. et al.]

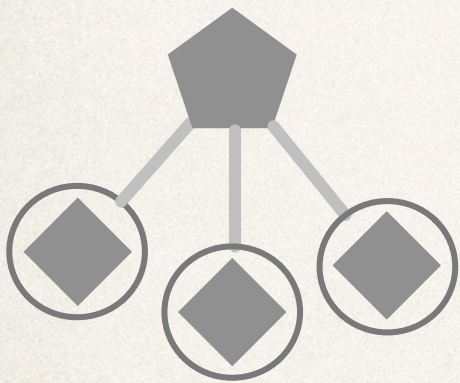
- ❖ Model for research training in a learning community
- ❖ All students, regardless of seniority, conduct independent research and receive authentic research practice.



ARS scales faculty time

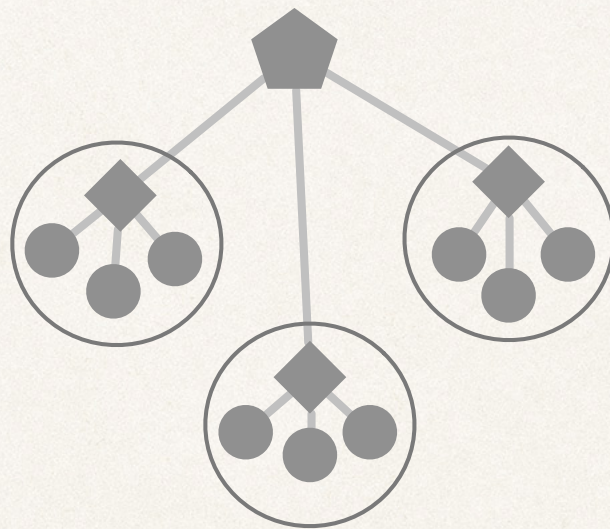
The ARS approach: Dispersed Control

Apprenticeship

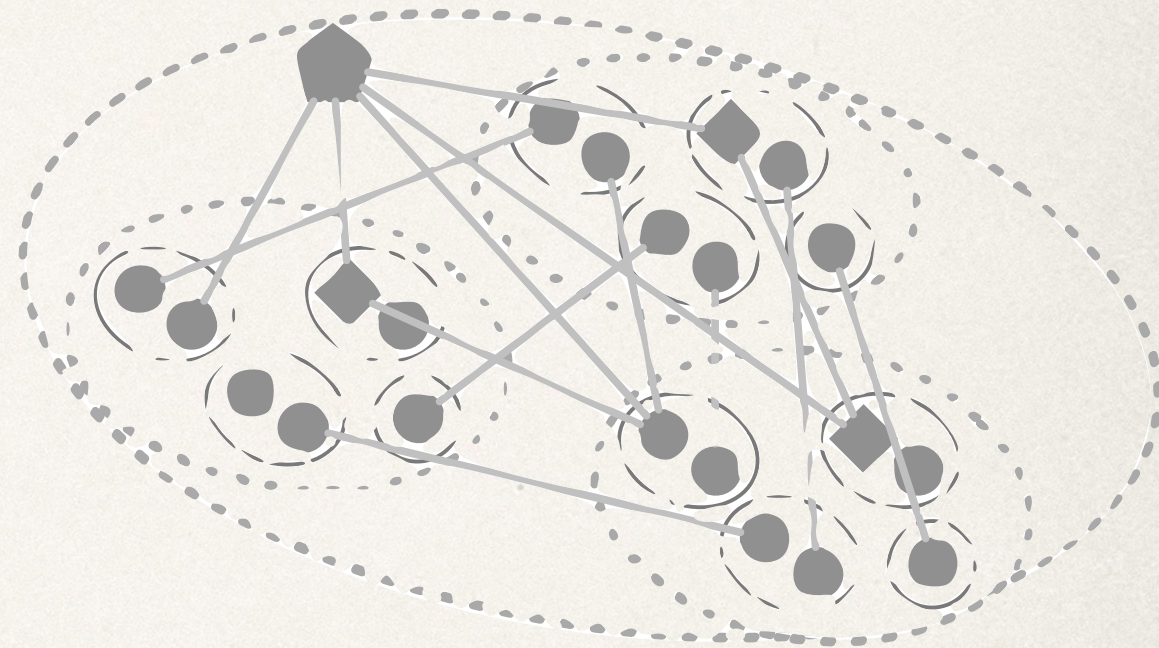


very small teacher
to student ratio
[Collins, 2005]

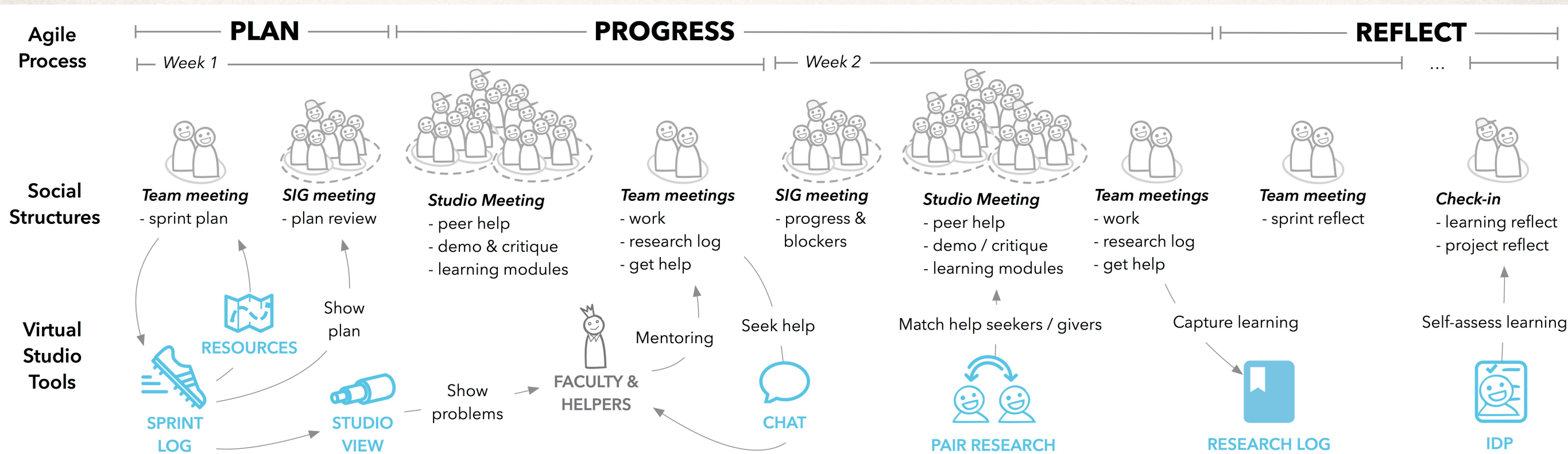
Hierarchical, 1:1:1



grad students are
novice mentors
[Shulman, 1986]



overcome 1:X
*[Bain & Weston,
2012]*



To learn more:
agileresearch.io
forward.movie
dtr.northwestern.edu/letters



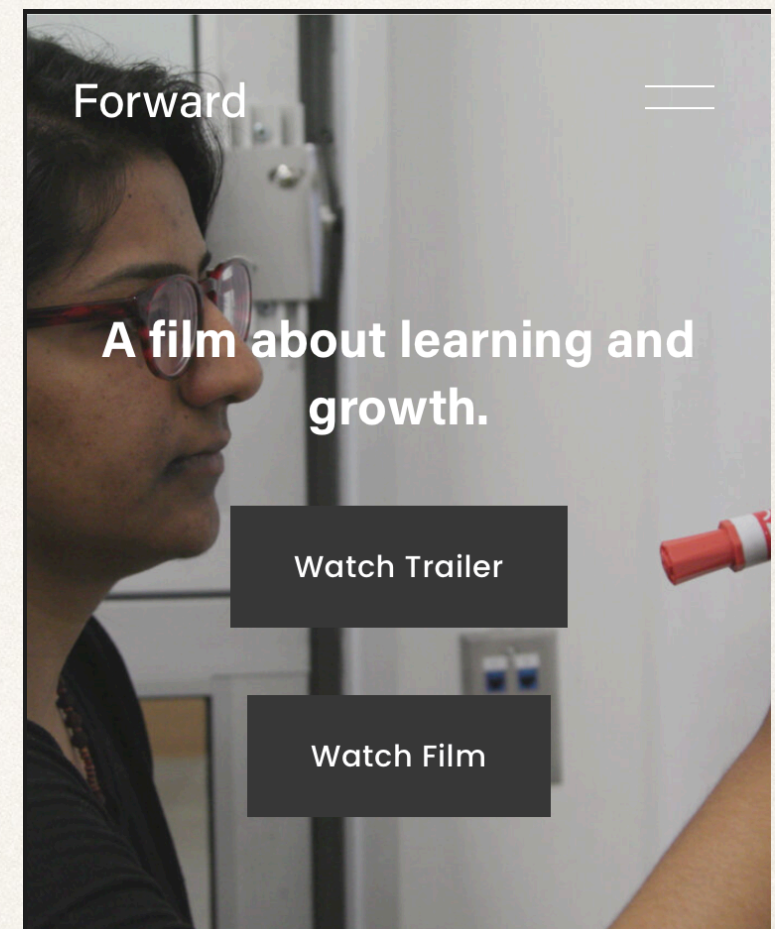
Outcomes (10 yrs)

- ❖ 160 students (139 UG, 9 MA, 14 PhDs) who led 70+ research projects.
- ❖ 46% women. 80%+ this quarter!
- ❖ 70 undergraduate research grants
- ❖ 30 papers + extended abstracts; 7 winners at major ACM Student Research Competitions
- ❖ 40% of DTR undergraduates placed at Apple, Google, Microsoft, Meta, and Amazon; others have founded their own companies.



Success beyond Northwestern

- ❖ Founded Agile Research University (ARU) to support 70+ faculty at universities across the world using the ARS model (even in the humanities!)
- ❖ Produced the DTR documentary, *Forward*
- ❖ DTR annual letters to start deeper conversations on mentoring and learning
- ❖ Founded cross-institutional junior faculty support group

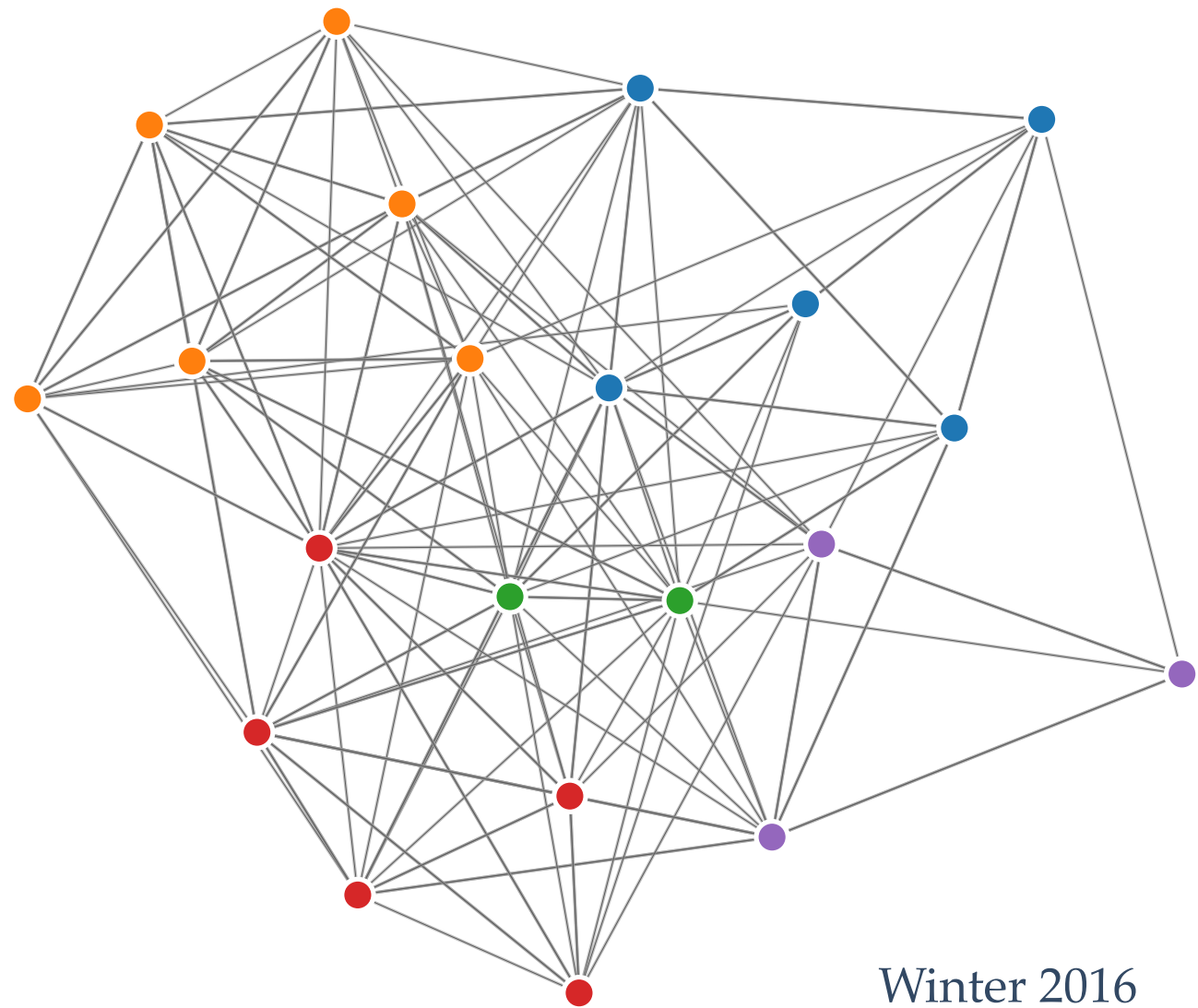


Planning Strategies

- ❖ assessing risks
- ❖ using effective representations for thinking about problems and solutions
- ❖ building at the appropriate fidelity
- ❖ prioritizing important features and research questions
- ❖ moving on despite uncertainty or imperfect knowledge.

Help & Help-seeking

- ❖ *"I can ask for help and that everyone asks for help and it doesn't make them stupid to need help."*



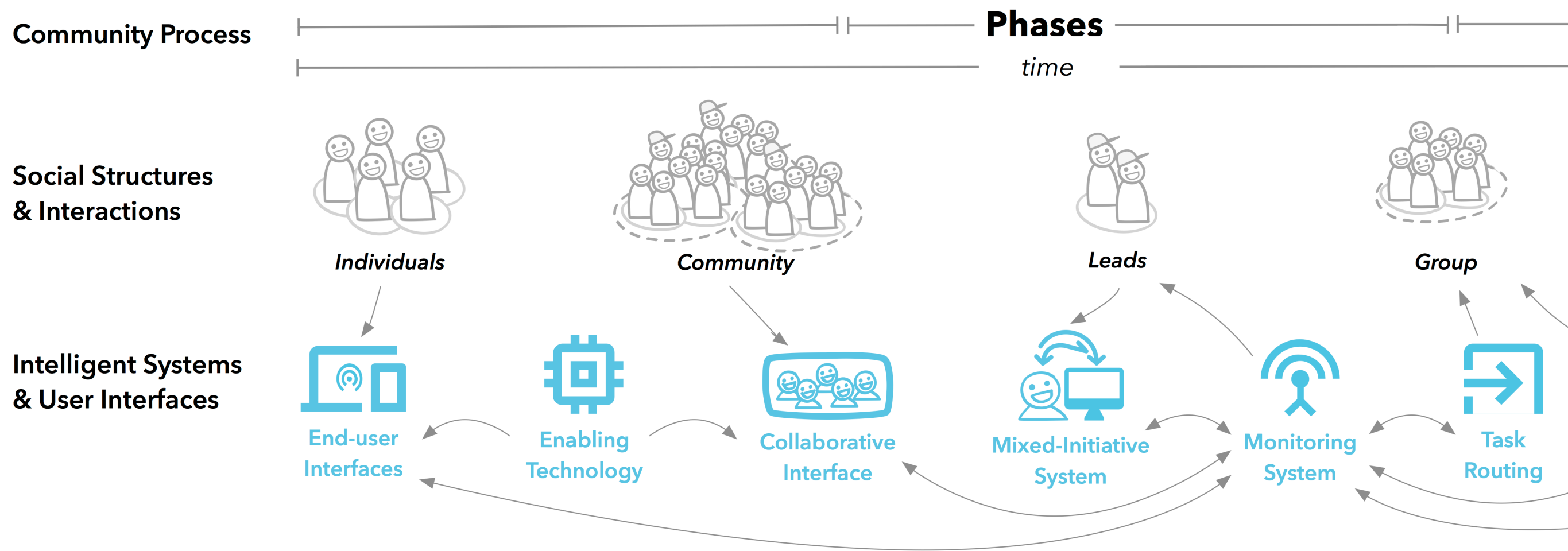
Winter 2016

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, and to engage more deeply with ourselves and with research

Our recent work: moving beyond ecosystem design



1: Developing regulation skills for building a self-directed (research) practice

Cognitive skills

- ❖ representing problem and solution spaces
- ❖ assessing risks
- ❖ critical thinking and argumentation
- ❖ core design, research, and STEM methods

Metacognitive skills and dispositions

- ❖ planning: forming feasible plans and planning effective iterations
- ❖ help-seeking: leveraging resources; seeking help; communication skills
- ❖ reflection: awareness of one's own skills, abilities, and metacognitive blockers

Emotional regulation and disposition toward self and learning

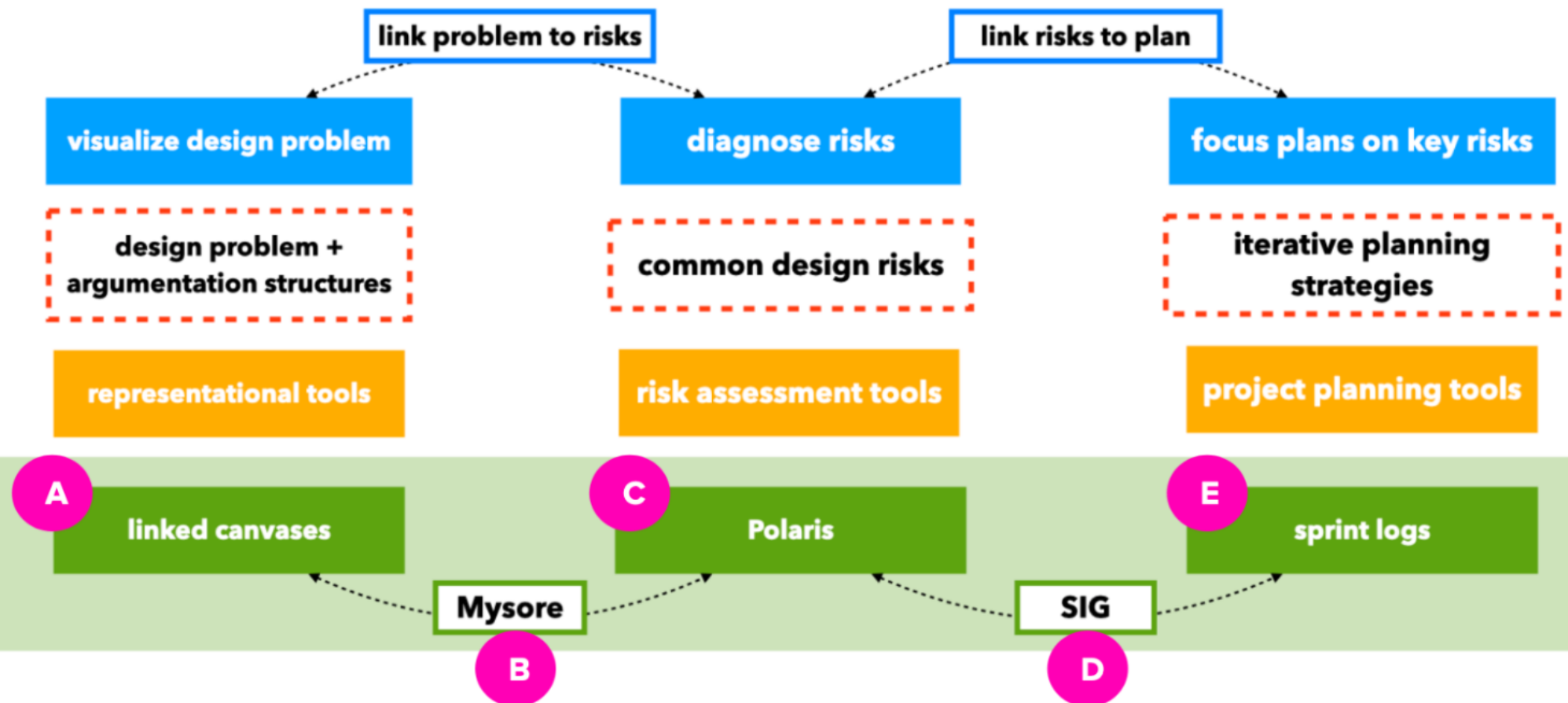
- ❖ emotional regulation: understanding one's fears and anxieties
- ❖ disposition: dealing with failure, embracing challenges, embracing self-direction

Building a planning practice in the ARS computational ecosystem [Maliakal et al., 2023]

PLANNING

expert process
↓
knowledge needed
↓
component solutions

ARS planning subsystem



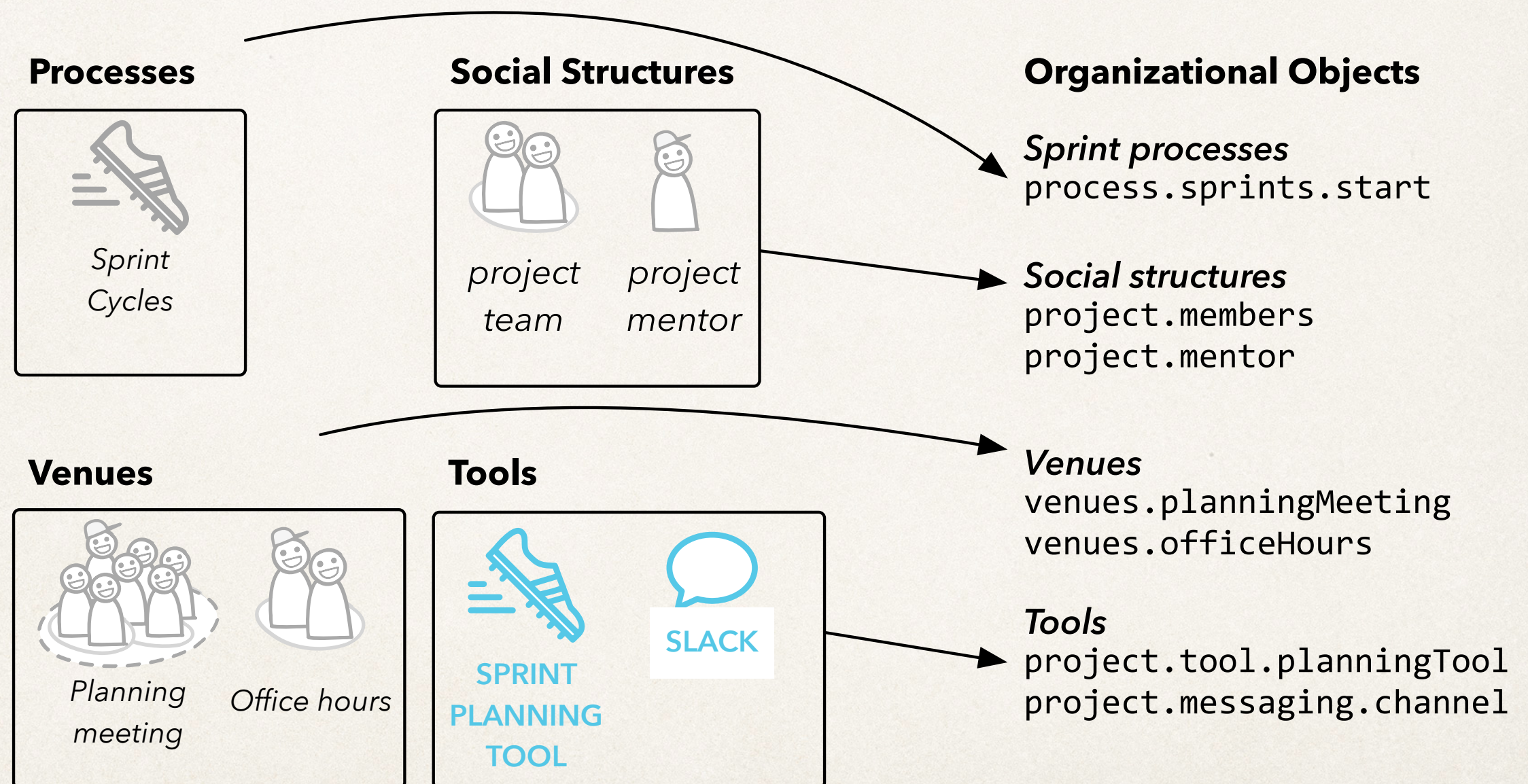
In-action cues for replanning

[Maliakal et al., 2023]



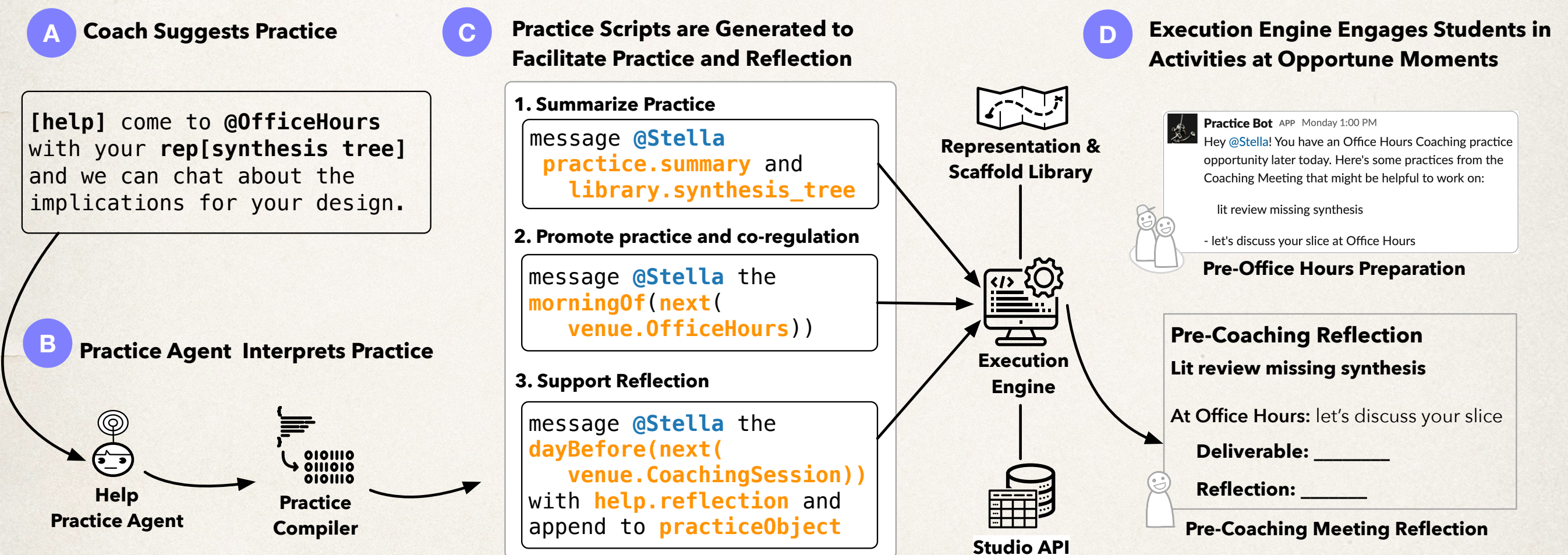
Organizational Objects for Workplaces

[Garg, Gergle, Z., 2023]



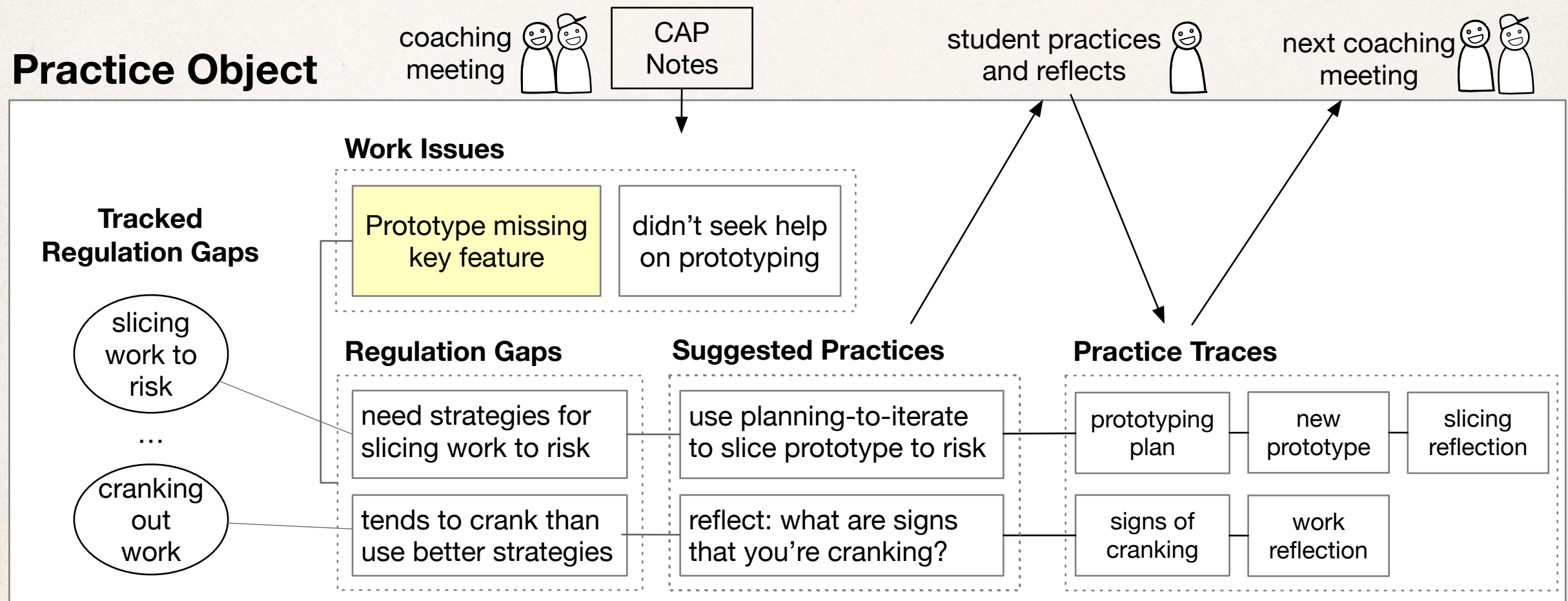
Practice Agents for facilitating practice

[Garg, Gergle, Z., 2024]



Practice Objects for tracking practice

[Garg, Gergle, Z., 2024]




Summary: Building a self-directed practice

- ❖ Computational supports for facilitating a practice across ecosystem interactions
- ❖ Ecosystem-level monitoring and orchestration to promote, coordinate, and restructure interactions *across* a computational ecosystem

2. Computational Understanding of Human Experiences

2. Computational Understanding of Human Experiences



parks

La Jolla, San Diego

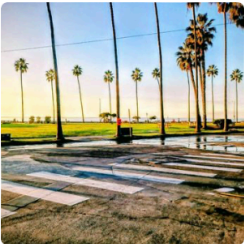
Yelp for Business Write a review

Restaurants Home Services Auto Services More

Active Life > Parks

parks La Jolla, San Diego, CASort: Recommended

AllPriceOpen NowGood for KidsDogs AllowedOpen to AllOffers Military Discount




1. Kellogg Park

★★★★★ 4.8 (23 reviews)

Playgrounds Parks La Jolla Shores

“There are great shops around and I love the covered **park** and with a beautiful view.” [more](#)




2. La Jolla Cove

★★★★☆ 4.6 (1.5k reviews)

Parks Beaches La Jolla

“The beach and **park** were pretty. There were some interesting trees throughout the park which were all...” [more](#)




3. Maruta Gardner Playground

★★★★★ 4.8 (24 reviews)

Playgrounds


“We love this **park**! The structures are all so unique and it's honestly a fun

2. Computational Understanding of Human Experiences



parks

La Jolla, San Diego



Yelp for Business

Write a review

Restaurants

Home Services

Auto Services

More

Active Life > Parks

parks La Jolla, San Diego, CA

Sort: Recommended

All

Price

Open Now

Good for Kids

Dogs Allowed

Open to All

Offers Military Discount




1. Kellogg Park
★★★★★ 4.8 (23 reviews)
Playgrounds Parks La Jolla Shores
"There are great shops around and I love the covered **park** and with a beautiful view." [more](#)



2. La Jolla Cove
★★★★★ 4.6 (1.5k reviews)
Parks Beaches La Jolla
"The beach and **park** were pretty. There were some interesting trees throughout the park which were all..." [more](#)




3. Maruta Gardner Playground
★★★★★ 4.8 (24 reviews)
Playgrounds
"We love this **park**! The structures are all so unique and it's honestly a fun



Warm Meal on a Cold Day

La Jolla, San Diego, CA



All

Price

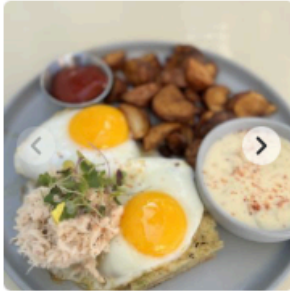
Open Now

Reservations

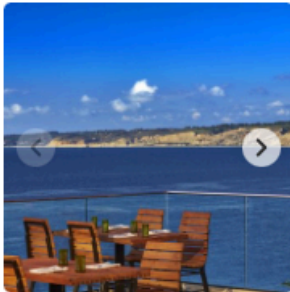
Offers Online Waitlist

Offers Delivery

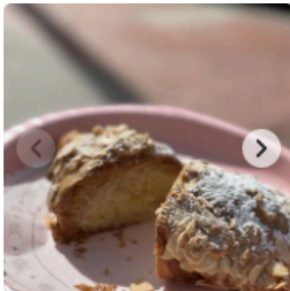
Offers Takeout



1. Cove House
★★★★★ 4.4 (463 reviews)
La Jolla • \$\$ • **Open** until 6:00 PM
"They were not thoroughly **heated** to a piping hot temp however. Service was great"
New American Breakfast & Brunch Bars



2. Duke's La Jolla
★★★★★ 4.1 (3.7k reviews)
La Jolla • \$\$ • **Open** until 8:30 PM
"Plenty of **heat** lamps to keep you warm on cool nights. We really liked that they have by the..." [more](#)
New American Breakfast & Brunch Seafood



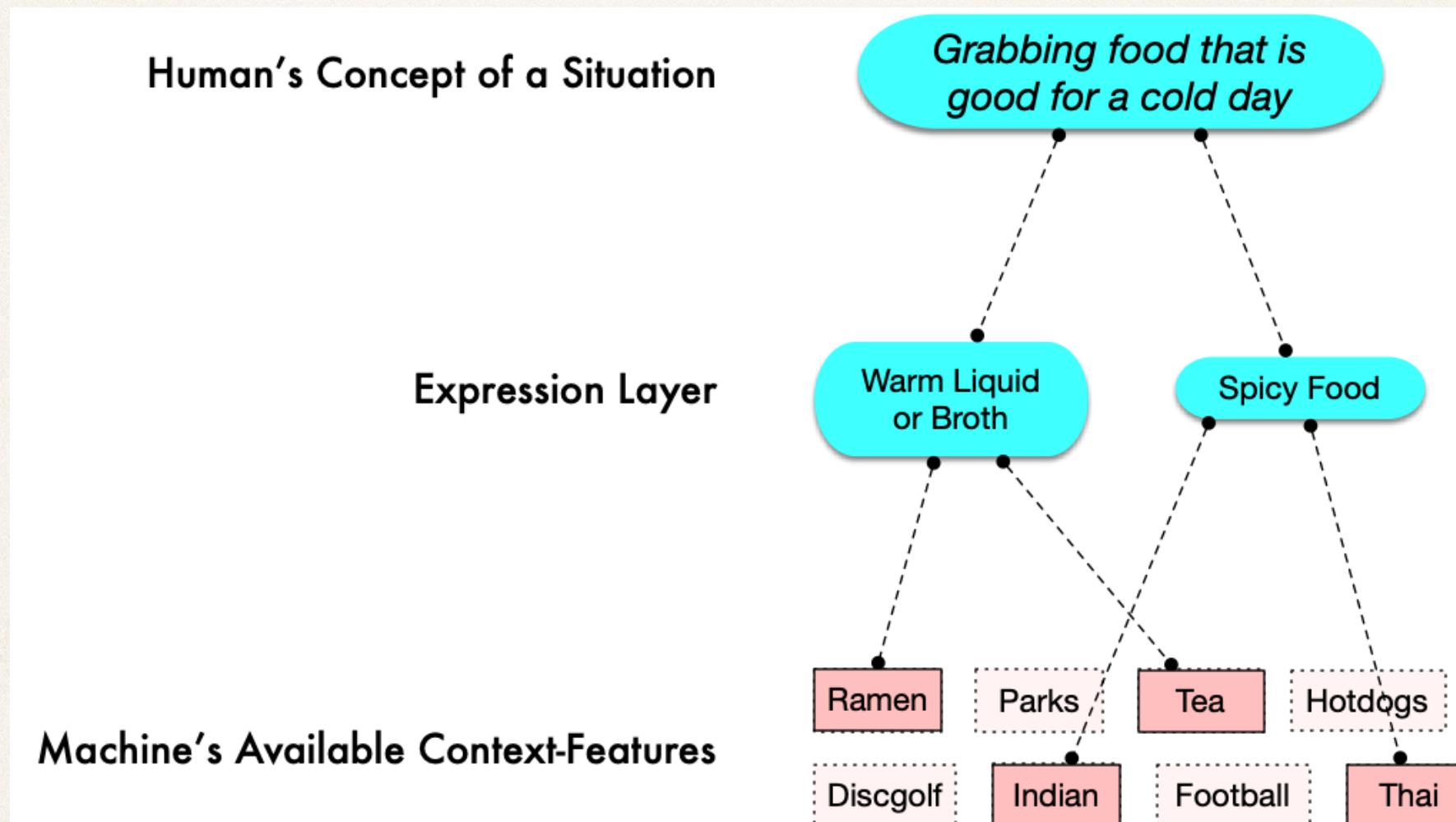
3. Parisien Gourmandises
★★★★★ 4.5 (292 reviews)
La Jolla • \$\$ • **Open** until 5:30 PM
"For the danish, the tomatoes were pretty cold so it would've been nice if it could've **heated** up..." [more](#)
Bakeries Patisserie/Cake Shop Desserts

2. Computational Understanding of Human Experiences

"an increasing understanding on the part of system developers that human activities are enmeshed in a variety of [cultural and social] practices and relations that make them meaningful by setting a context within which they can be understood..."

Seeking a Foundation for Context-Aware Computing
Paul Dourish, **2001 (!!)**

Bridging Human-Machine Understanding of Human Experiences [Louie et al, 2022]



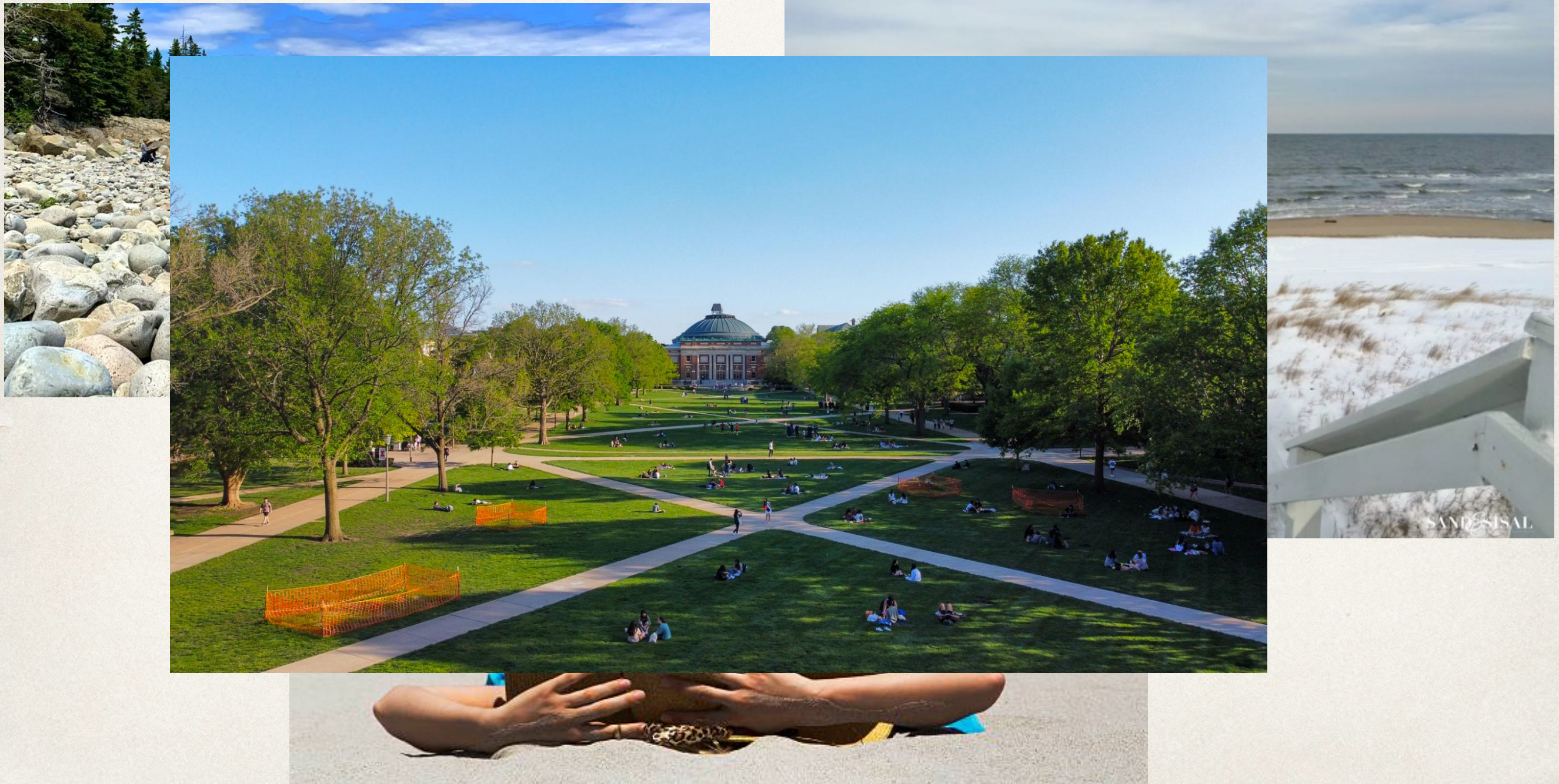
Fundamental challenge: understanding human experiences across contexts



Fundamental challenge: understanding human experiences across contexts

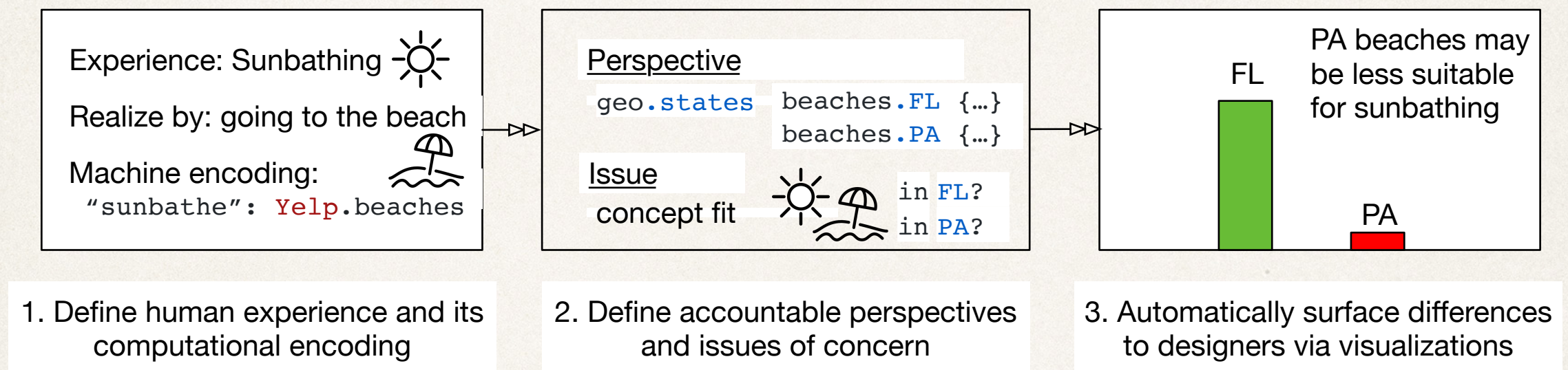


Fundamental challenge: understanding human experiences across contexts



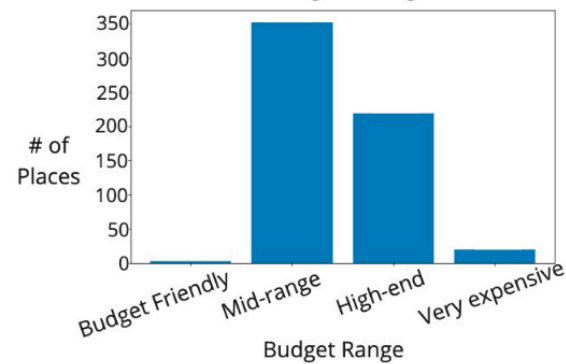
Differ: An Experiential Computing Platform

[He, Zhang, Gergle, Z.]



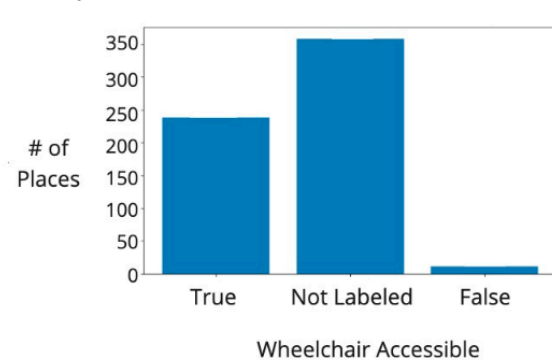
Example: Going on a first date

Number of Places Good For First Date Experience Across Budget Ranges



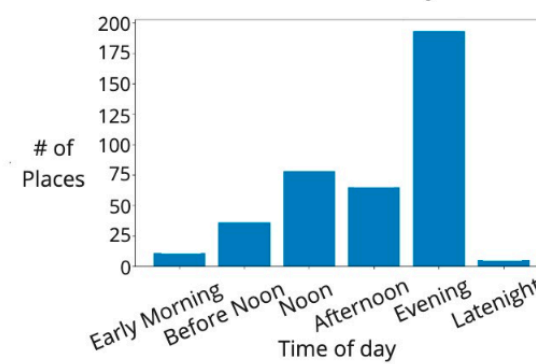
(a) Budget Range, Prevalence

Number of Places Good For First Date Experience Across Wheelchair Accessibility



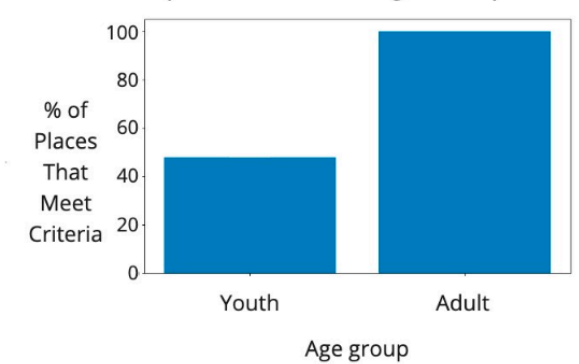
(b) Wheelchair Accessibility, Prevalence

Number of Places Good For First Date Experience Across Time of Day



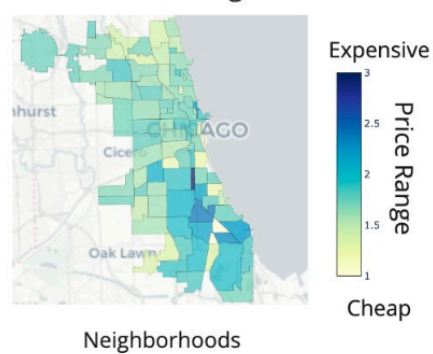
(c) Time of day, Prevalence

Percentage of Places Good For First Date Experience Across Age Groups



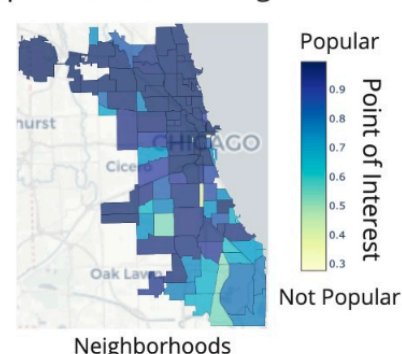
(d) Age group, Prevalence

Average Price of Places Good For First Date Experience Across Neighborhoods



(e) Neighborhood, Affordability

Average Point of Interest Score of Places For First Date Experience Across Neighborhoods



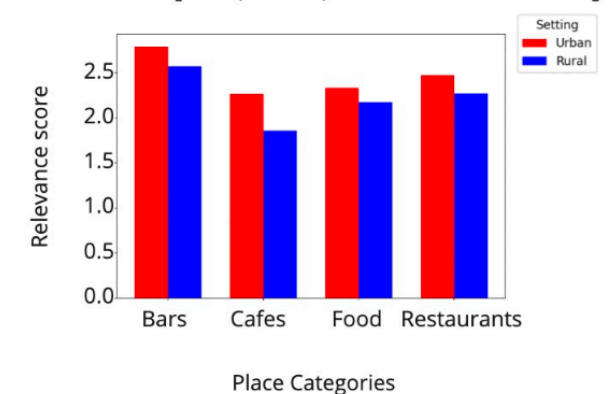
(f) Neighborhood, Popularity

Total Crime Count Around Places Good For First Date Experiences



(g) City places x Time of day, Safety

First Date at [Bars, Cafes, Food or Restaurants]



(h) Urban/Rural, Conceptual fit

Summary: Computational Understanding of Human Experiences

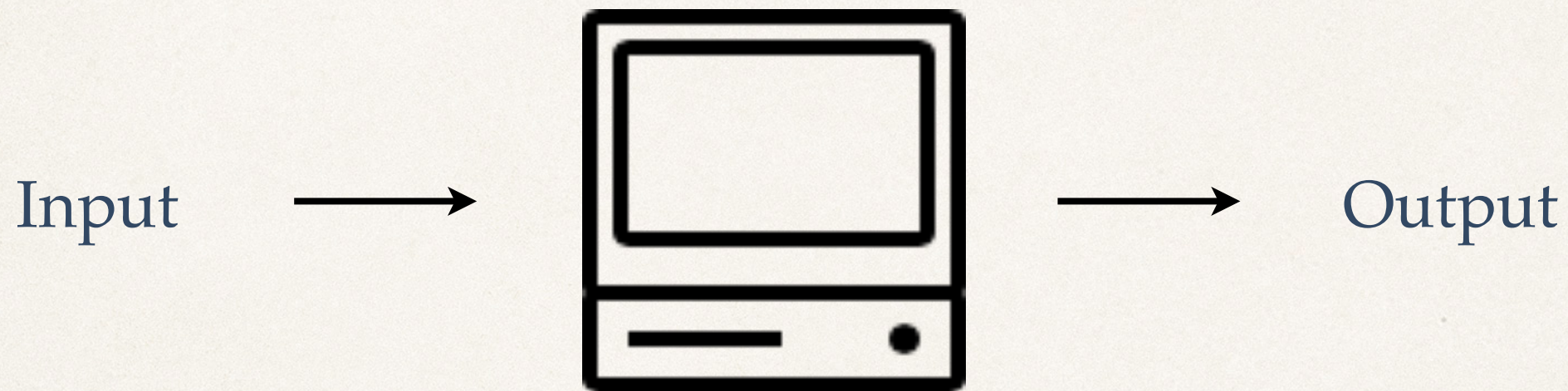
- ❖ Computational understanding of human experiences is foundational for building richer computational ecosystem that support intrinsically valuable human activities
- ❖ Centering experiential understanding requires its own ecosystem of supports - which we can build as foundation for supporting other ecosystems!

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



- ❖ Digital computers are insufficient for advancing human values
- ❖ We need computational ecosystems not just for consequential aims, but for advancing human values

Understand the limitations of the digital computers



Computers reliably produce
desired consequential outcomes

HCI is largely consequentialist

The role of designers is precisely to “produce novel integrations of HCI research [to make] a product that transforms the world from its current state to a preferred state.”

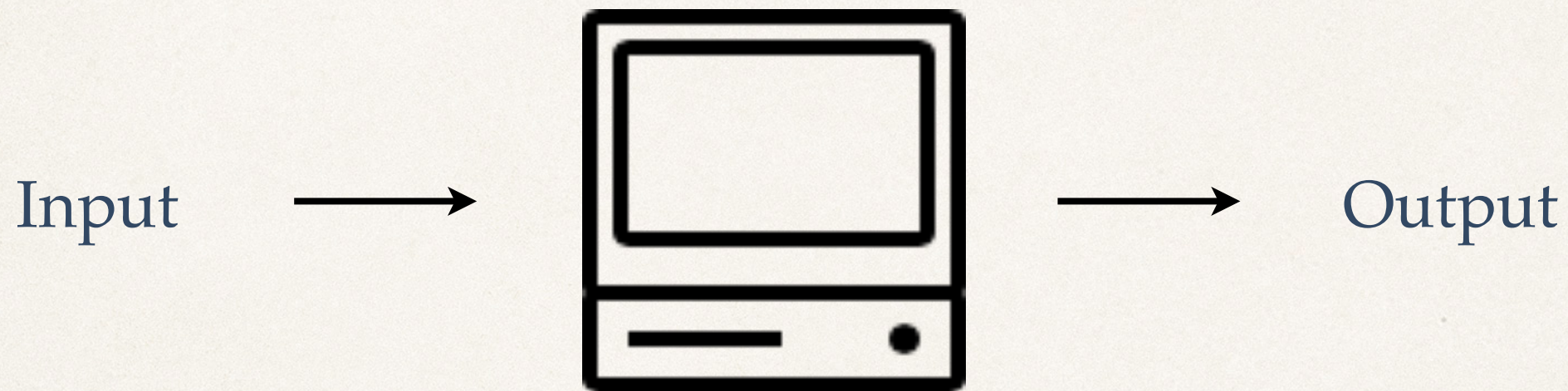
Zimmerman et al., CHI 2007

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

“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

**Claim: computers can never be the be-all and end-all
to promoting human values rooted in intrinsically
valuable human activities [Z., 2024]**



Computers encode consequentialist thinking

Claim: computers can never be the be-all and end-all to promoting human values rooted in intrinsically valuable human activities [Z., 2024]

Searching for the Non-Consequential: Dialectical Activities in HCI and the Limits of Computers

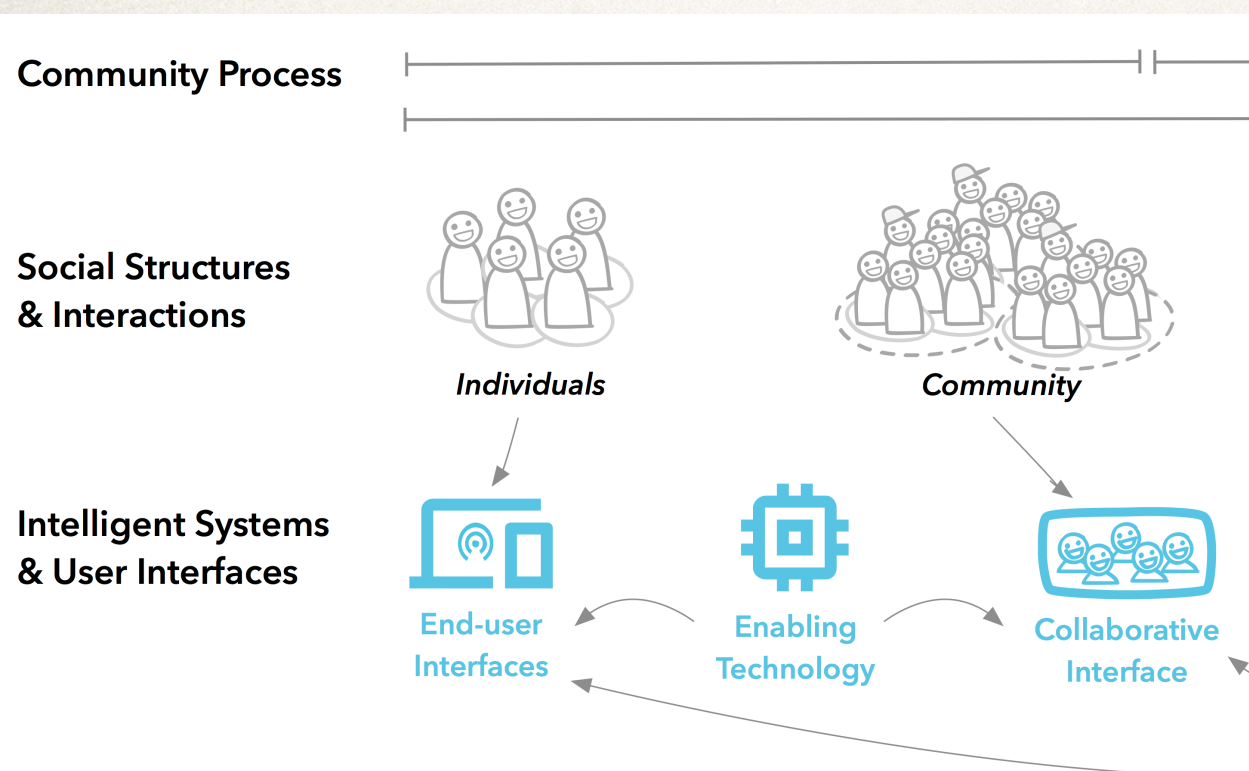
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ABSTRACT

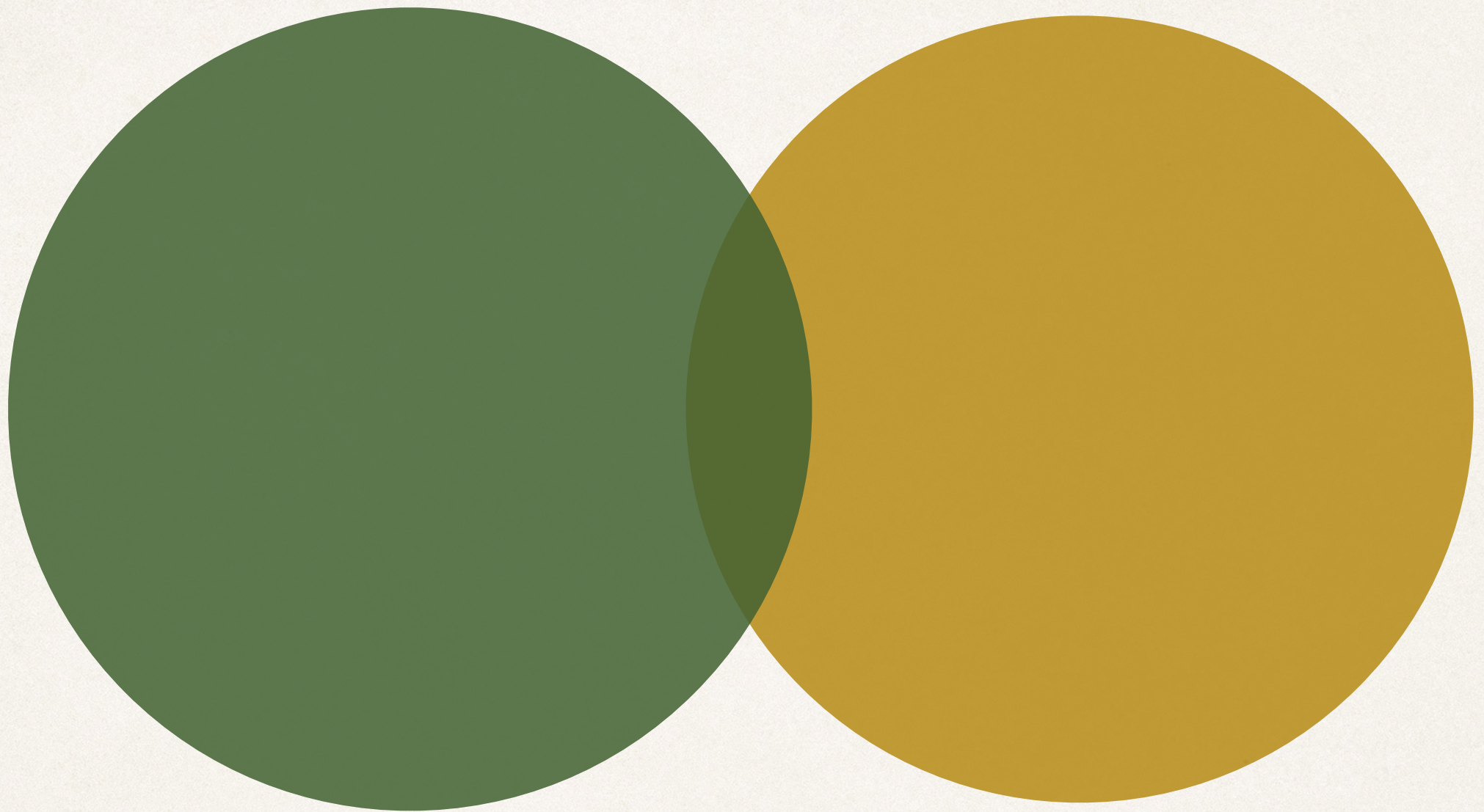
This paper examines the pervasiveness of consequentialist thinking in human-computer interaction (HCI), and forefronts the value of non-consequential, dialectical activities in human life. *Dialectical activities* are human endeavors in which the value of the activity is intrinsic to itself, including being a good friend or parent, engaging in art-making or music-making, conducting research, and so on. I argue that computers—the ultimate consequentialist machinery for reliably transforming inputs into outputs—cannot be the be-all and end-all for promoting human values rooted in dialectical activities. I examine how HCI as a field of study might reconcile the consequentialist machines we have with the dialectical activities we value, and propose *computational ecosystems* as a vision for HCI that makes proper space for dialectical activities.

But while the HCI mission of using computational technologies to shape the world to meet our needs and desires rolls on full steam, questions to the very idea of focusing on the production of desired ends remain largely unanswered. As is the case in our culture, much of HCI research and practice is rooted in *consequentialist thinking*: reasoning about actions as means for achieving desired outcomes and ends. But as philosophers have contested across millennia, certain quintessential human values, activities, and ways of being cannot be easily reconciled nor understood through the consequentialist lens. For instance, *dialectical activities* [25], or activities whose values are rooted in the intrinsic nature of the activity itself and that are revealed only through repeated engagement with the activity—such as parenting, being a good friend, engaging in art-making and other creative pursuits, conducting research—do not easily reduce to producing certain desired outcomes. Continued

The real value of computational ecosystems is not “merely” consequential

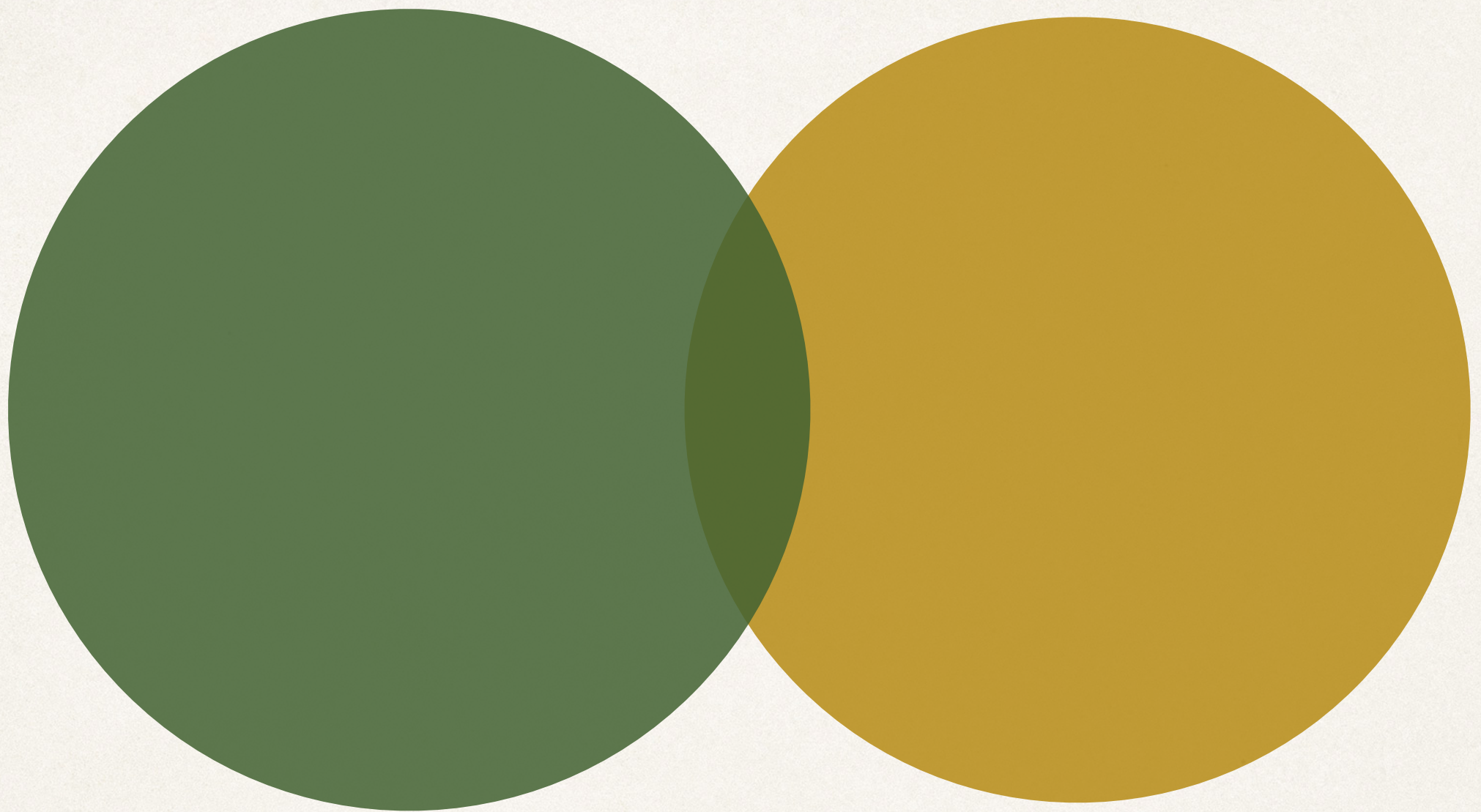


- ❖ Computational Ecosystems produce desired goods and services; they solve consequential problems
- ❖ Computational Ecosystems promote engagement in intrinsically valuable human activities

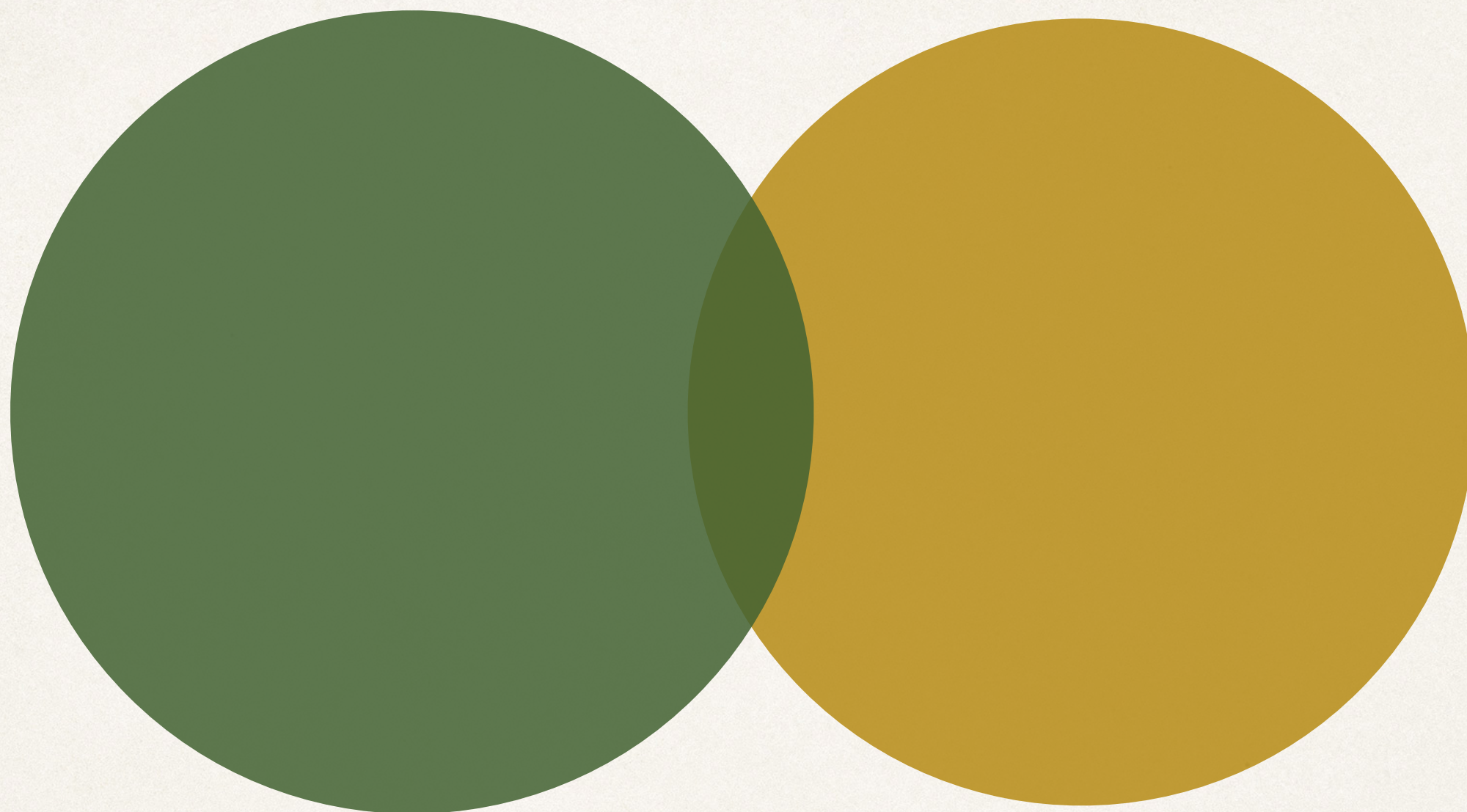


**Values you wish
to scale**

**Technological
solutions**



**“Technological
values”**

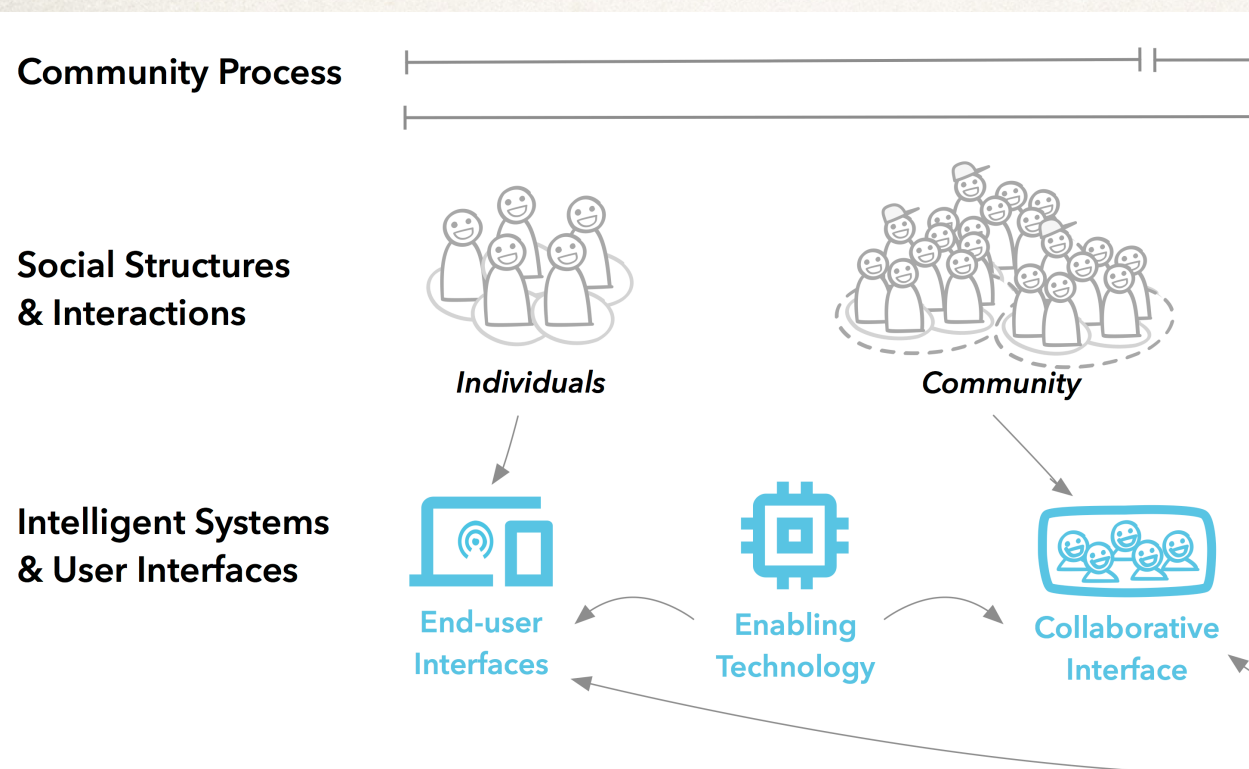


Values you wish to scale

Mindful of values.

Accept the limits of technology.

Learn to scale.



❖ **Ecological thinking:** create sustainable processes and interactions that foreground the intrinsic value of human engagement

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

Cobi

Community Informed Planning



Paul André
CMU



Anant Bhardwaj
MIT



Lydia Chilton
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Juho Kim
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Steven Dow
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David Karger
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Rob Miller
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Nneoma Oradiegwu
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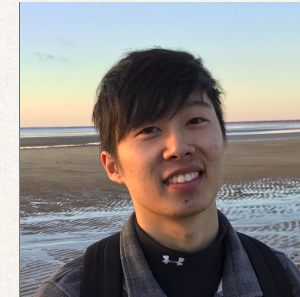
Situated Practice Systems



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thank you



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