A PhD Thesis Presentation in 10 Questions
Hannes Hofmann
2021

The Coprofessional Practice of Design

An Exploratory Analysis on Teams of Architects and Structural Engineers in Swiss Architecture Competitions

ETH zürich DARCH structural design

Question 1 / 10

Why did I study
teams of architects and structural engineers?

Our built environment faces multiple demands

Firmitas
solid, durable, resource-saving, ...

Utilitas
useful, value-adding, sustainable, ...

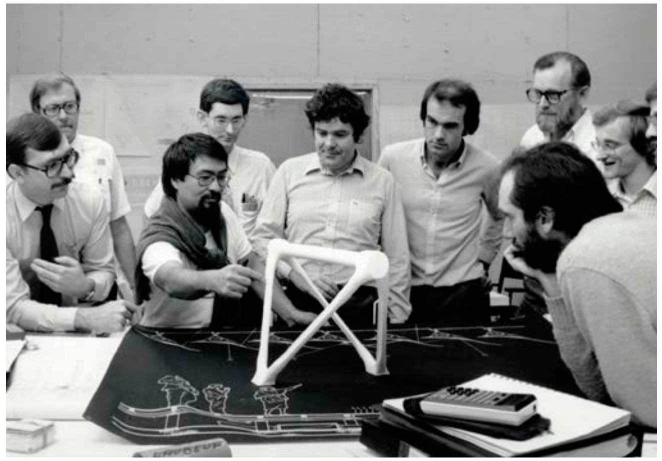
Venustas
beautiful, inspiring, subtle, ...

Sources: Vitruvius. De architecture libri decem, 33 - 22 BC.
Vittorio Magnago Lampugnani. Brauchbarkeit, Werthaltigkeit, Schönheit, Neue Zürcher Zeitung, 02.08.2013
cap.img.pmdstatic.net; www.emanuelegentile.it; www.telerama.fr

Building design includes experts with heterogeneous knowledge

Gary Cooper as architect Howard Roark
Movie still “The Fountainhead”, 1949

Fuller, Hunt, Foster, et al.
Samuel Beckett Theatre, 1971



Ishida, Barker, Rice, Noble, Piano, et al.
Menil Collection, 1984

Sources: (middle) www.abc.es/cultura/arte/buckyfuller-201009090000_noticia.html
(right) www.ricedesignalliance.org/on-engineering-the-menil-and-other-houston-landmarks-a-profile-of-larry-whaley-by-dan-singer

Architects and structural engineers

Structure strongly contributes to the overall building scheme

Wright, Peters
Johnson Wax Building, Racine, 1939

Piano, Rogers, Rice
Centre Pompidou, Paris, 1978

Koolhaas, Balmond
Maison à Floirac, Bordeaux, 1998

Sources: (left) www.miriamhavelin.com
(middle) www.artnexus.com/en/magazines/see/5d61e3ceeb5c0578bcec432d/104
(right) www.thoughtco.com/maison-a-bordeaux-rem-koolhaas-178058, photo by Ila Bêka and Louise Lemoine

Architect and structural engineer form the core of the planning team already at the beginning of the design process

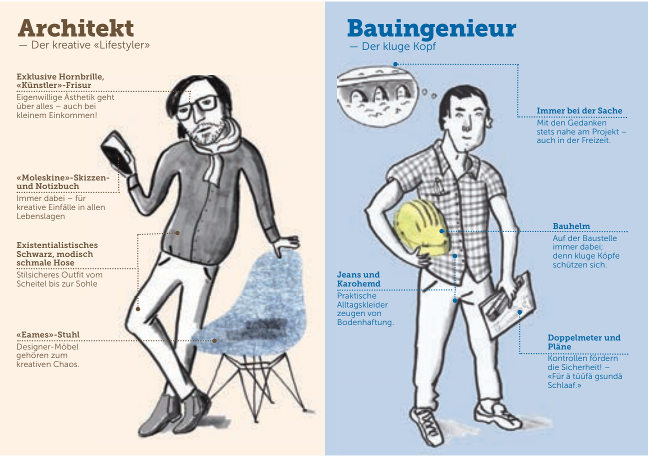
Peters, Wright, Masselink
Taliesin, 1955

Rice, Piano, Rogers
Centre Pompidou, 1976

Balmond, Koolhaas
Location and date unknown

Sources: (left) www.guggenheim.org/blogs/checklist/the-two-williams-who-helped-build-the-guggenheim
(middle) www.archpaper.com/2020/09/remembering-the-long-career-of-richard-rogers/
(right) www.architectuur.org/xlfotonieuws.php?pr=3220&id=1&nr=1

Architect and structural engineer are surrounded by contrary worlds



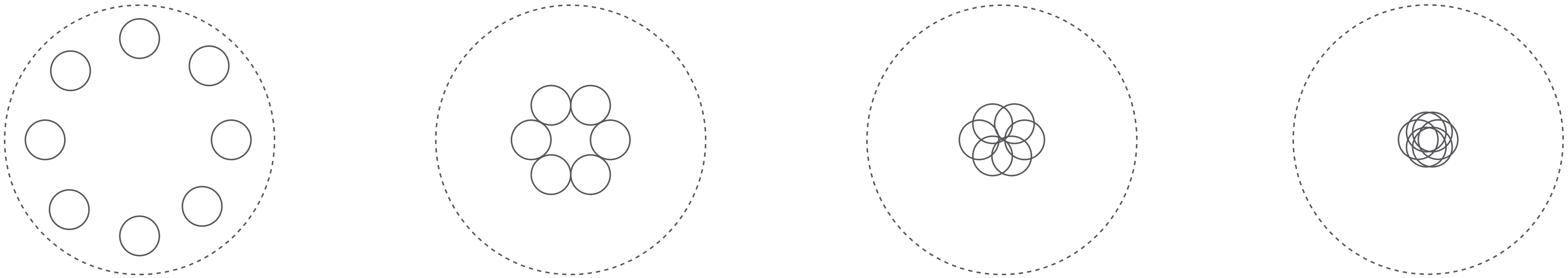
Study guide
ETH Zurich, 2014

Architecture office
BIG Architects, 2015

Structural engineering office
Schnetzer Puskas Ingenieure, 2021

Sources: (left) ETH Zurich. Editorial Office Architecture and Civil Engineering Studies, September 2014
(middle) https://gestion.pe/tu-dinero/inmobiliarias/aire-oficinas-genera-problemas-parecen-atontarnos-103819-noticia/
(right) www.oskarvonmillerforum.de/en/programme/event/cal/event/detail/vortrag-26/2021/january/28.html

Multiple forms of relationships evolve when working together

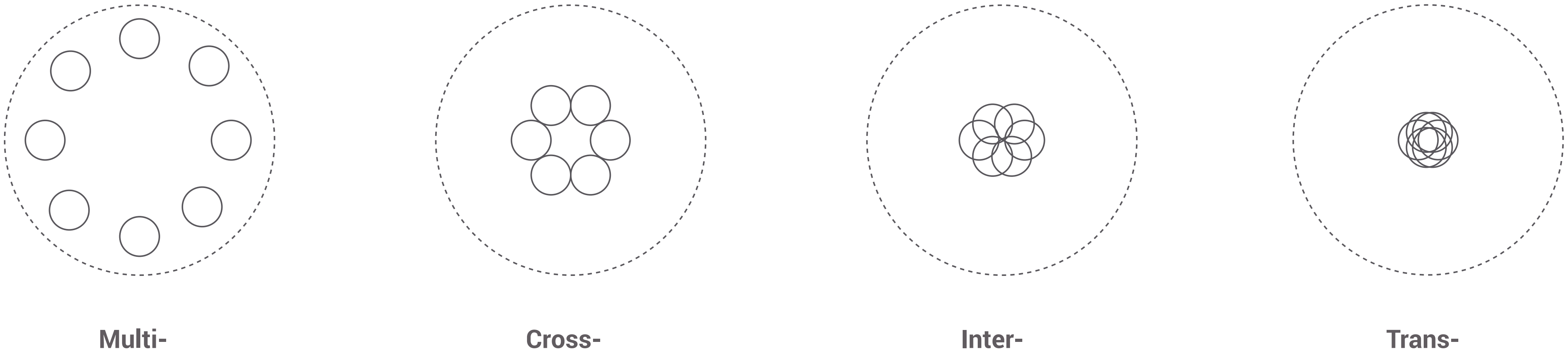


Multi- **Cross-** **Inter-** **Trans-**

- disciplinary
- professional
- functional
- ...

Source: Cooke, S. et al. (2020). Diverse perspectives on interdisciplinarity from Members of the College of the Royal Society of Canada. FACETS, 5, 138–165.

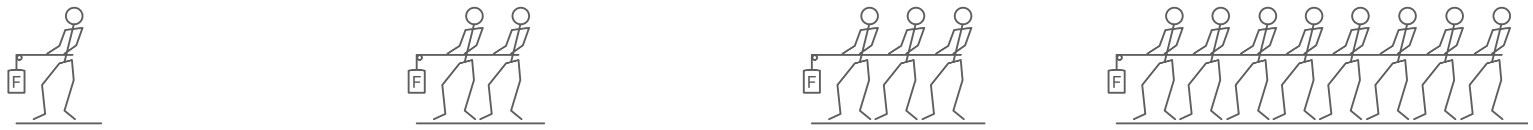
"Coprofessional" includes all forms of relationship, and focuses on professions rather than academic disciplines



- disciplinary
Co - professional
- functional
- ...

Source: Cooke, S. et al. (2020). Diverse perspectives on interdisciplinarity from Members of the College of the Royal Society of Canada. FACETS, 5, 138–165.

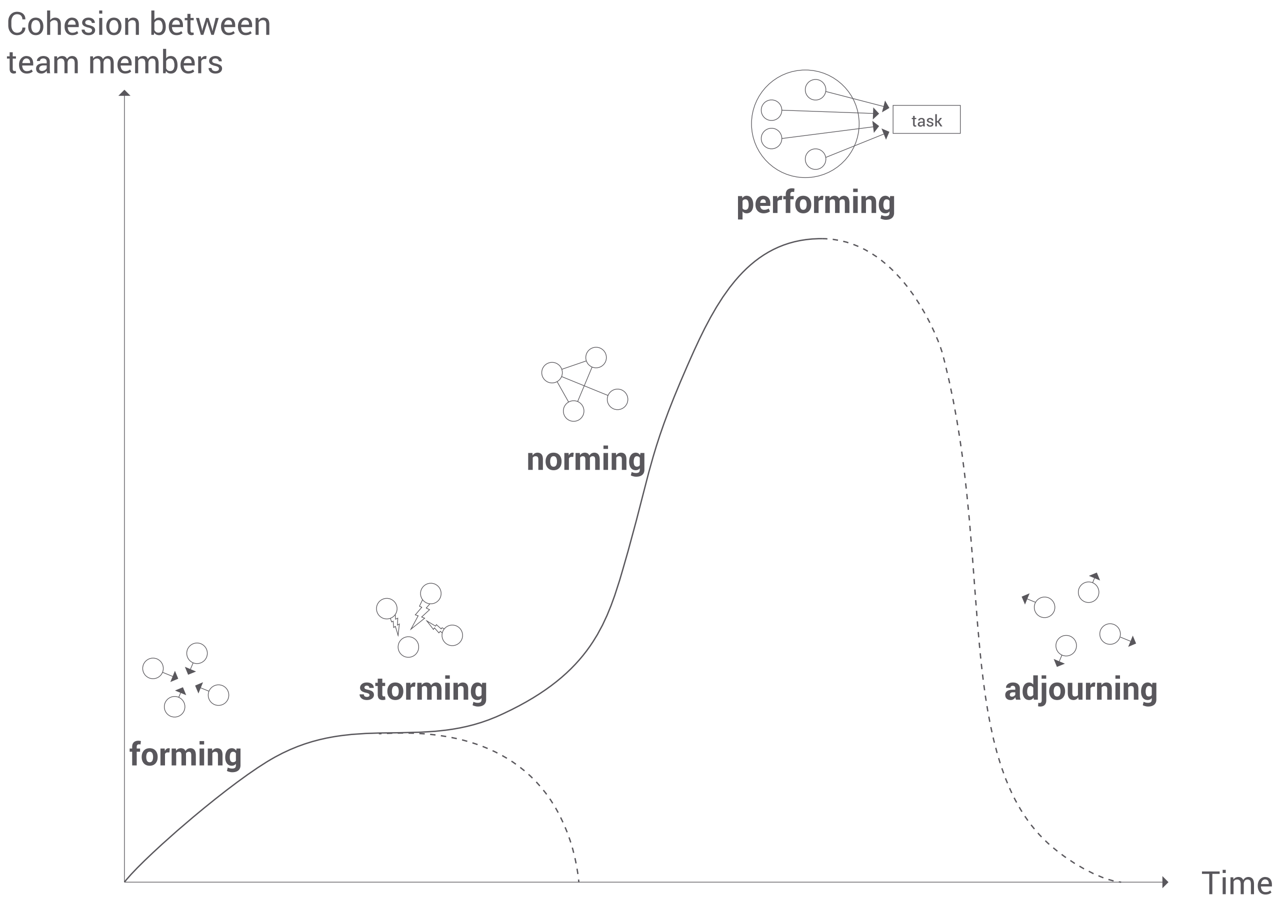
If not set right, teams suffer from various process losses



Amount people	1	2	3	8
Weight F	63 kg	118 kg	160 kg	248 kg
Individual performance	**100 %**	**93 %**	**85 %**	**49 %**

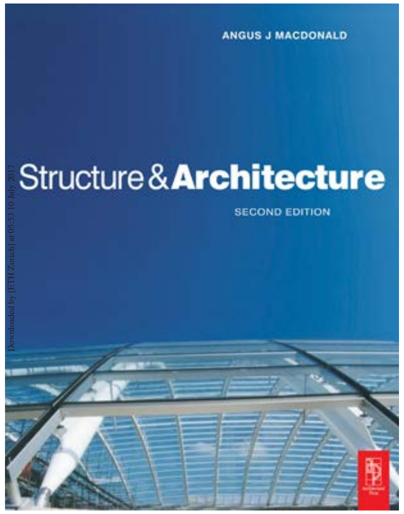
Experimental setup for the Ringelmann effect, after:
Ringelmann, M. (1913). Recherches sur les moteurs animés. Travail de l'homme. In: Annales de l'Institut National Agronomique, 2e série, tome XII

Working in a team is more than just working on a task together

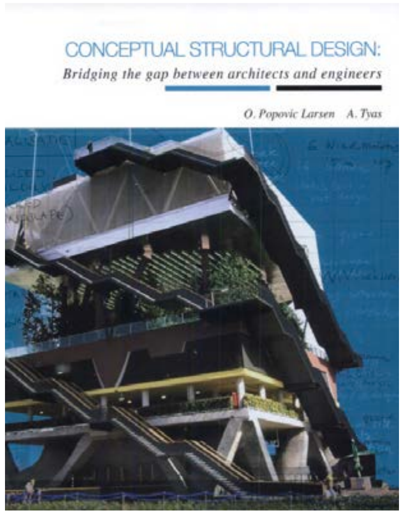


Sources: Tuckman, B. W. (1965). Developmental sequence in small groups. Psychological Bulletin, 63(6), 384–399.
Tuckman, B. W., & Jensen, M. A. (1977). Stages of small-group development revisited. Group & Organization Studies, 2(4), 419–427.

Existing publications focus on buildings, and less on the team



Macdonald
(2001)



Larsen, Tyas
(2003)

Rappaport
(2007)

Flury
(2012)

Olsen, Mac Namara
(2014)

Sources: Macdonald, A. J. (2001). Structure and architecture (2nd ed). Oxford : Architectural Press.
Larsen, O. P., & Tyas, A. (2003). Conceptual Structural Design: Bridging the gap between architects and engineers. Thomas Telford Publishing.
Rappaport, N. (2007). Support and resist : structural engineers and design innovation. New York : Monacelli Press.
Flury, A. (2012). Kooperation : zur Zusammenarbeit von Ingenieur und Architekt.
Olsen, C., & Mac Namara, S. (2014). Collaborations in architecture and engineering. Collaborations in Architecture and Engineering,

Teams of architects & engineers face a fundamental dilemma

Building design has to solve multiple demands

↓

Architect and structural engineer have to combine heterogeneous knowledge

↓

Working in a coprofessional team is necessary

↓

The complexity of working in a coprofessional team is unexplored

↓

Today's coprofessional teams apply a trial-and-error approach to teamwork

↓

Teams of architects and structural engineers often do not reach their full potential

Source: www.architectmagazine.com/practice/kierantimberlakes-new-sandbox_o

My research introduces a model to overcome this dilemma

- The descriptive model supports a better understanding of team processes in teams of architects and structural engineers
- The exploration and description of these processes in my research lays the groundwork for the model
- By understanding team processes better through the model, teams of architects and structural engineers easier reach their full potential

Source: Haus-Rucker-Co, Grüne Lunge (Green Lung), outdoor installation at Kunsthalle Hamburg, 1973. Courtesy Archive Zamp Kelp. Photo: Haus-Rucker-Co

How did I study
teams of architects and structural engineers?

My research uses methods from social psychology

Semi-structured interviews

- 27 interviews with 17 architects and 10 structural engineers
- Interviews between 45 to 90 minutes, conducted Aug. 2018 to Feb. 2019

Cognitive mapping- interviews

- 23 cognitive mapping- interviews with 15 architects and 8 structural engineers
- Interviews between 15 to 30 minutes, conducted Aug. 2018 to Feb. 2019

Observations of design meetings

- 4 teams with 7 design meeting observations
- Observations between 36 to 127 minutes, conducted Dec. 2018 to March 2019

My research builds on a Swiss culture of coprofessional teams

Meili Peter, Conzett
Mursteg, Murau, 1995

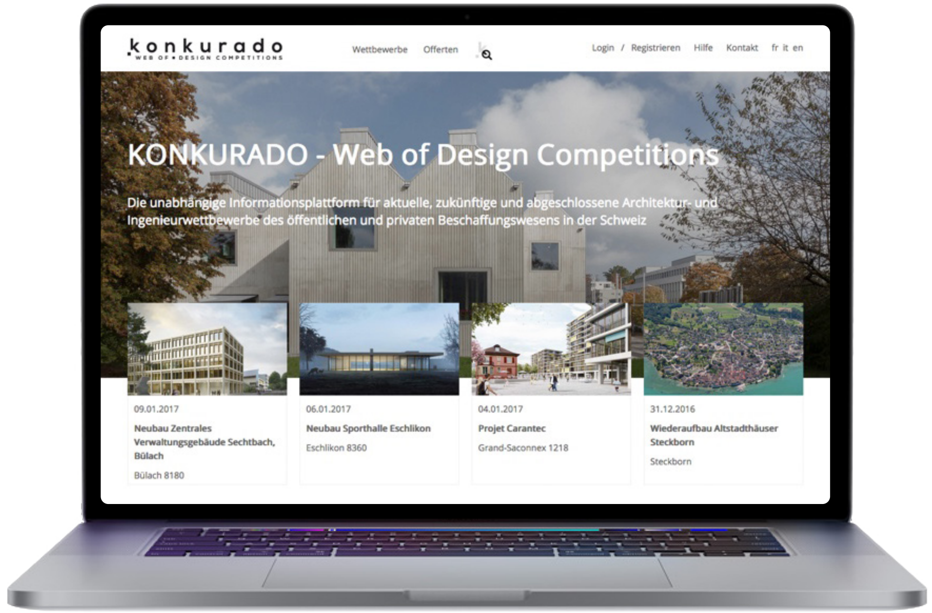
Kerez, Schwartz
House Forsterstrasse, Zurich, 2003

Vacchini, Fürst Laffranchi
Sports hall Mülimatt, Windisch, 2010

Sources: (left) Conzett, J., Meili, M., & Peter, M. (1995). Raumbrücke : Mursteg in Murau/Steiermark. Werk, Bauen + Wohnen,
(middle) www.subtilitas.site/post/156949653449/christian-kerez-apartment-building-on
(right) Lensing, T. (2011). Großes Faltwerk aus einem Guss. Bauwelt, 10, 26–35.

The Swiss competition culture offers an institutionalized early-design-stage with highly motivated coprofessional teams

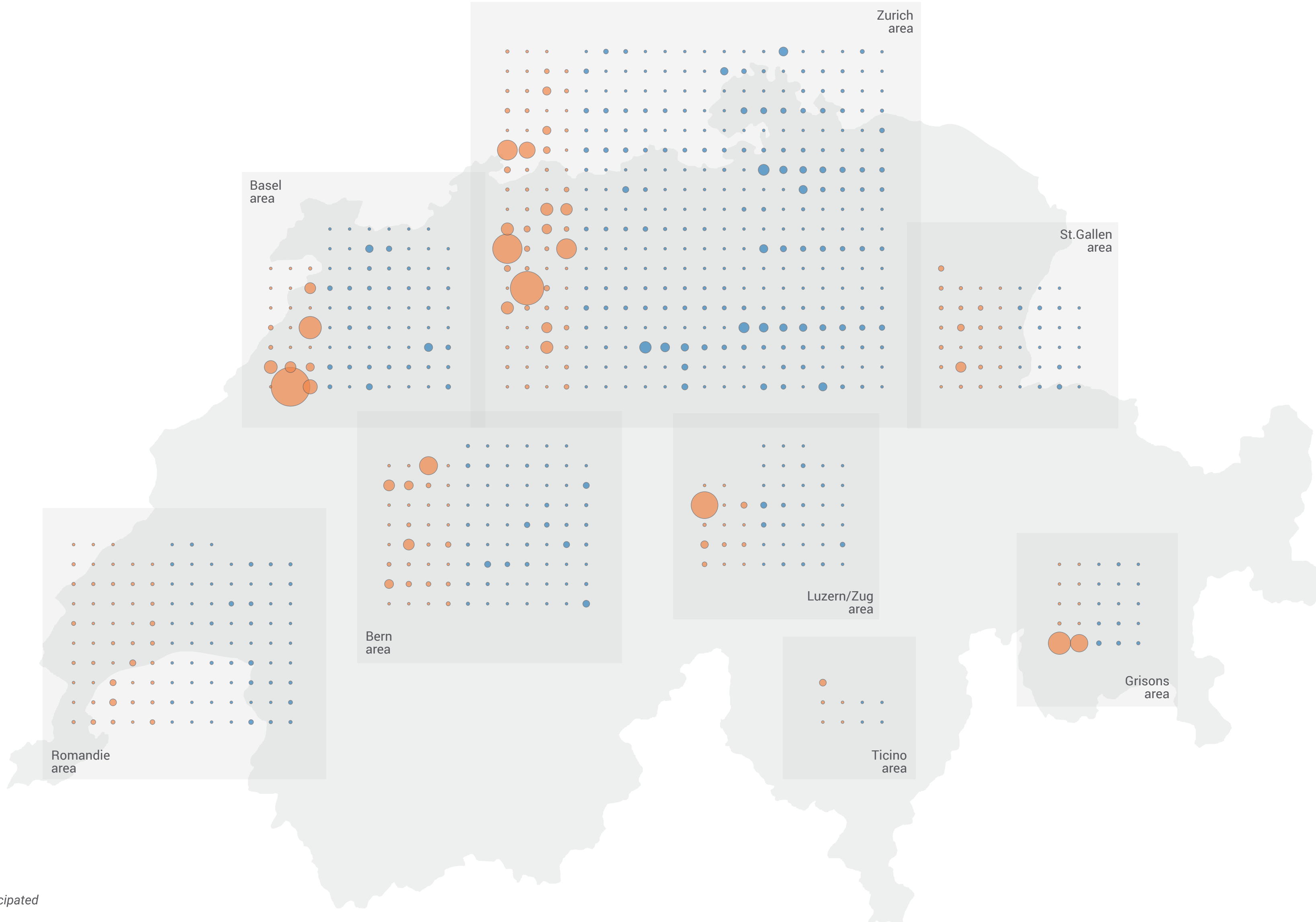
“The architectural competition is a cultural asset.”
Exhibition Main Station Zurich, 2008



Publication and archive of competitions
Website konkurado.ch, 2020

Sources: (left) www.espazium.ch/de/aktuelles/architekturwettbewerbe-sind-wissensgeneratoren
(right) https://konkurado.ch

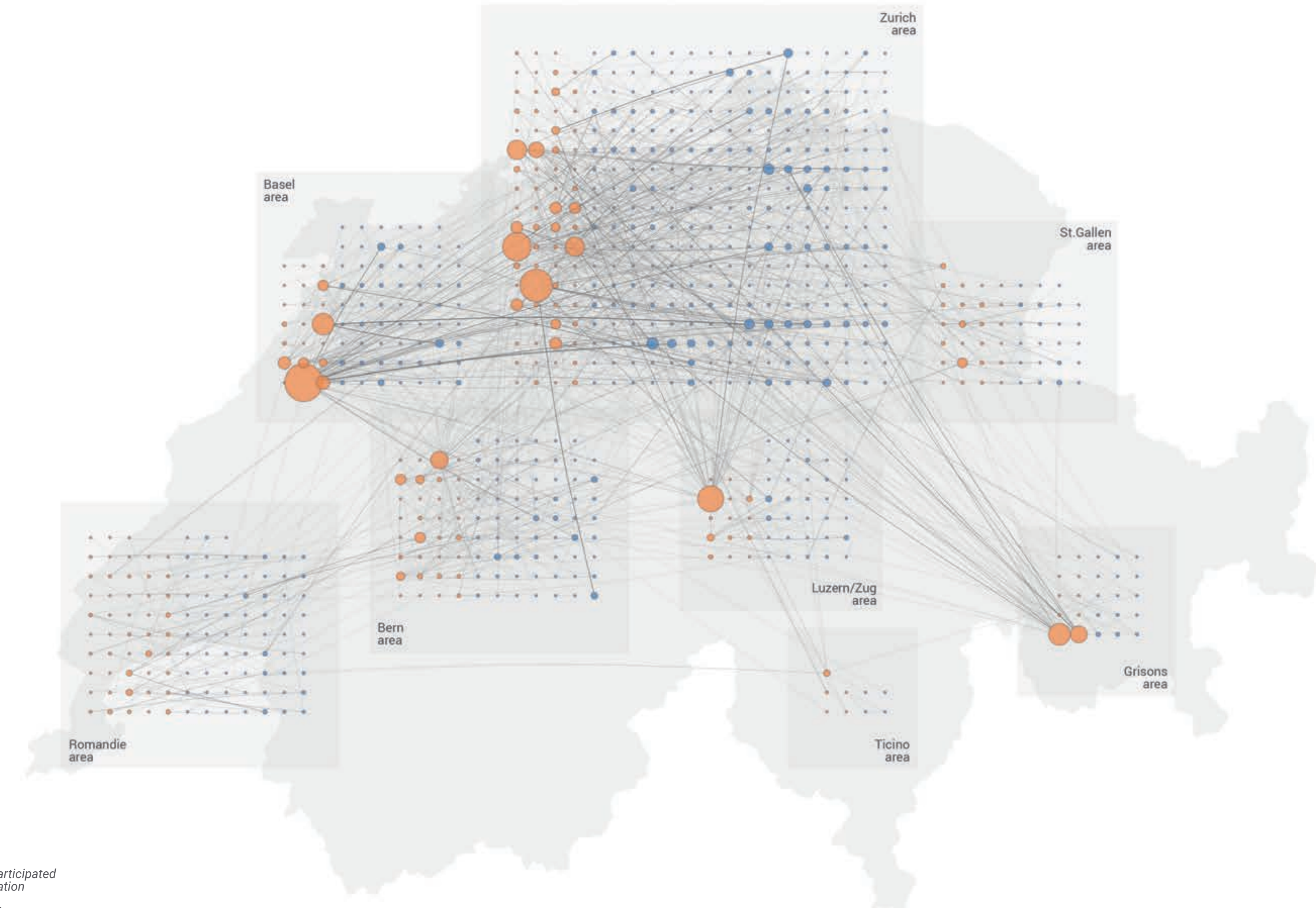
>700 architecture and engineering offices participate in competitions



Legend:
Engineering office
Architecture office
Amount of competitions participated
Data source: konkurado.ch.
Data time frame: 2014 to 2019.
Image by author.

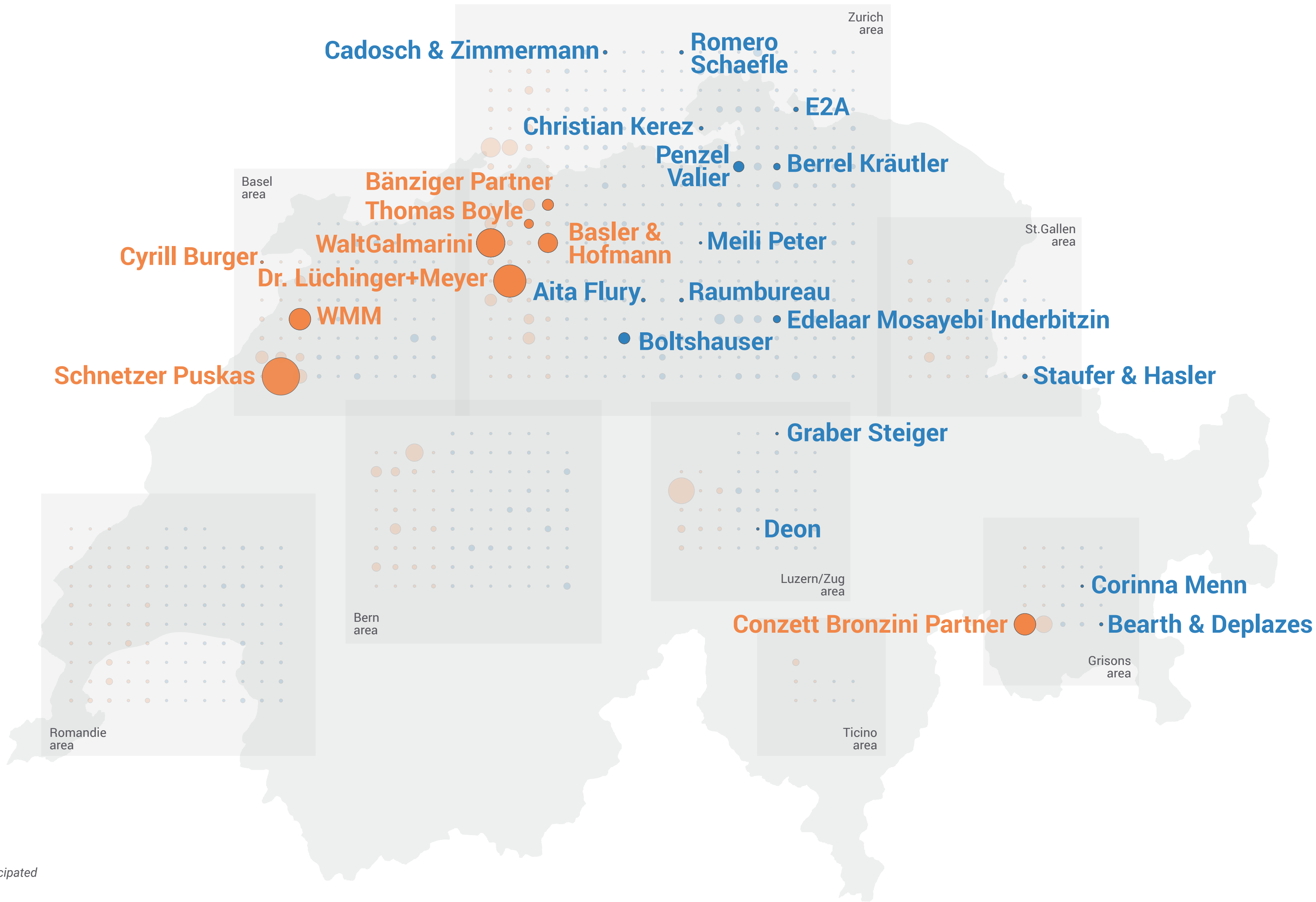
How to study teams

Architects and structural engineers form >1000 team compositions



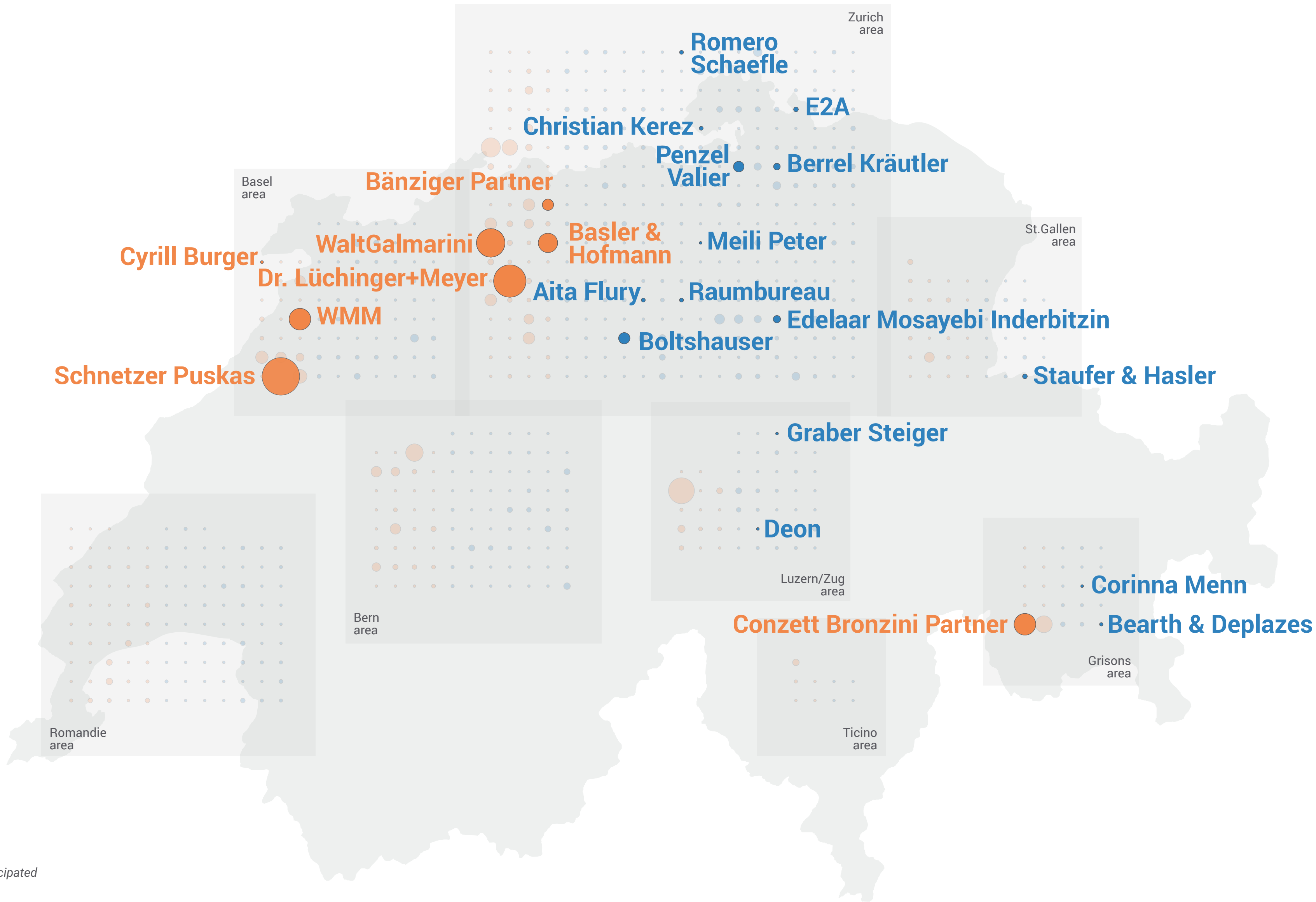
Legend:
Engineering office
Architecture office
Amount of competitions participated
Competition team participation
Data source: konkurado.ch.
Data time frame: 2014 to 2019.
Image by author.

17 architects & 10 engineers with divers experiences were interviewed for this thesis



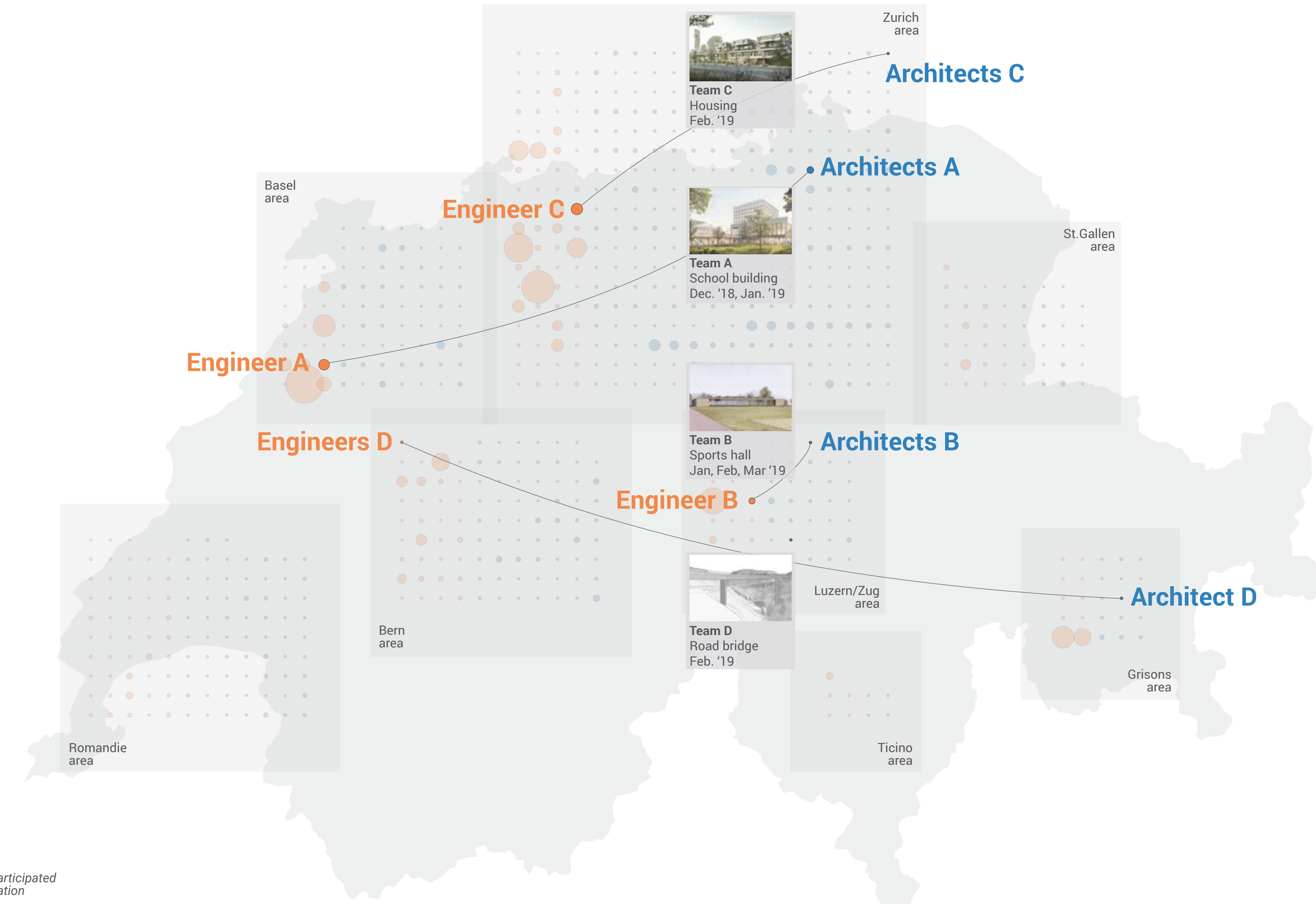
Legend:
Engineering office
Architecture office
Amount of competitions participated
Data source: konkurado.ch.
Data time frame: 2014 to 2019.
Image by author.

15 architects and 8 structural engineers provided cognitive maps for this thesis



Legend:
Engineering office
Architecture office
Amount of competitions participated
Data source: konkurado.ch.
Data time frame: 2014 to 2019.
Image by author.

4 teams working on various competitions were observed in 7 meetings

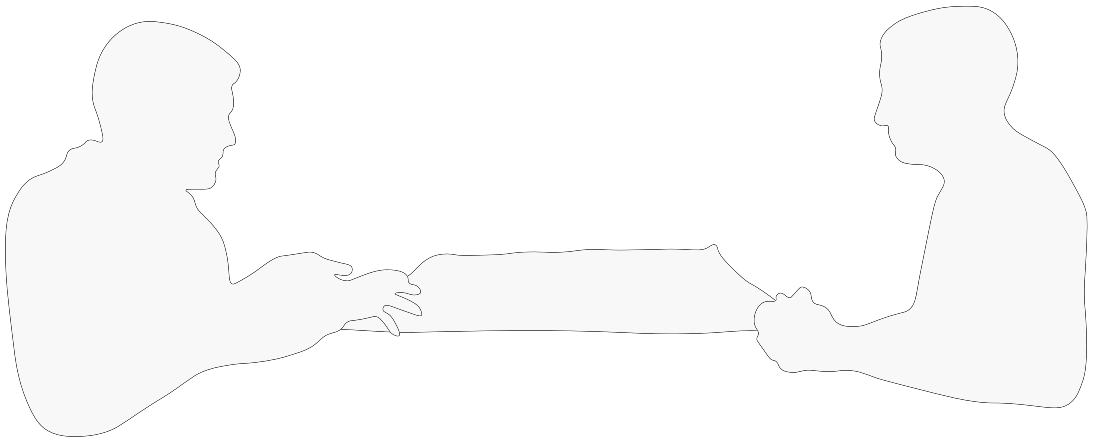


Legend:
Engineering office
Architecture office
Amount of competitions participated
Competition team participation
Data source: konkurado.ch.
Data time frame: 2014 to 2019.
Image by author.

What underlying framework did I develop in order to study teams of architects and structural engineers working on Swiss architecture competitions?

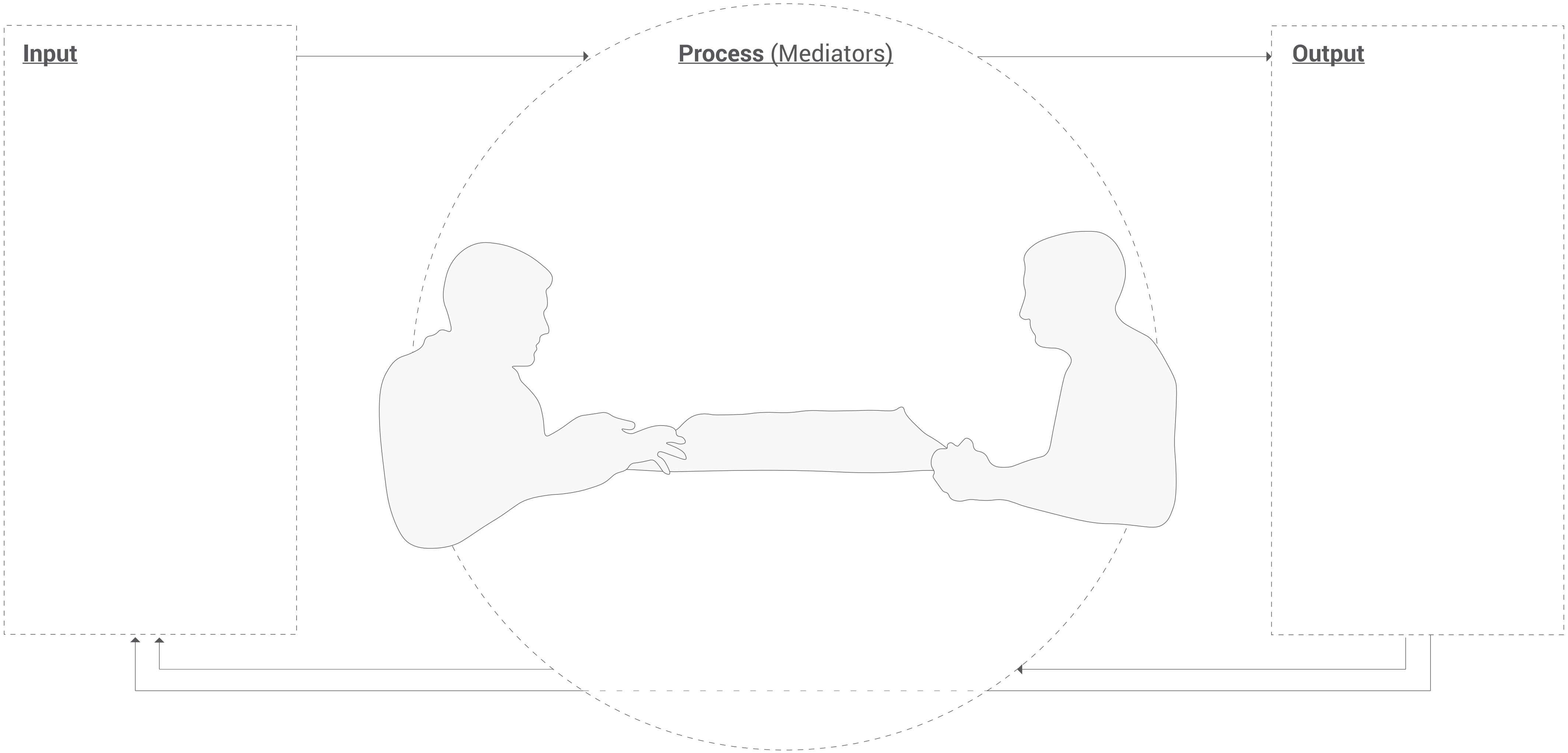
Underlying framework

A team is a group of two or more people working on a mutual task



Source: Forsyth, D. R. (2010). Group Dynamics (5th ed.). Wadsworth Cengage Learning.

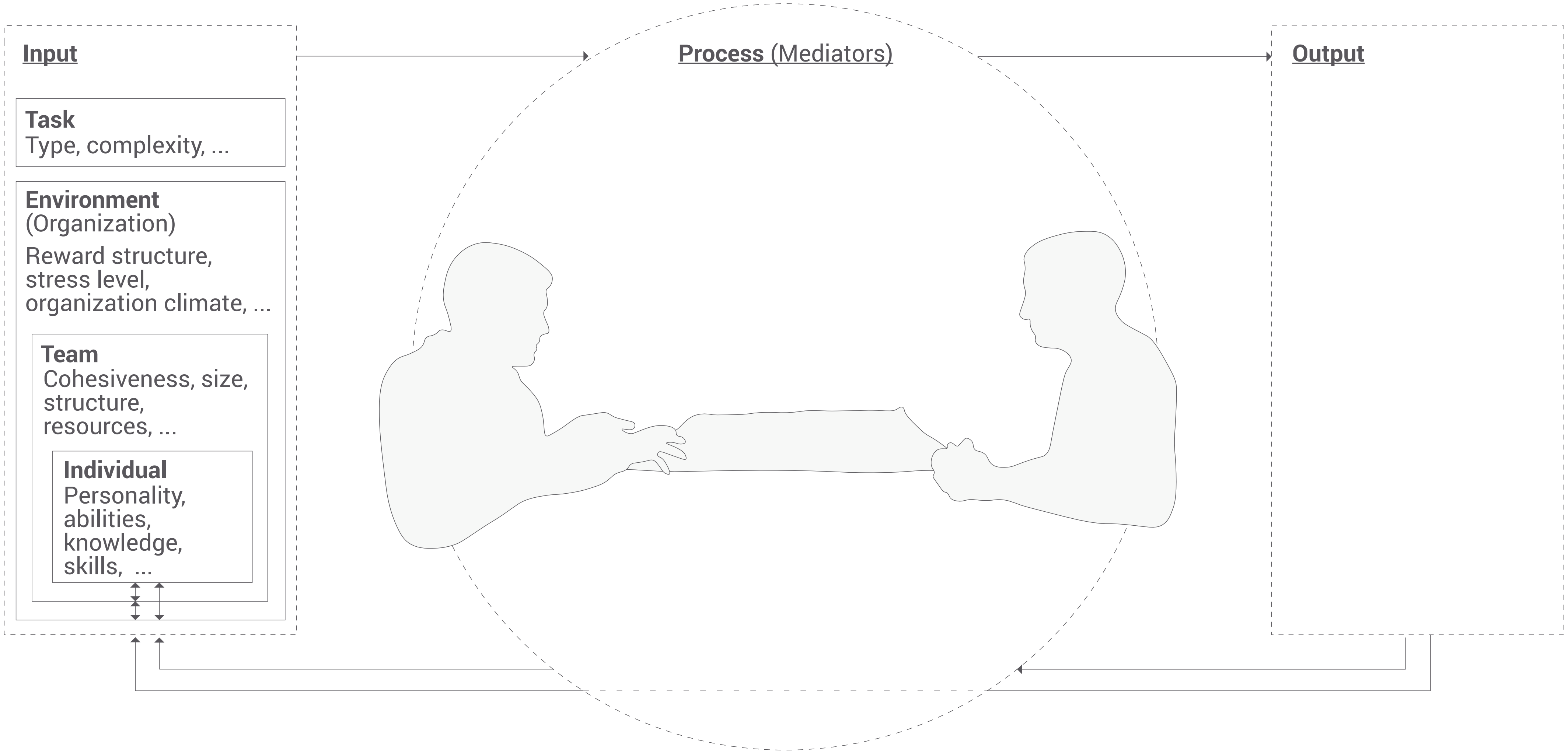
A team resembles a system with inputs, processes and outputs



Sources: Hackman, J. R., & Morris, C. G. (1975). Group tasks, group interaction process, and group performance effectiveness: A review and proposed integration. Advances in Experimental Social Psychology, 8(C), 45–99.
Mathieu, J., Maynard, M. T., Rapp, T., & Gilson, L. (2008). Team Effectiveness 1997-2007: A Review of Recent Advancements and a Glimpse Into the Future. Journal of Management, 34(3), 410–476.

Underlying framework

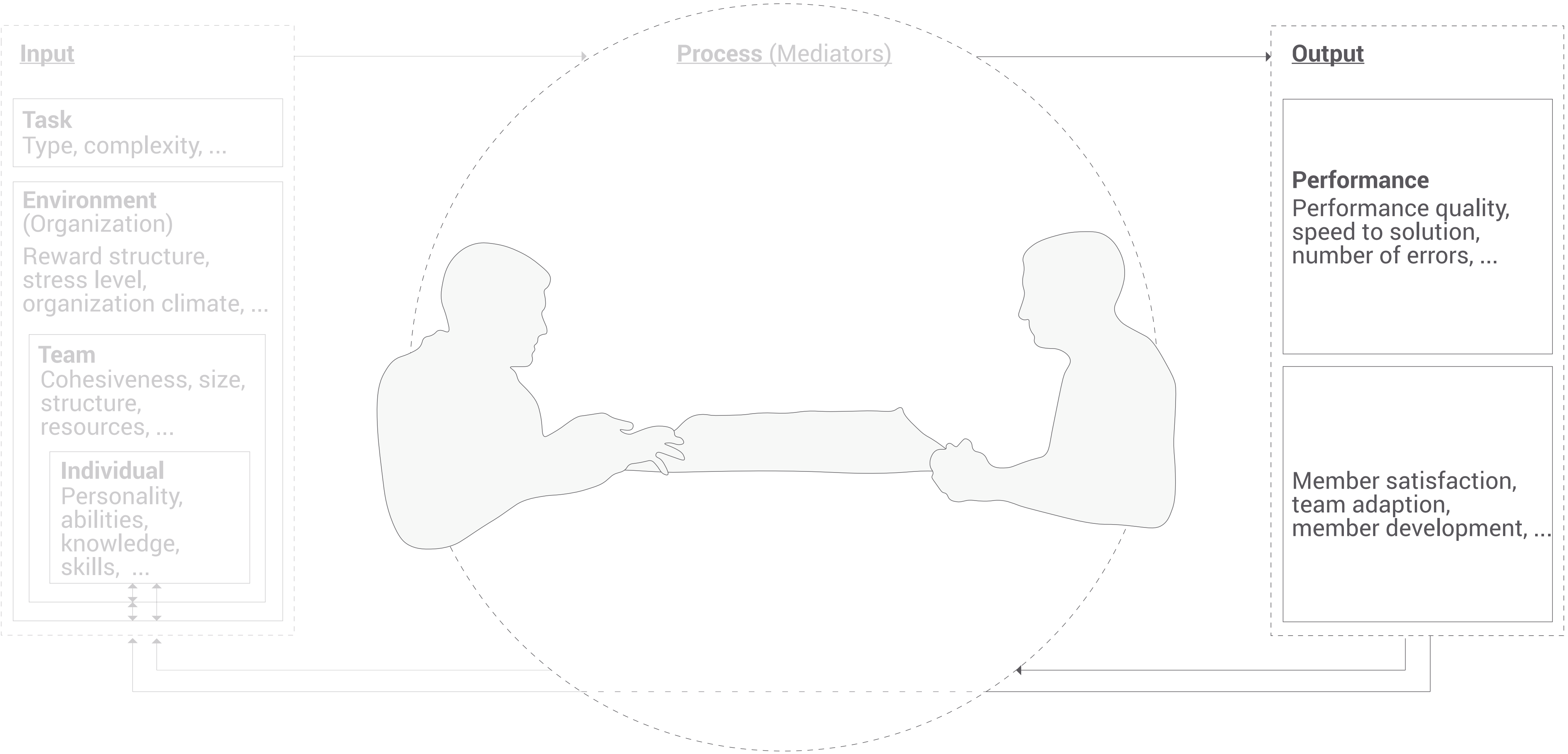
Inputs come from task, environment, team, and team members



Sources: Hackman, J. R., & Morris, C. G. (1975). Group tasks, group interaction process, and group performance effectiveness: A review and proposed integration. *Advances in Experimental Social Psychology, 8*(C), 45–99.
Mathieu, J., Maynard, M. T., Rapp, T., & Gilson, L. (2008). Team Effectiveness 1997-2007: A Review of Recent Advancements and a Glimpse Into the Future. *Journal of Management, 34*(3), 410–476.

Underlying framework

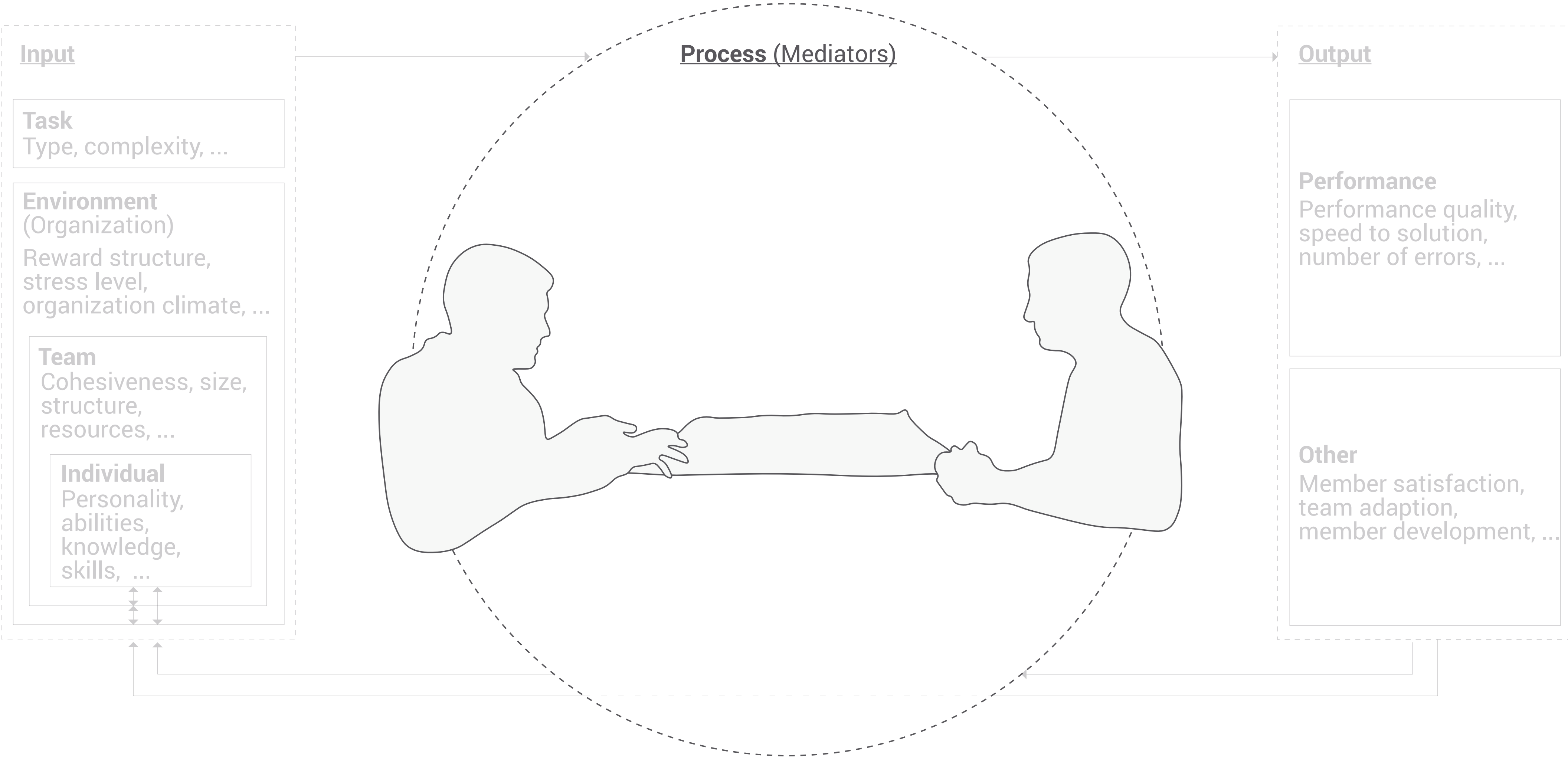
Outputs relate to performance and development



Sources: Hackman, J. R., & Morris, C. G. (1975). Group tasks, group interaction process, and group performance effectiveness: A review and proposed integration. Advances in Experimental Social Psychology, 8(C), 45–99.
Mathieu, J., Maynard, M. T., Rapp, T., & Gilson, L. (2008). Team Effectiveness 1997-2007: A Review of Recent Advancements and a Glimpse Into the Future. Journal of Management, 34(3), 410–476.

Underlying framework

Processes are fundamental actions of a team



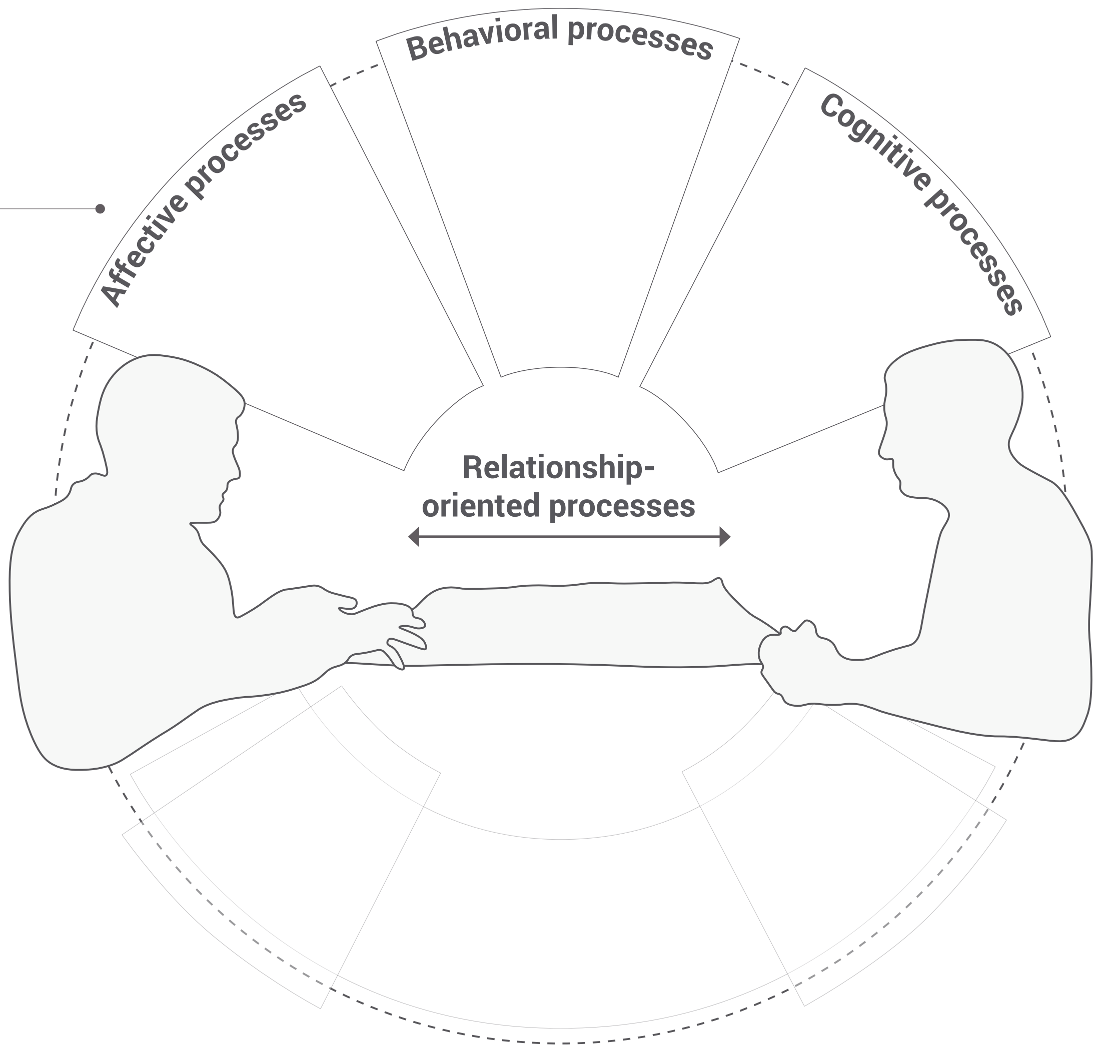
Sources: Hackman, J. R., & Morris, C. G. (1975). Group tasks, group interaction process, and group performance effectiveness: A review and proposed integration. Advances in Experimental Social Psychology, 8(C), 45–99.
Mathieu, J., Maynard, M. T., Rapp, T., & Gilson, L. (2008). Team Effectiveness 1997-2007: A Review of Recent Advancements and a Glimpse Into the Future. Journal of Management, 34(3), 410–476.
Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. (2001). A temporally based framework and taxonomy of team processes. Academy of Management Review, 26(3), 356–376.

Relationship-oriented processes focus on team members

Affective processes:
What teams feel
Moods and emotions among team members (cohesion, team confidence, trust, ...)

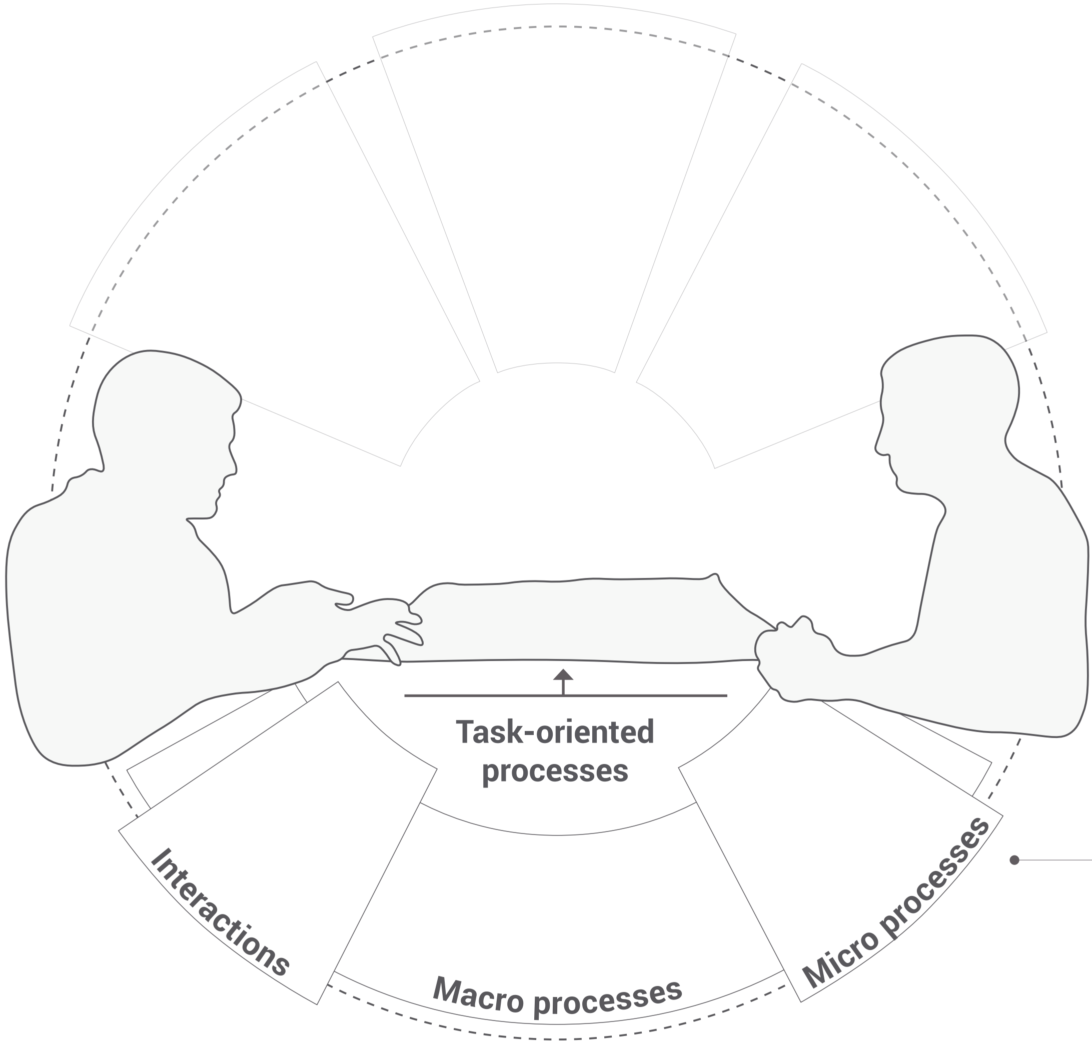
Behavioral processes:
What teams do
Coordination, evaluation, or planning of task-oriented processes

Cognitive processes:
What teams think
Team members' shared understandings and their ability to reflect upon own actions and adapt accordingly



Sources: Grossman, R., Friedman, S. B., & Kalra, S. (2017). Team Effectiveness Teamwork Processes and Emergent States. The Psychology of Team Working and Collaborative Processes, 245–269.

Task-oriented processes focus on accomplishing the task



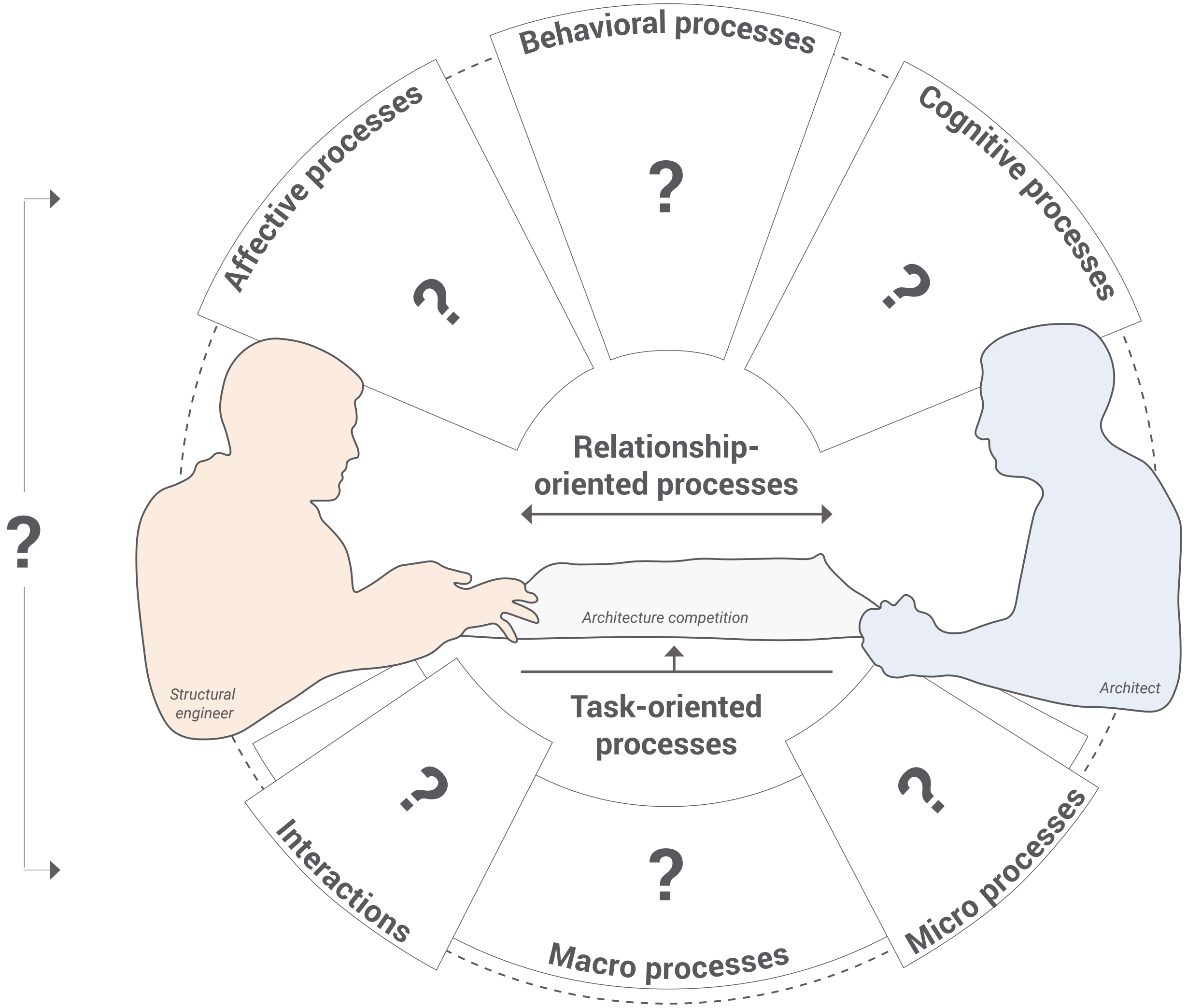
Macro processes:
High-level subdivision of task-oriented processes
E.g. in design teams:
Analyse - Define - Design - Finalise - Implement

Micro processes:
Short period of time with one intention
E.g. in design teams:
Problem definition - Idea generation - Idea Analysis - Idea evaluation - Idea selection

Interactions:
The form of engagement of team members regarding task-oriented processes
E.g. in design teams:
Loosely coupled - closely coupled

Sources: Gero, J. S., & Mc Neill, T. (1998). An approach to the analysis of design protocols. Design Studies, 19(1), 21–61.
Bobbe, T., Krzywinski, J., & Woelfel, C. (2016). A comparison of design process models from academic theory and professional practice. Proceedings of International Design Conference, DESIGN, DS 84, 1205–1214.
Stempfle, J., & Badke-Schaub, P. (2002). Thinking in design teams - An analysis of team communication. Design Studies, 23(5), 473–496.
Kvan, T. (2000). Collaborative design: what is it? Automation in Construction, 9(4), 409–415.

Team processes are unknown for teams of architects and structural engineers



What are my findings about relationship-oriented processes in teams of architects and structural engineers working on Swiss architecture competitions?

My thesis explores relationship-oriented processes with 2 methods

Semi-structured interviews

Allow to give voice to the people who actually experience relationship-oriented processes

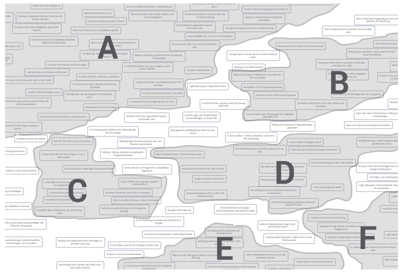
Cognitive mapping- interviews

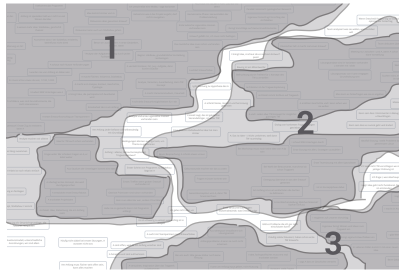
Observations of design meetings

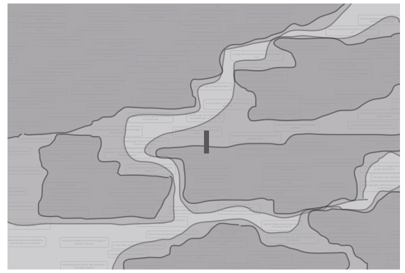
Provide unfiltered and direct insights to the actual events

Semi-structured interviews are analyzed with an axial-coding method

Semi-structured interviews → **Representative 1st Order Data** → **1st Order Concepts** → **2nd Order Themes** → **Overarching Dimensions**







Written transcripts of 27 semi-structured interviews

Collection of 1714 quotes, maintaining the integrity of informant-centric terms

Development of a comprehensive compendium of 1st-order terms

Organization of 1st-order codes into 2nd-order (theory-centric) themes

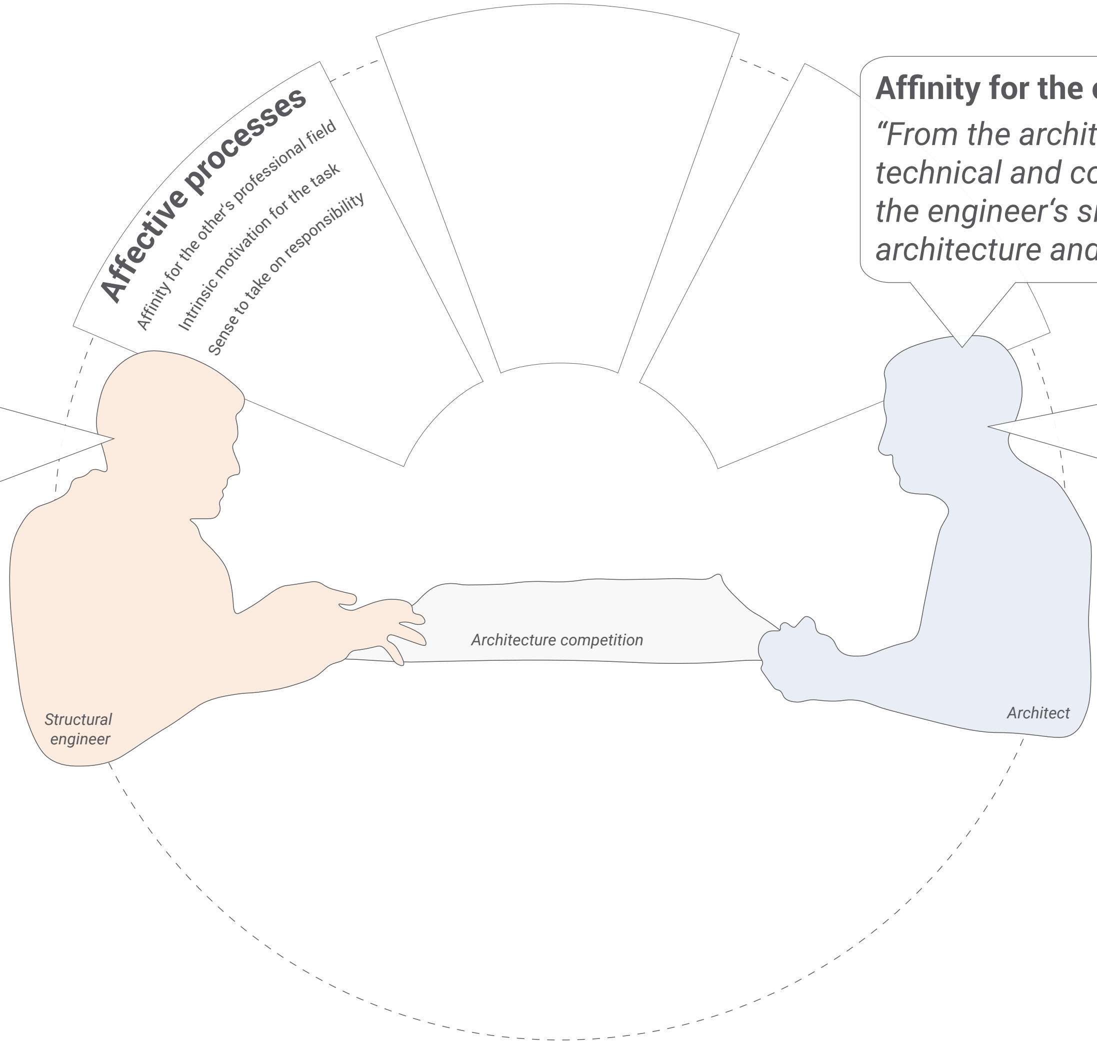
Distillation of 2nd-order themes into overarching theoretical dimensions

Source: Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology. Organizational Research Methods, 16(1), 15–31.

Team members feel for the other profession and the task

Strong sense to take on responsibility

"It's not that I want the boss at the table, but the person who is responsible for the competition, otherwise I get mails and back and forth again." (Engineer 4)



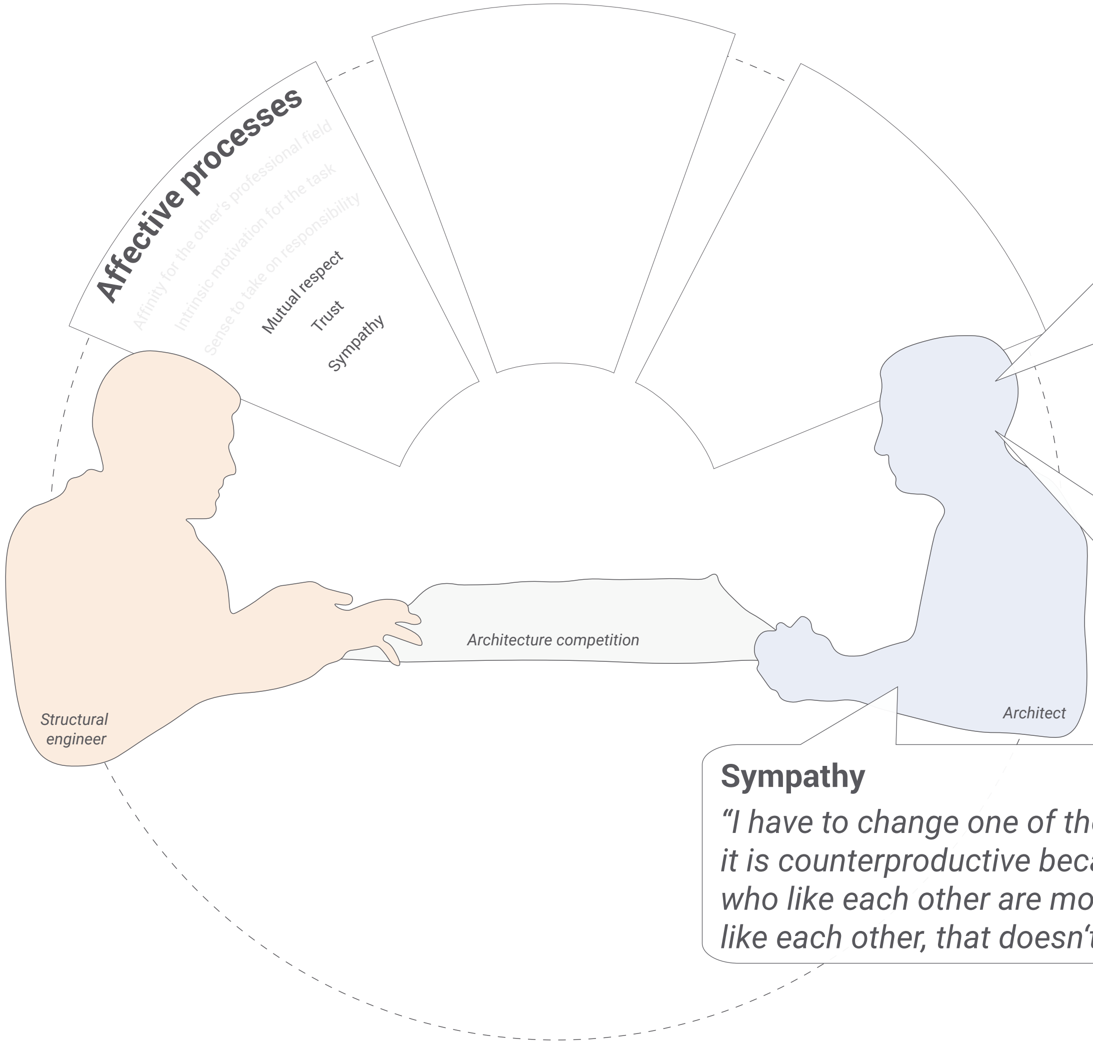
Affinity for the other's professional field

"From the architect's side there is an affinity for technical and constructive questions, and from the engineer's side there is a great interest in architecture and design." (Architect 8)

Intrinsic motivation for the task

"The most important activity, both as an architect and as an engineer, is which task you want to work on, what interests you and for which task you are motivated." (Architect 6)

Team members show respect, trust, and sympathy



Mutual respect
“There is mutual respect for the areas of competence, which one also does not want to exceed or strain.” (Architect 12)

Trust
“If you have built up a level of trust, you can really stand together even when there‘s problems and help each other.” (Architect 2)

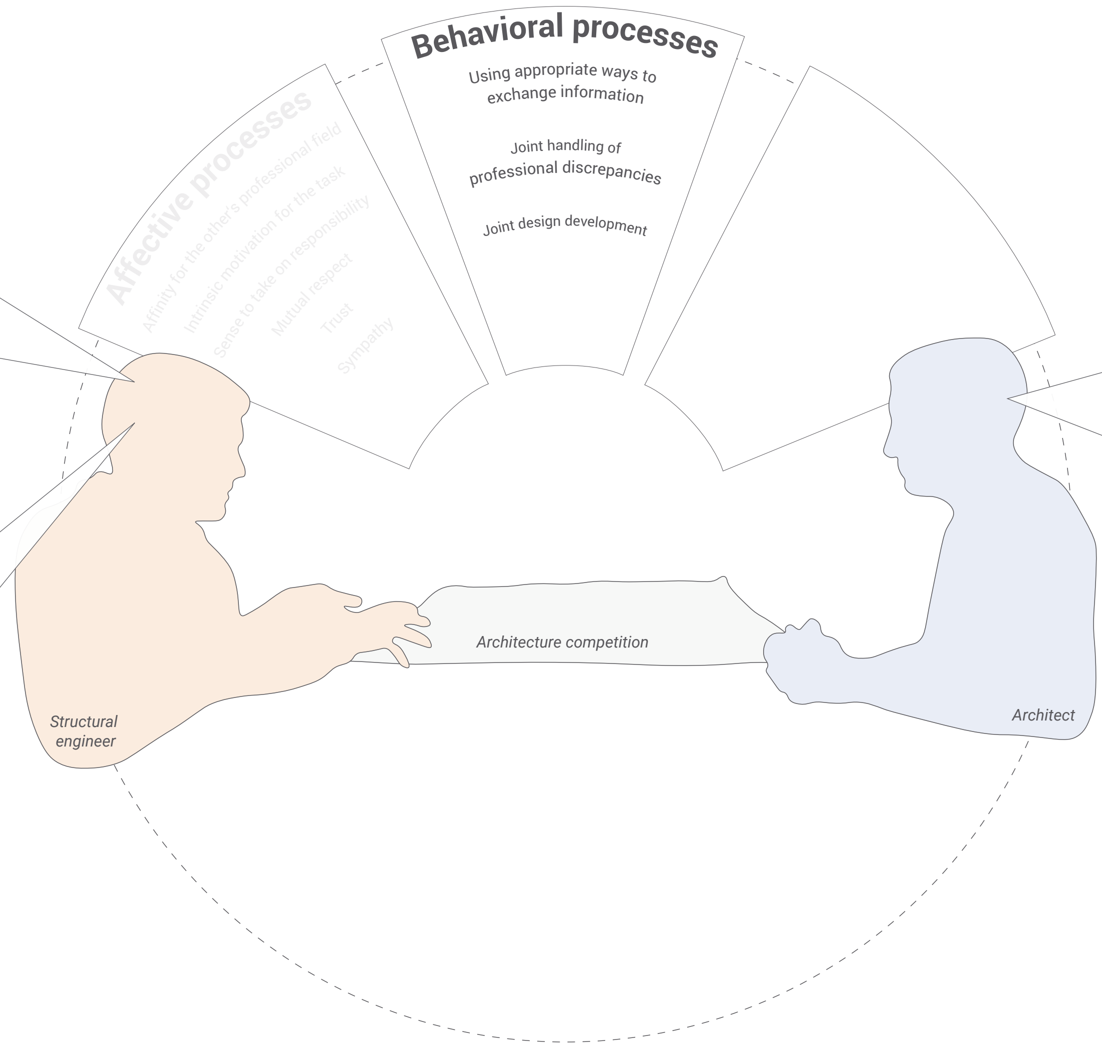
Sympathy
“I have to change one of the team members when I realize that it is counterproductive because we have learned that people who like each other are more productive, and those who don‘t like each other, that doesn‘t give a good result.“ (Architect 11)

Relationship-oriented processes

Team members develop the design together

Using appropriate ways to exchange information
“If the physical model exists, that is always a very big advantage. I still think it is a very good tool.“ (Engineer 1)

Joint design development
“It is ideal if you are looking for a common solution together.” (Engineer 2)

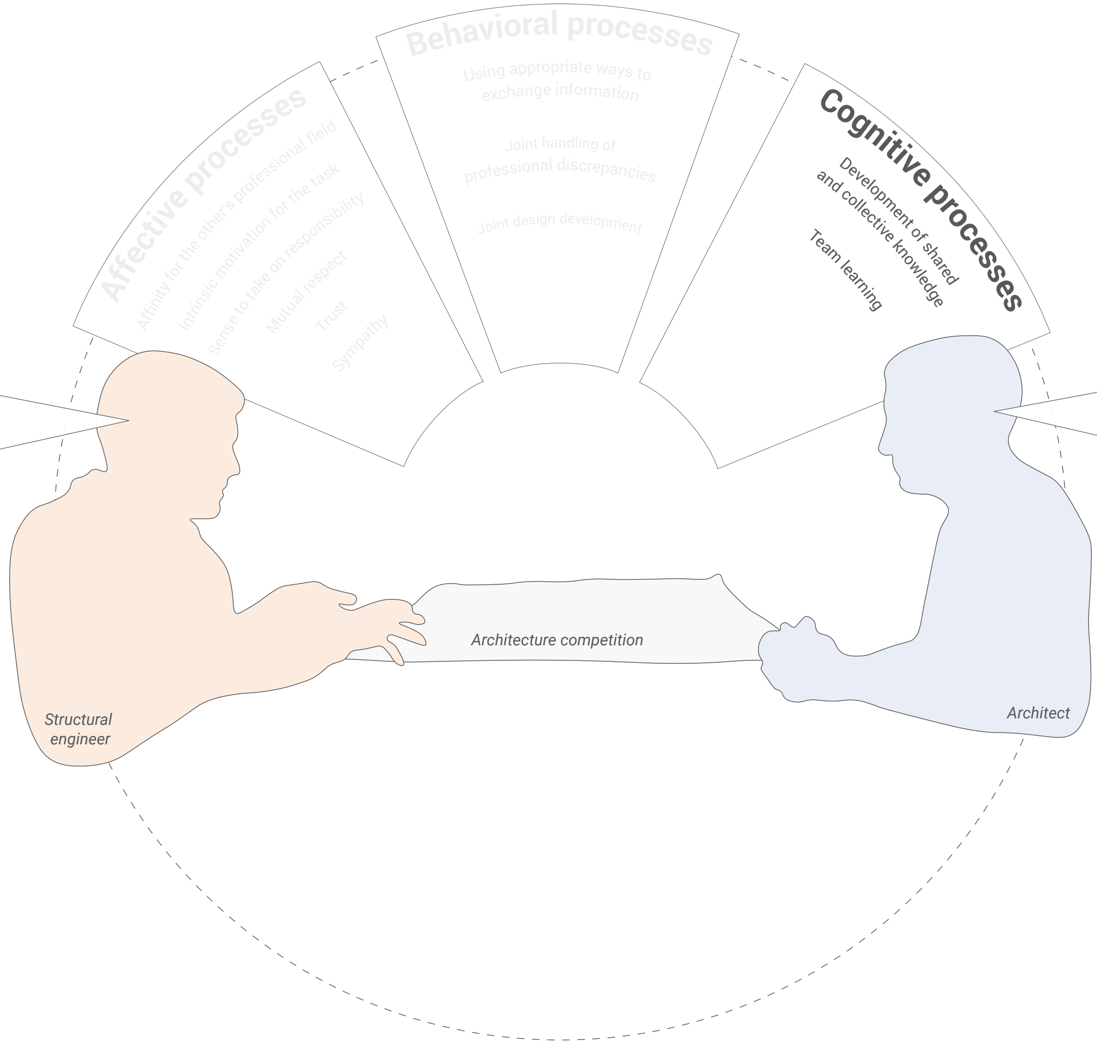


Joint handling of professional discrepancies
“It is a phenomenon of a long-standing partnership that you do not only cultivate respect and friendly relations with each other, but also the ability to criticize each other in order to get closer to the task or solution.“ (Architect 3)

Team members built on experience and learn from each other

Development of shared and collective knowledge

“The competences must be clear. It must be clear what the engineer can do, what the architect can do.“ (Engineer 2)



Team learning

“Mutual learning is also a factor that helps the team, one wants to learn from the other.” (Architect 10)

Team identity creation is a central relationship-oriented process

Creation of a team identity

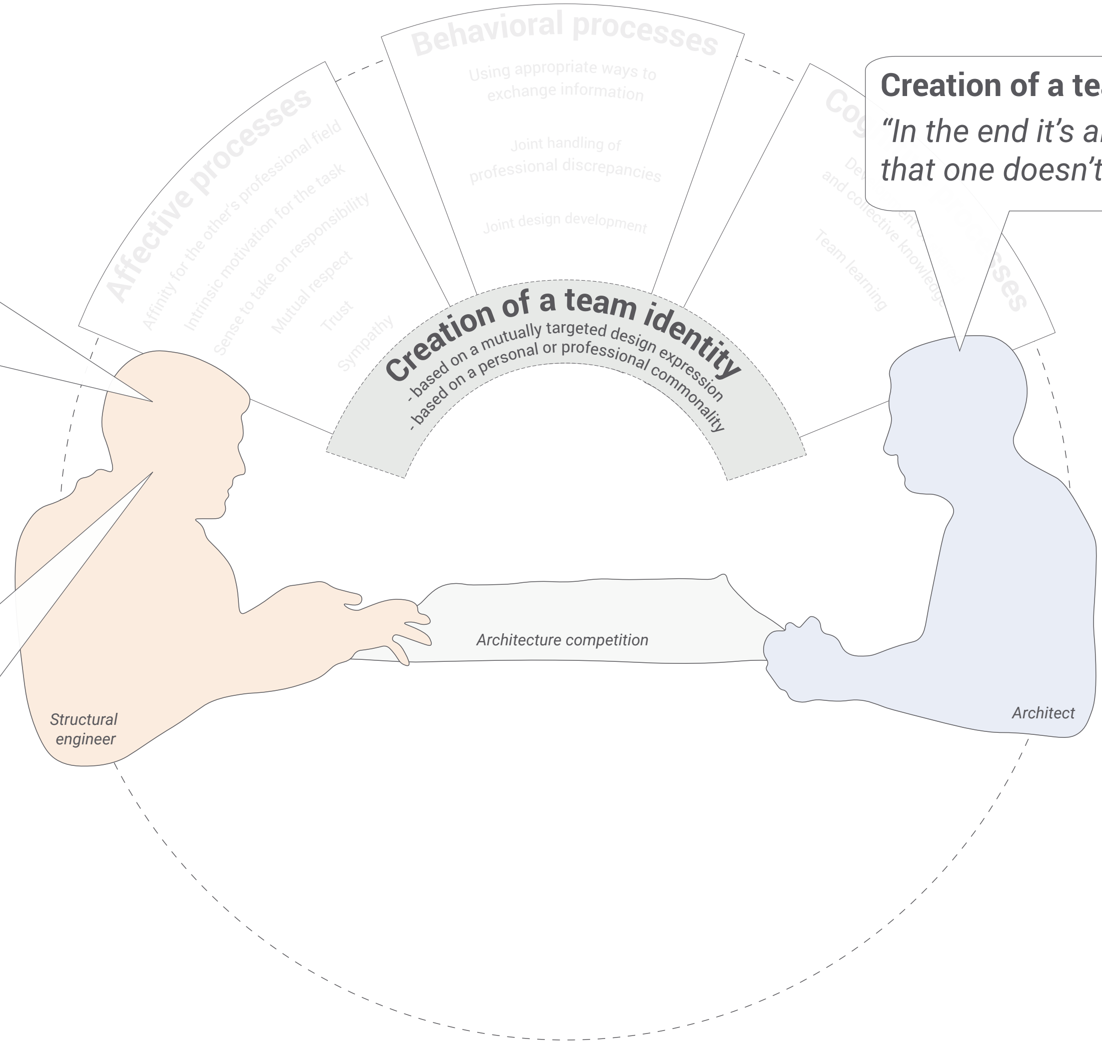
“In the end it’s all about placing oneself in something that one doesn’t determine oneself.” (Architect 6)

Based on a mutually targeted design expression

“I was able to take up the image of the architect, I saw the vision, and I noticed that we have to realize it together.” (Engineer 8)

Based on a personal or professional commonality

“It becomes exciting when the exchange of know-how comes to the foreground, suddenly we stick together as it becomes a new process of knowledge for everyone.” (Engineer 2)



Observations complement findings from interviews with more detail

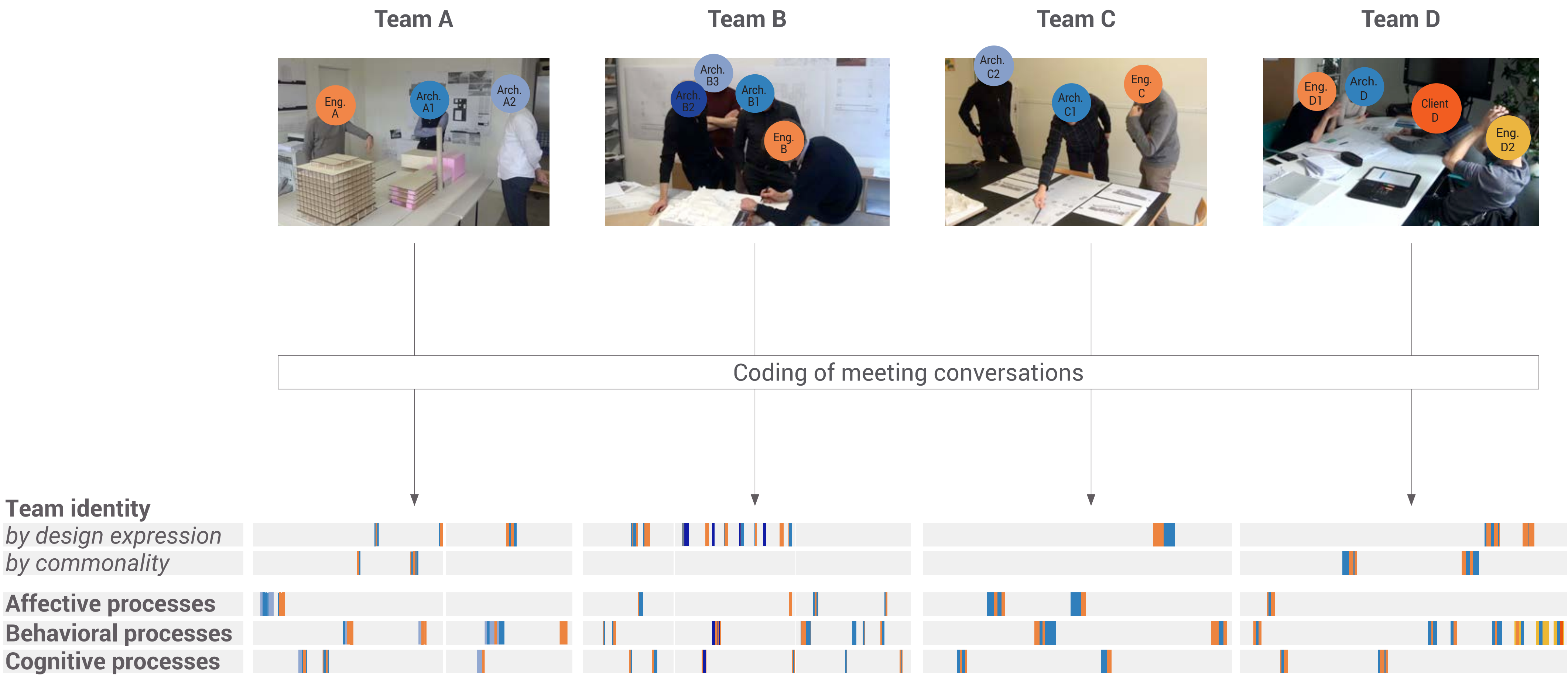
Semi-structured interviews

Cognitive mapping- interviews

Observations of design meetings

Data development and complementarity

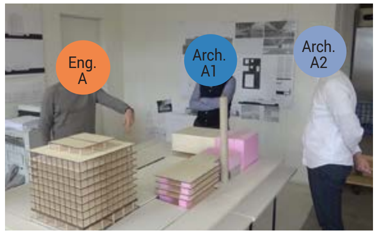
Meetings are coded regarding relationship-oriented processes



Relationship-oriented processes

Team A creates a team identity on two layers

Team A *



- Develops team identity based on design expression and personal commonality
- Sense of trust in the other’s competencies

Team B

- Strong sense of team identity based on multiple mutually targeted design expressions
- Strong affinity for the other’s professional field

Team C

- A mutually targeted design expression is only found late in the meeting
- Signs of communication difficulties

Team D

- Engineer D1 and Architect D agree on the design expression
- Engineer D2 and Client D disagree with Architect D’s proposals

Team identity

by design expression

by commonality

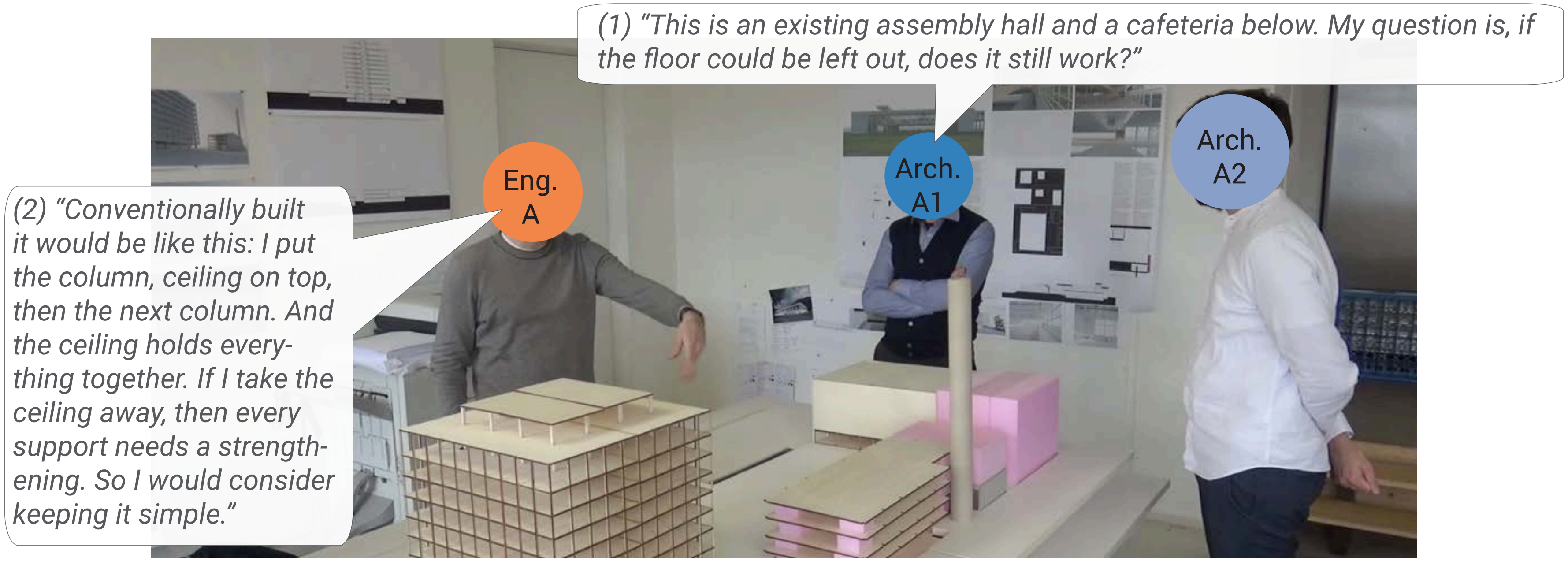
Affective processes

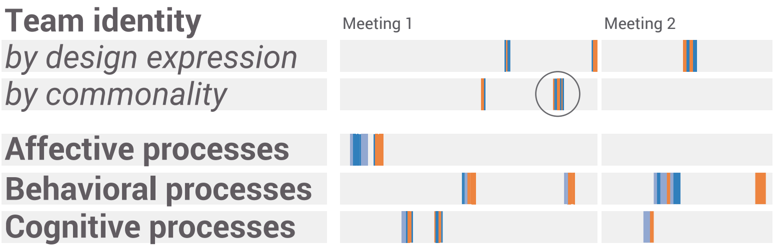
Behavioral processes

Cognitive processes

** more details on next page*

Team A’s team identity centers in mutual learning





Team A is united through mutual learning, here by the educating role of Engineer A.

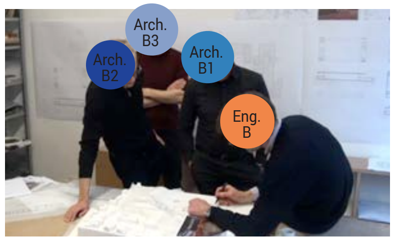
Relationship-oriented processes

Team B creates a strong team identity by multiple design expressions

Team A

- Develops team identity based on design expression and personal commonality
- Sense of trust in the other's competencies

Team B *



- Strong sense of team identity based on multiple mutually targeted design expressions
- Strong affinity for the other's professional field

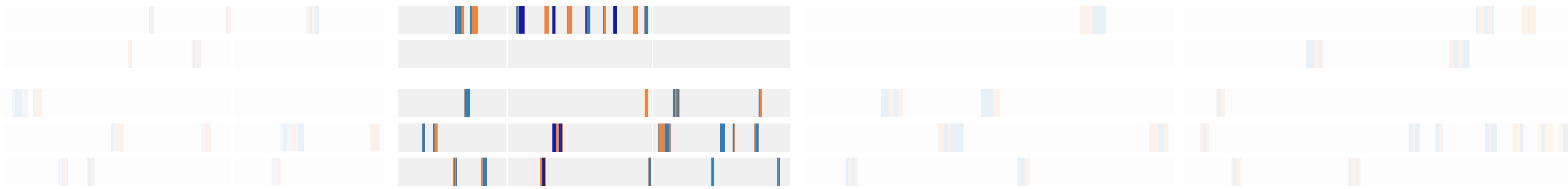
Team C

- A mutually targeted design expression is only found late in the meeting
- Signs of communication difficulties

Team D

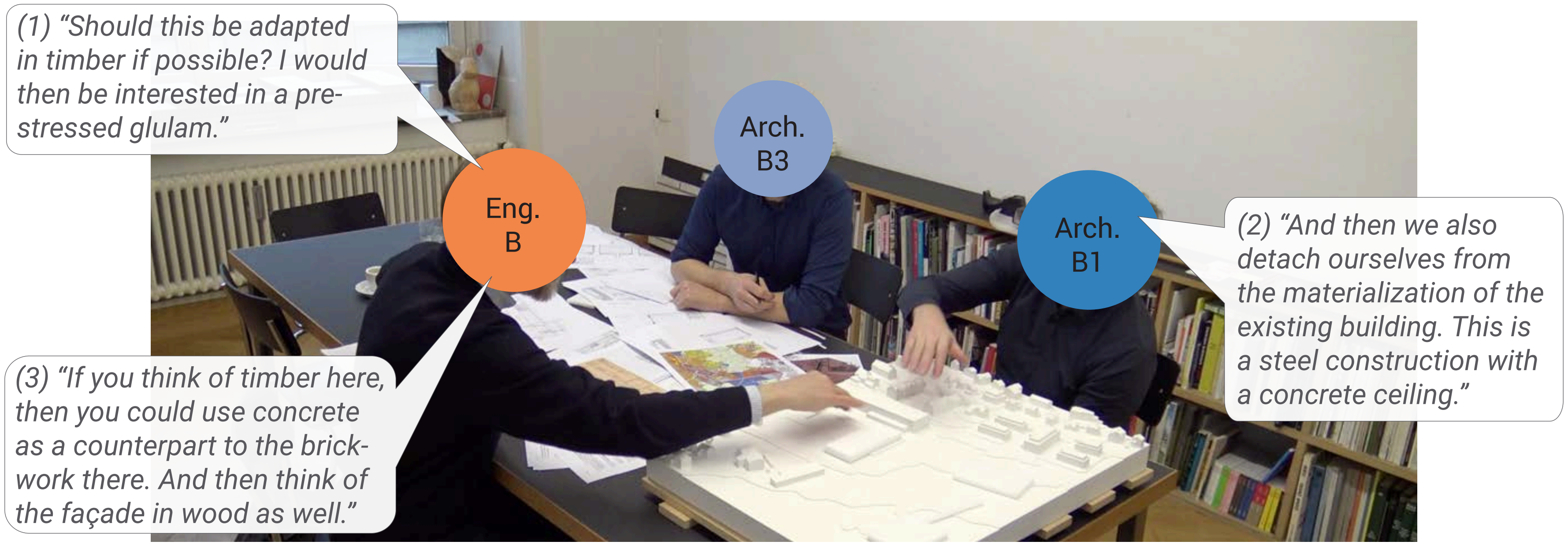
- Engineer D1 and Architect D agree on the design expression
- Engineer D2 and Client D disagree with Architect D's proposals

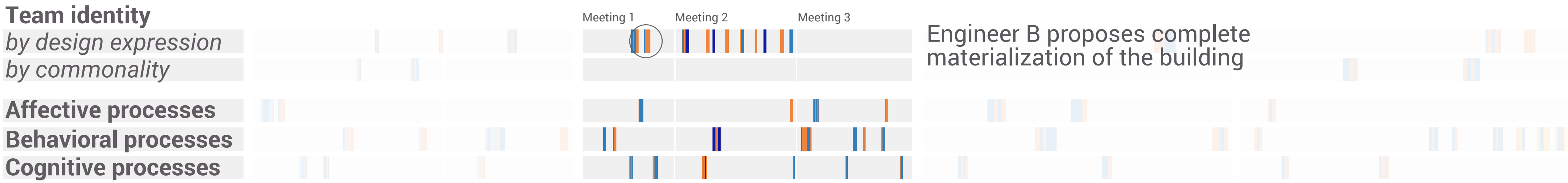
Team identity
by design expression
by commonality
Affective processes
Behavioral processes
Cognitive processes



** more details on next page*

Engineer B actively contributes to finding the design expression





Team C is hampered in team identity creation

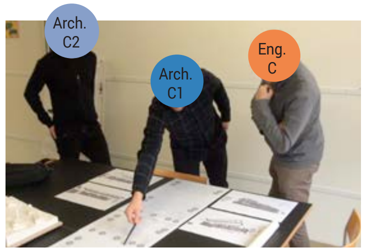
Team A

- Develops team identity based on design expression and personal commonality
- Sense of trust in the other's competencies

Team B

- Strong sense of team identity based on multiple mutually targeted design expressions
- Strong affinity for the other's professional field

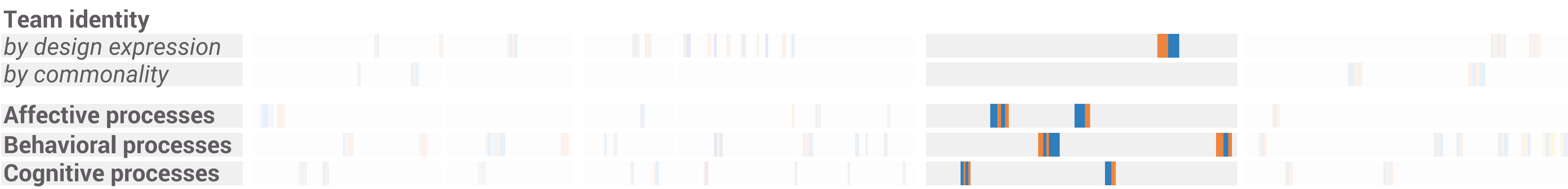
Team C



- A mutually targeted design expression is only found late in the meeting
- Signs of communication difficulties

Team D

- Engineer D1 and Architect D agree on the design expression
- Engineer D2 and Client D disagree with Architect D's proposals



Team D cannot include all team members to create a team identity

Team A

- Develops team identity based on design expression and personal commonality
- Sense of trust in the other's competencies

Team B

- Strong sense of team identity based on multiple mutually targeted design expressions
- Strong affinity for the other's professional field

Team C

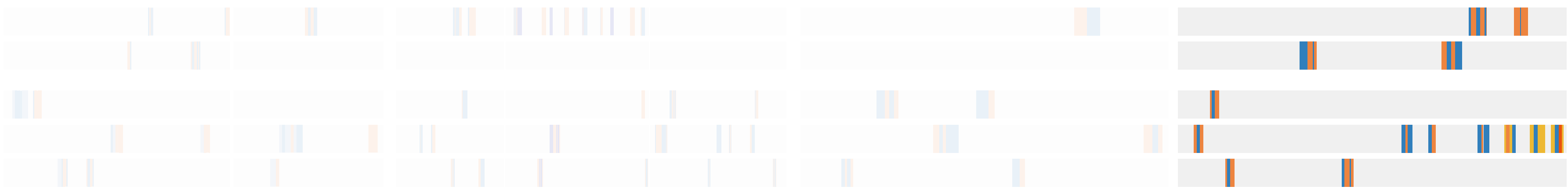
- A mutually targeted design expression is only found late in the meeting
- Signs of communication difficulties

Team D

- Engineer D1 and Architect D agree on the design expression
- Engineer D2 and Client D disagree with Architect D's proposals

Team identity
by design expression
by commonality

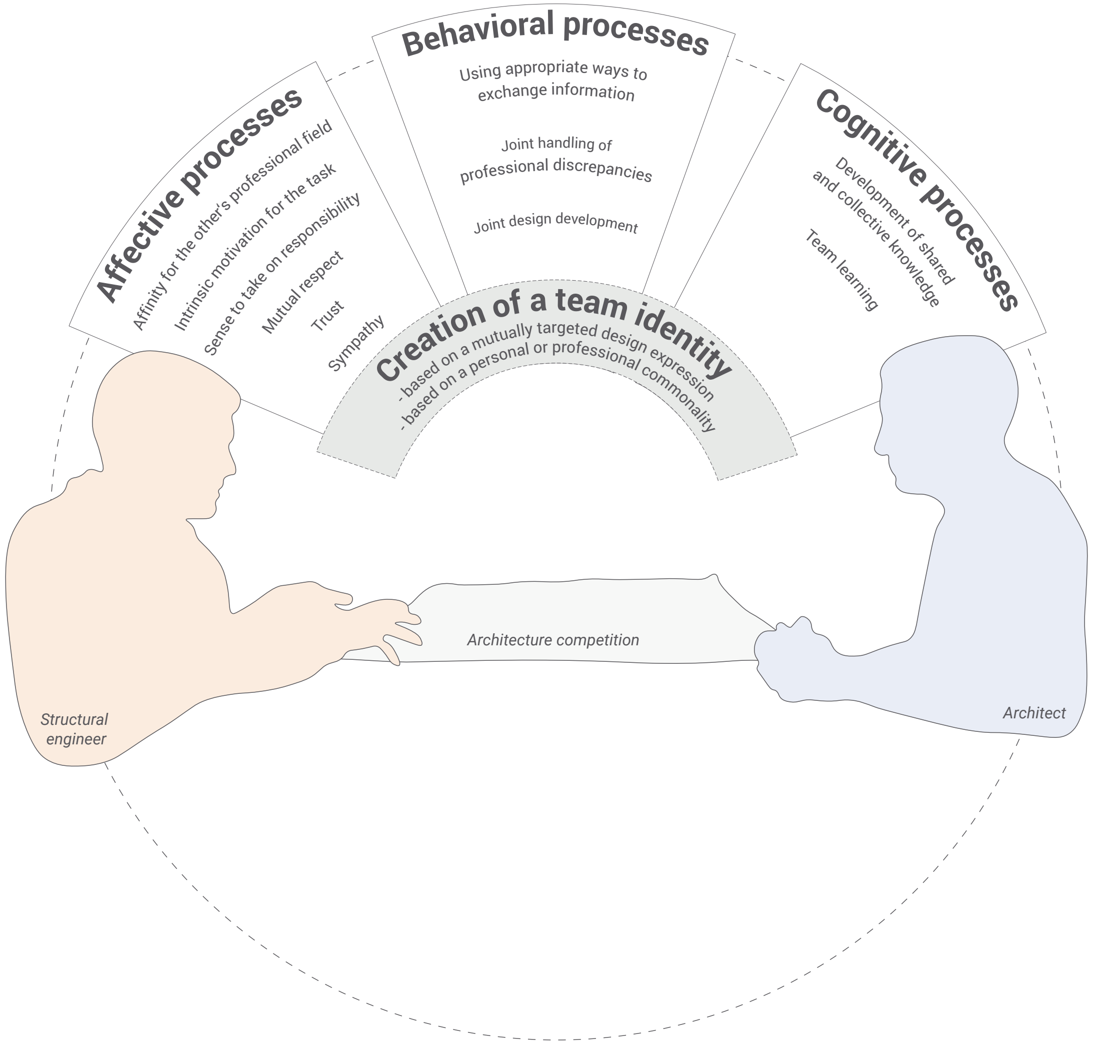
Affective processes
Behavioral processes
Cognitive processes



My model includes insights into relationship-oriented processes

From the interviews

- Teams of architects and structural engineers engage in specific affective, behavioral, and cognitive processes
- The creation of a team identity plays a central role when architects and structural engineers work together



From the observations

- Different teams create different team identities, with different intensities
- Different affective, behavioral, and cognitive processes can support or hamper the creation of a team identity

What are my findings about task-oriented processes in teams of architects and structural engineers working on Swiss architecture competitions?

My thesis explores task-oriented processes with 2 research methods

Semi-structured interviews

Cognitive mapping- interviews

Allow to gain access to the interview participants' thoughts in a graphical way

Observations of design meetings

Provide unfiltered and direct insights to the actual events

Cognitive maps give access to procedural understandings

Scenario: The city of Zurich organizes an open competition for the construction of a new school building including a sports hall. Only teams with members from architecture and structural engineering are allowed to participate.

Task: Determination and sorting of procedural components on how a team of architects and structural engineers works on such a competition.

Given starting point: Issue of the competition documents by the city of Zurich.

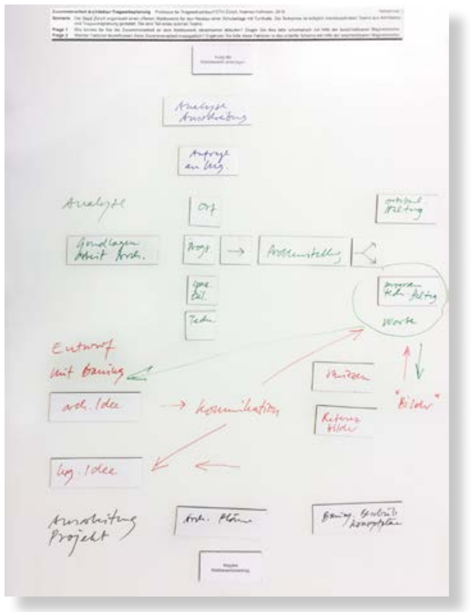
Given tools: Pens of different color and writeable magnetic strips on a magnetic A3 board

Given end point: Submission of the competition entry

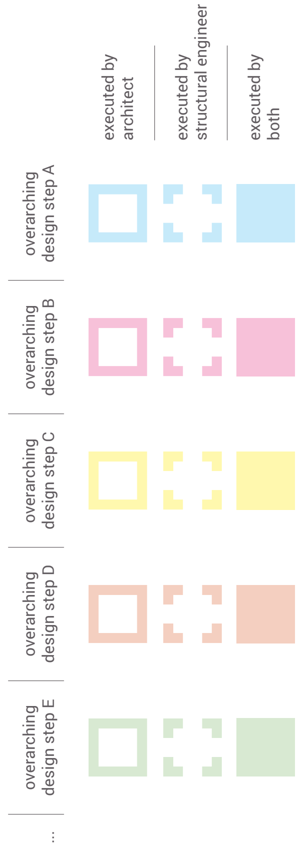
Sources: Burtscher, M. J., Kolbe, M., Wacker, J., & Manser, T. (2011). Interactions of Team Mental Models and Monitoring Behaviors Predict Team Performance in Simulated Anesthesia Inductions. Journal of Experimental Psychology: Applied, 17(3), 257–269.
Image: School building Leutschenbach, Zurich, 2009. Arch. Christian Kerez, Eng. Joseph Schwartz; https://www.zuerich.com/de/besuchen/sehenswuerdigkeiten/schulhaus-leutschenbach

23 cognitive maps are analysed with a specialized coding scheme

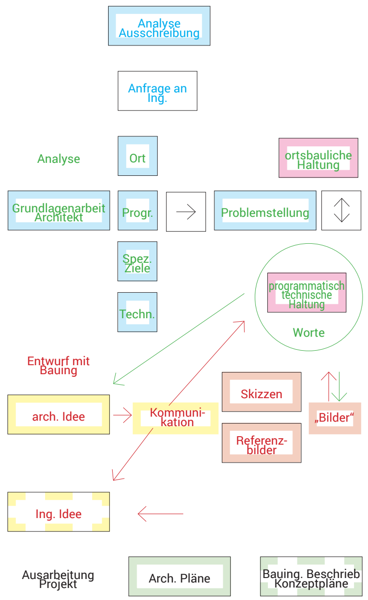
Cognitive map original, e.g. Architect 13



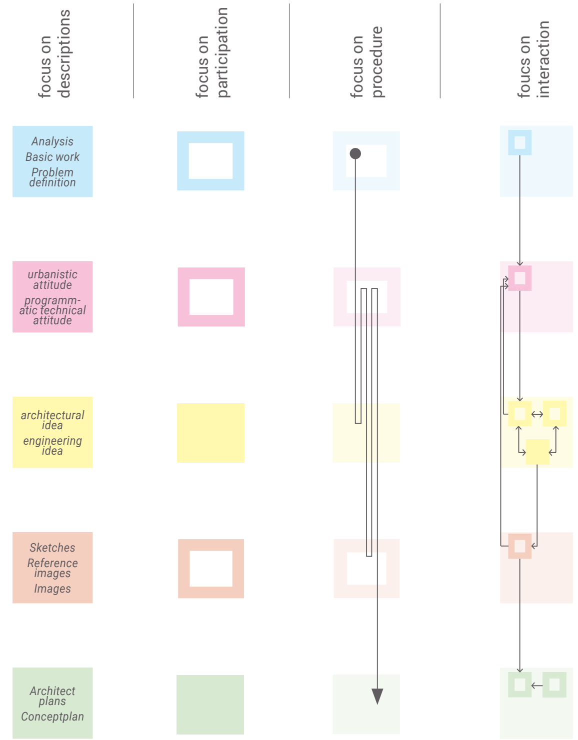
Coding scheme



Cognitive map standardized and coded



Different levels of abstraction



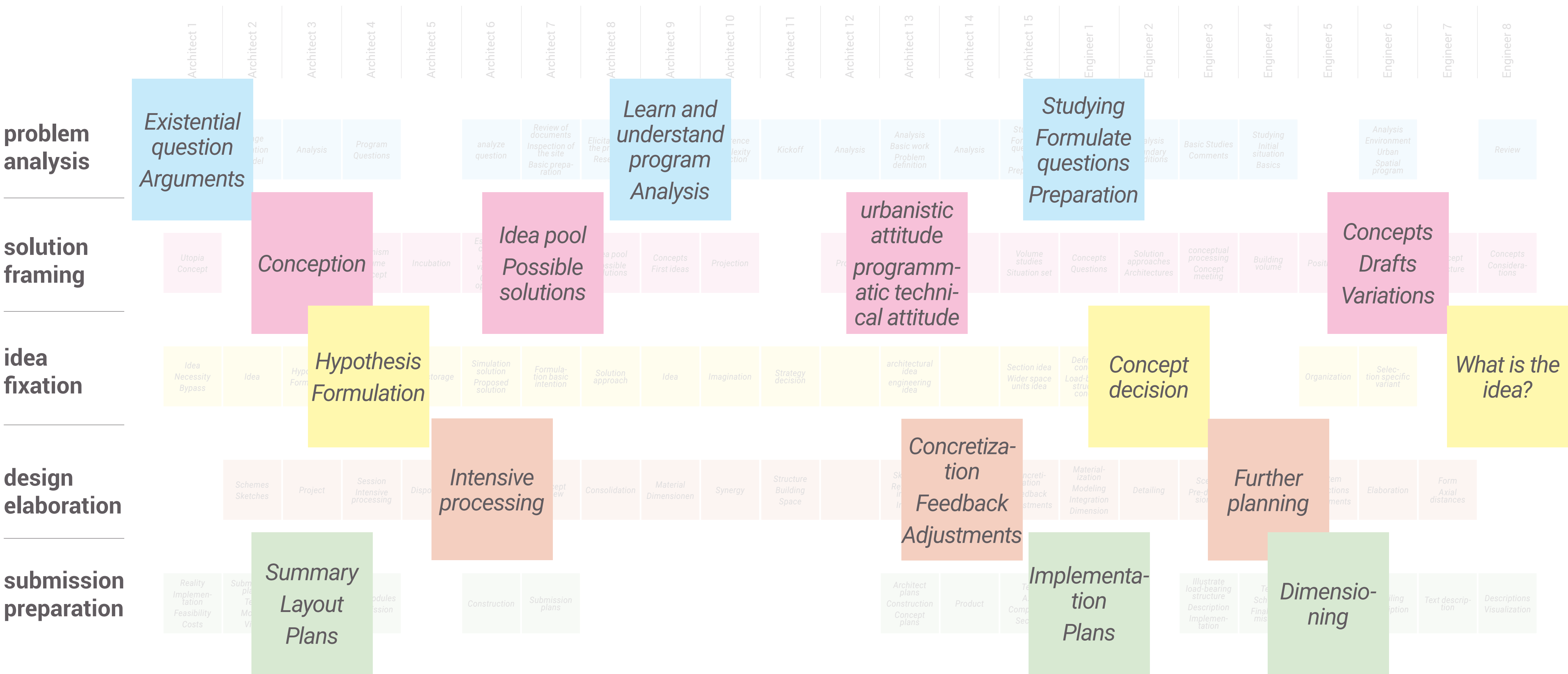
Task-oriented processes

Cognitive maps reveal 5 macro processes

	Architect 1	Architect 2	Architect 3	Architect 4	Architect 5	Architect 6	Architect 7	Architect 8	Architect 9	Architect 10	Architect 11	Architect 12
overarching design step A	Existential question Arguments	Usage Situation Model	Analysis	Program Questions		analyze question	Review of documents Inspection of the site Basic preparation	Elicitation of the problem Research	Learn and understand program Analysis	Coherence Complexity reduction	Kickoff	Analysis
overarching design step B	Utopia Concept		Konzeption	Urbanism Volume Concept	Incubation	Establish criteria Study variants Check opposite	Schematic variants	Idea pool Possible solutions	Concepts First ideas	Projection		Probing
overarching design step C	Idea Necessity Bypass	Idea	Hypothesis Formulation	Idea	Idea storage	Simulation solution Proposed solution	Formulation basic intention	Solution approach	Idea	Imagination	Strategy decision	
overarching design step D		Schemes Sketches	Project	Session Intensive processing	Disposition	Sketch stage	Concept Review	Consolidation	Material Dimensionen	Synergy	Structure Building Space	
overarching design step E	Reality Implementation Feasibility Costs	Submission plans Text Model Viso	Summary Layout Plans	Text modules Submission		Construction	Submission plans					

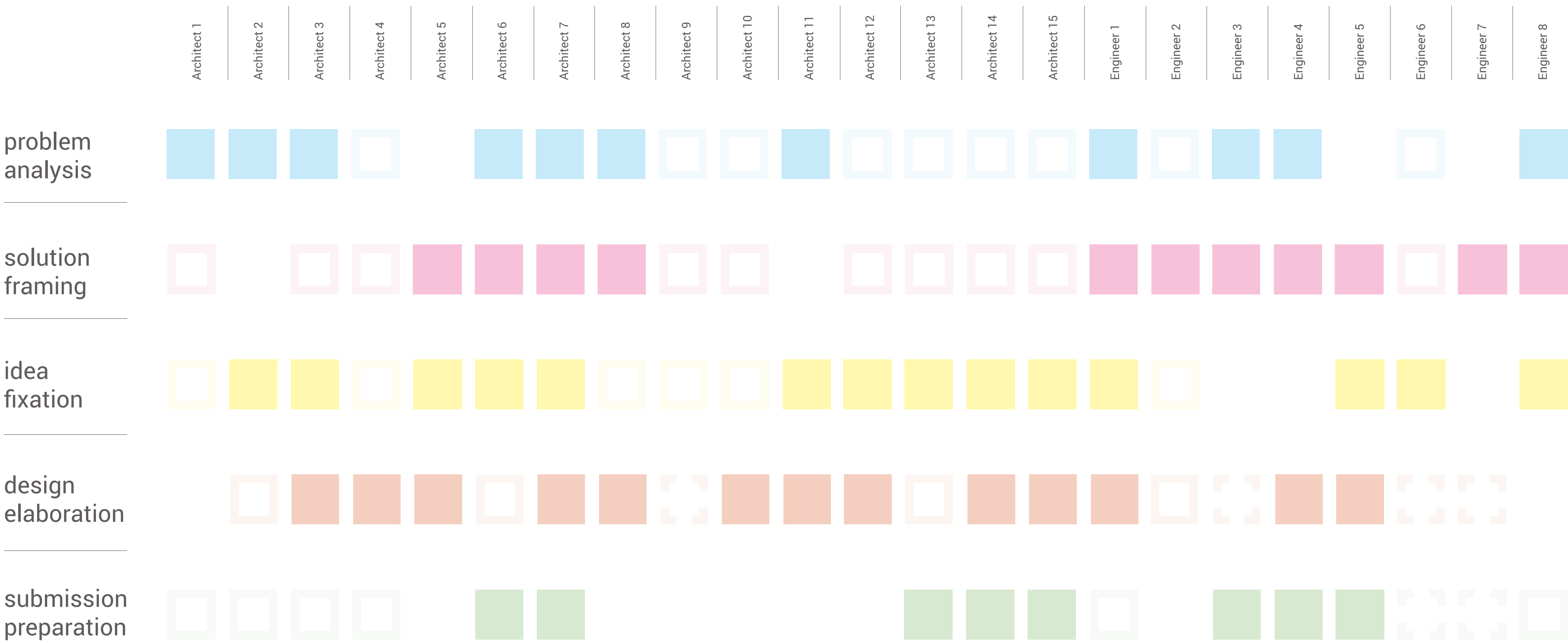
	Architect 13	Architect 14	Architect 15	Engineer 1	Engineer 2	Engineer 3	Engineer 4	Engineer 5	Engineer 6	Engineer 7	Engineer 8
overarching design step A	Analysis Basic work Problem definition	Analysis	Studying Formulate questions Visit Preparation	Basics	Analysis Boundary conditions	Basic Studies Comments	Studying Initial situation Basics		Analysis Environment Urban Spatial program		Review
overarching design step B	urbanistic attitude programmatic technical attitude		Volume studies Situation set	Concepts Questions	Solution approaches Architectures	conceptual processing Concept meeting	Building volume	Positioning	Concepts Drafts Variations	Concept Structure	Concepts Considerations
overarching design step C	architectural idea engineering idea		Section idea Wider space units idea	Definition concept Load-bearing structure concept	Concept decision			Organization	Selection specific variant		What is the idea?
overarching design step D	Sketches Reference images Images		Concretization Feedback Adjustments	Materialization Modeling Integration Dimension	Detailing	Scetch Pre-dimensioning	Further planning	System Corrections Adjustments	Elaboration	Form Axial distances	
overarching design step E	Architect plans Construction Concept plans	Product	Text Axo Completion Section	Implementation Plans		Illustrate load-bearing structure Description Implementation	Text Scheme Final submission	Dimensioning	Detailing Description	Text description	Descriptions Visualization

The 5 macro process terms are based on the descriptions in the maps



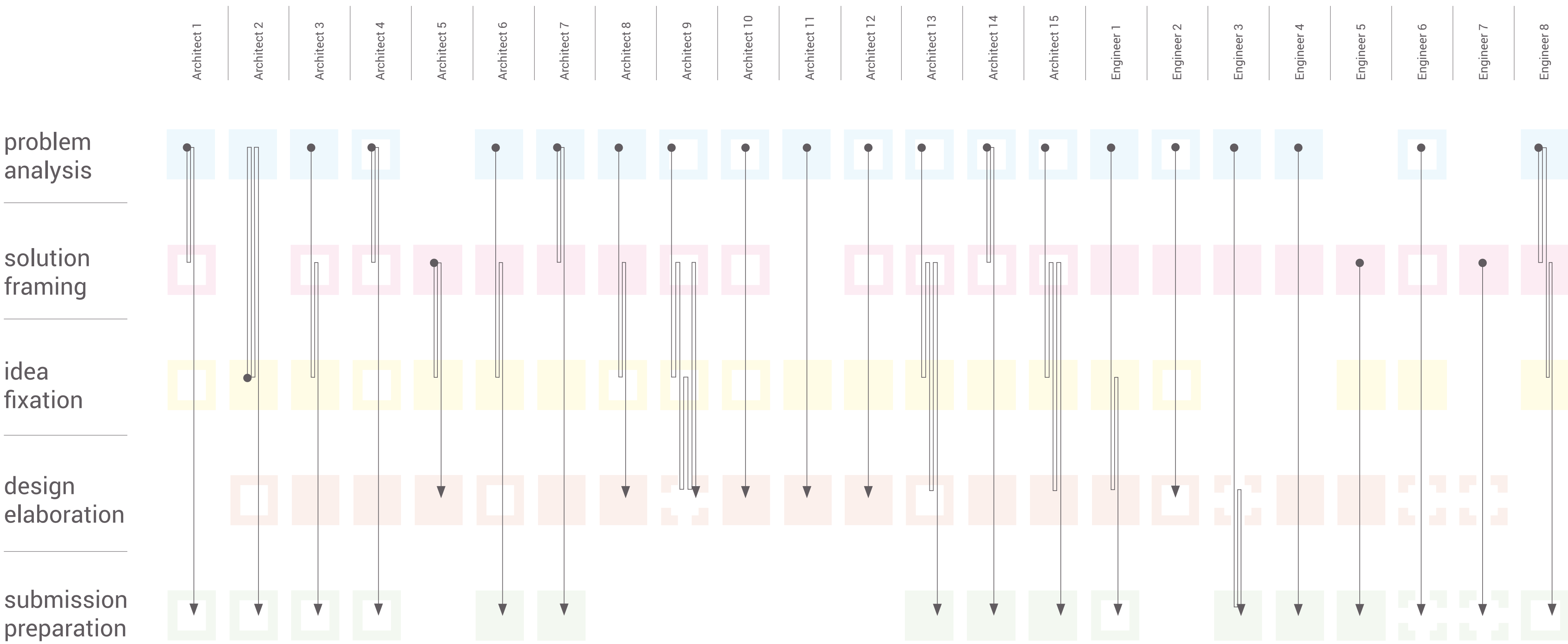
Task-oriented processes

Architect and structural engineer work together in all macro processes



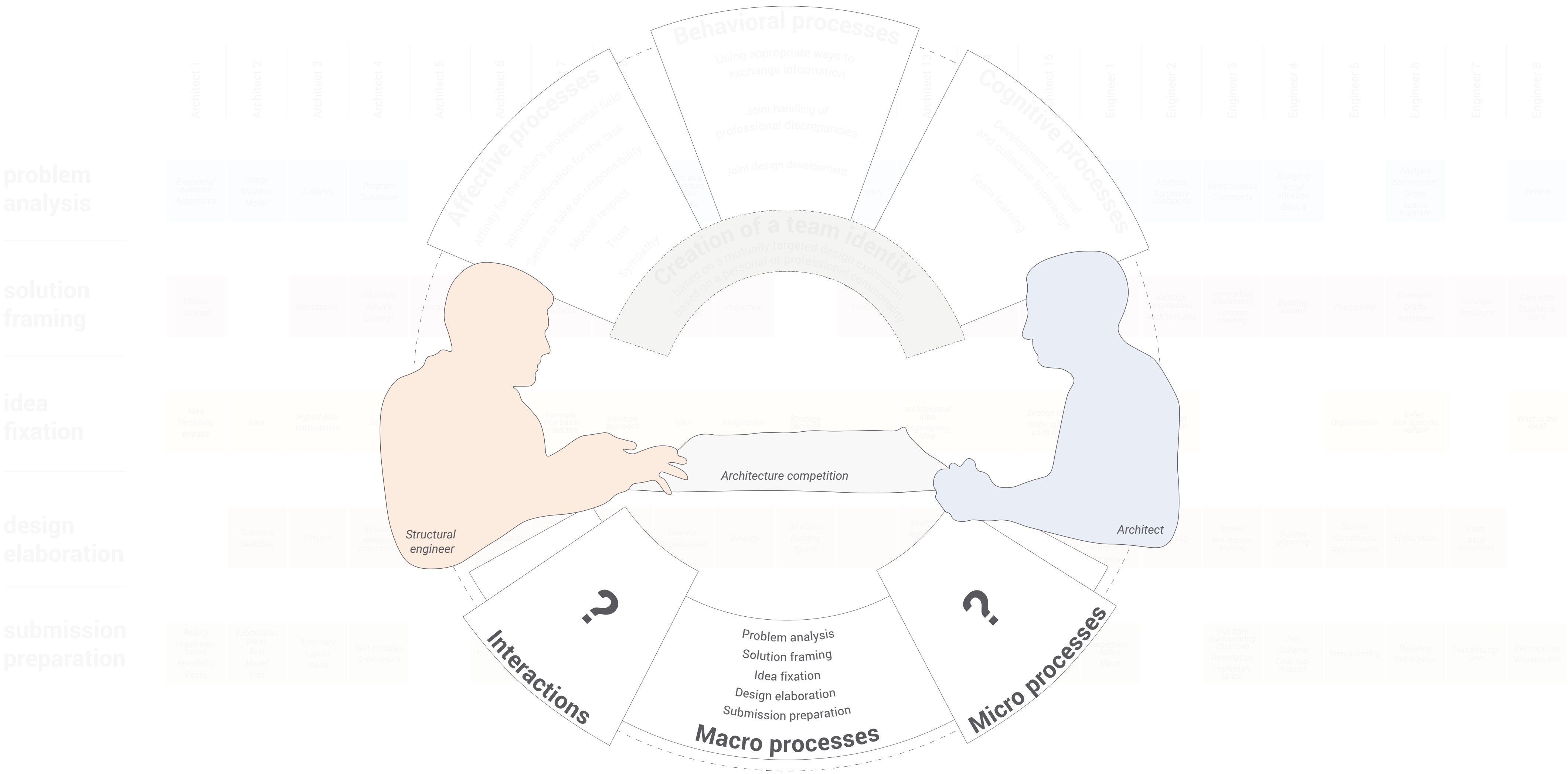
Task-oriented processes

Architects propose circular, structural engineers linear work flows



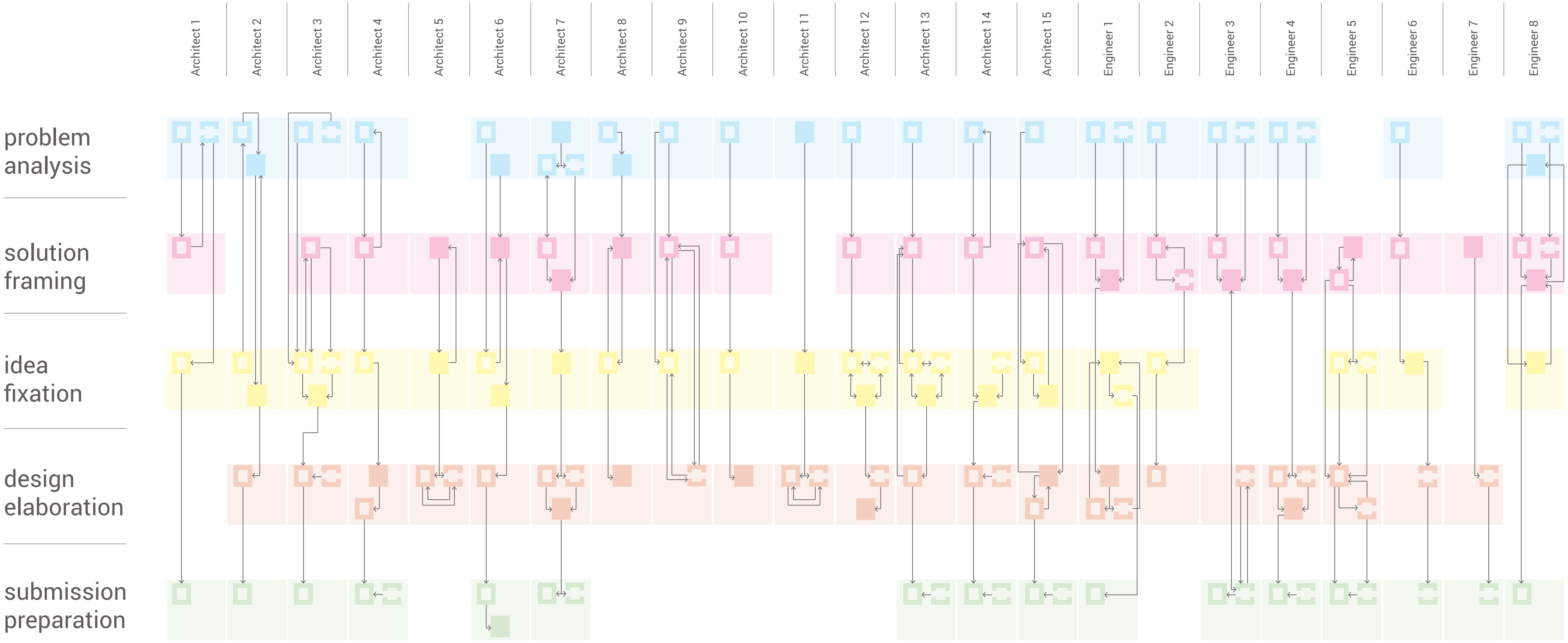
Task-oriented processes

The 5 macro processes are part of my model



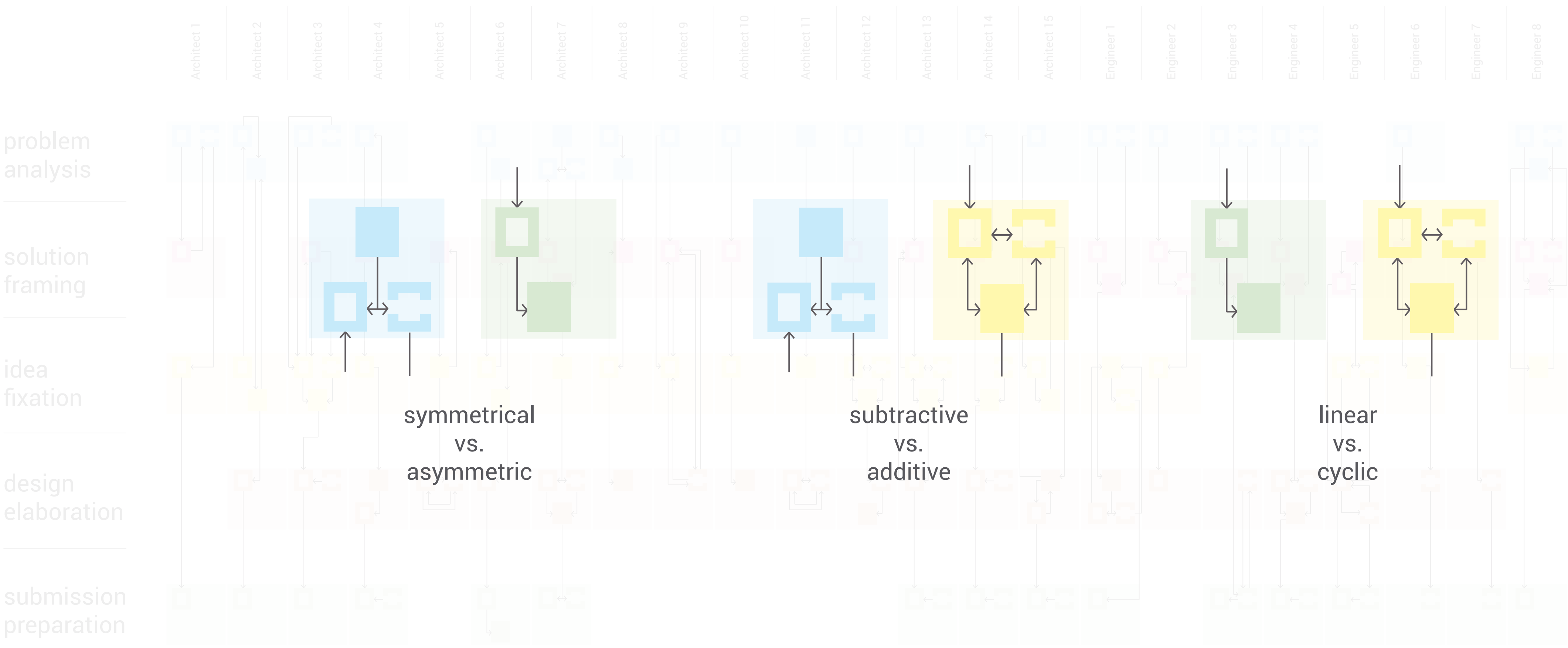
Task-oriented processes

Cognitive maps include different interactions between the professions

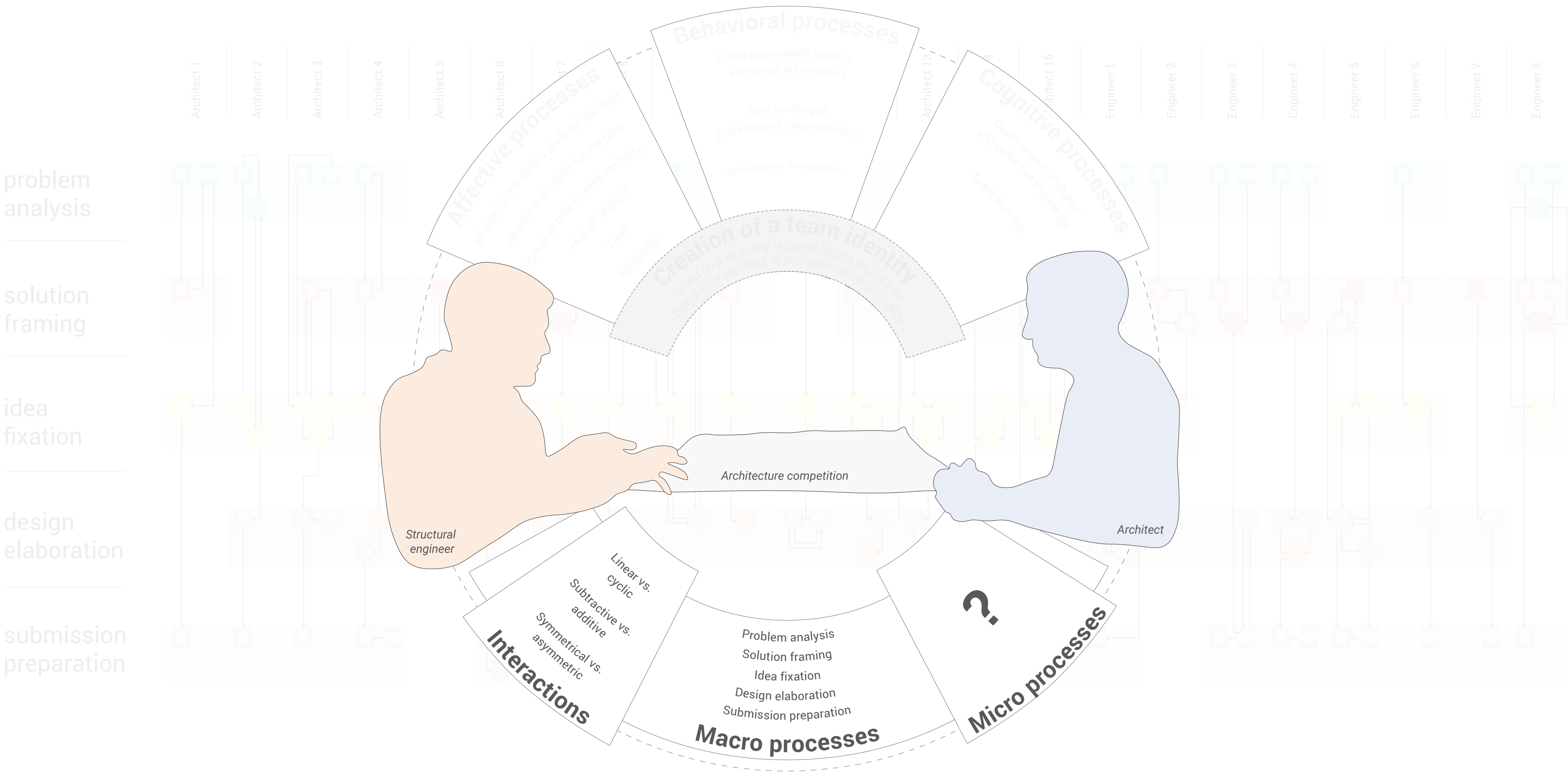


Task-oriented processes

Interactions can be classified along 3 categories



My model includes the 3 categories to describe interactions



Observations complement findings from cognitive maps

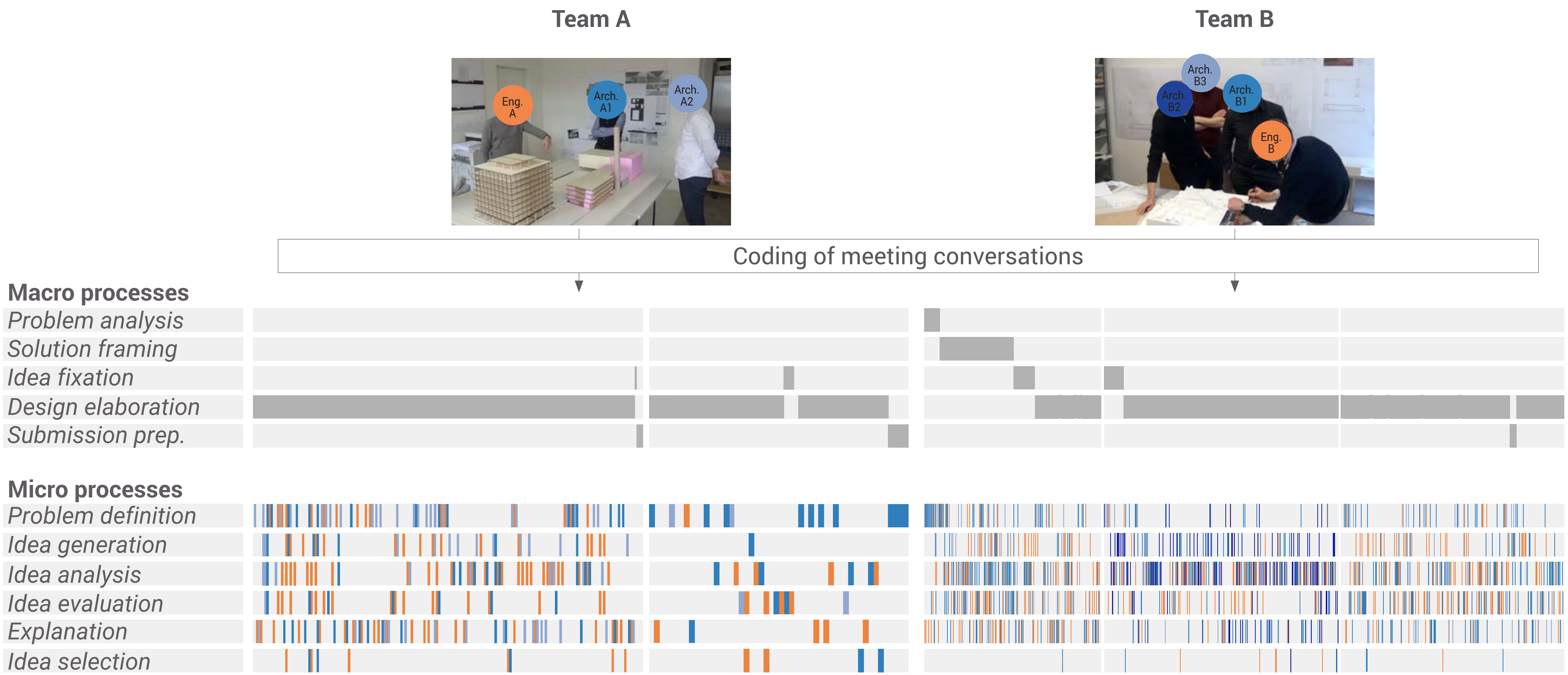
Semi-structured interviews

Cognitive mapping- interviews

Observations of design meetings

Data development and complementarity

Meetings of Team A and B are coded regarding task-oriented processes



Micro process categories after: Stempfle, J., & Badke-Schaub, P. (2002). Thinking in design teams - An analysis of team communication. Design Studies, 23(5), 473–496.

Micro processes are similar for both Team A and B

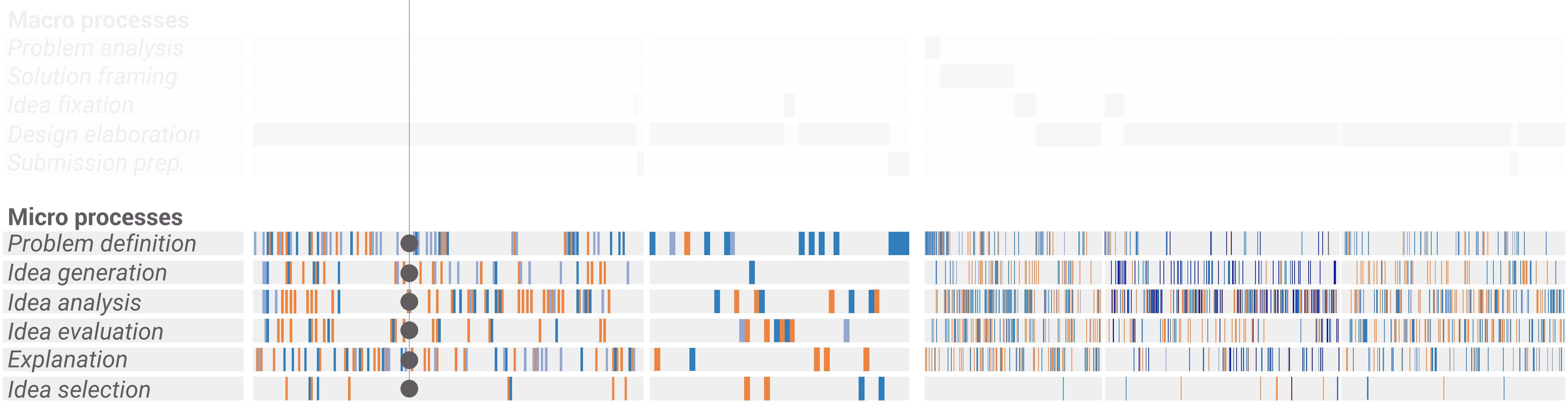
Team A and Team B

All team members of both teams engage in all micro processes

Architects are more active in problem definition

Architects and structural engineers engage in idea generation, explanation, and idea selection

Architects tend to focus more on idea analysis, structural engineers more on idea evaluation



Micro process categories after: Stempfle, J., & Badke-Schaub, P. (2002). Thinking in design teams - An analysis of team communication. Design Studies, 23(5), 473–496.

Architects of Team A and Team B act as meeting moderators

Team A and Team B

All team members of both teams engage in all micro processes

Architects are more active in problem definition

Architects and structural engineers engage in idea generation, explanation, and idea selection

Architects tend to focus more on idea analysis, structural engineers more on idea evaluation

“We want to connect the base-ment better to this first floor. So for once you could cut out a generous section here?”

“In terms of urban plan-ning, there are more or less two possibilities.”

Micro process categories after: Stempfle, J., & Badke-Schaub, P. (2002). Thinking in design teams - An analysis of team communication. Design Studies, 23(5), 473–496.

Engineers A and B contribute to their team's ideas and decisions

Team A and Team B

Architects and structural engineers engage in idea generation, explanation, and idea selection

"I would work here with a supporting beam ceiling. That means a construction height of 1.20m. I would put the beams where you have a wall. The beams have a distance between 1.5m to 2m."

"And it would also be nice if we could introduce frames here."

Micro process categories after: Stempfle, J., & Badke-Schaub, P. (2002). Thinking in design teams - An analysis of team communication. Design Studies, 23(5), 473–496.

Architects tend to analyse, engineers tend to evaluate ideas

Team A and Team B

All team members of both teams engage in all micro processes

Architects are more active in problem definition

Architects and structural engineers engage in idea generation, explanation, and idea selection

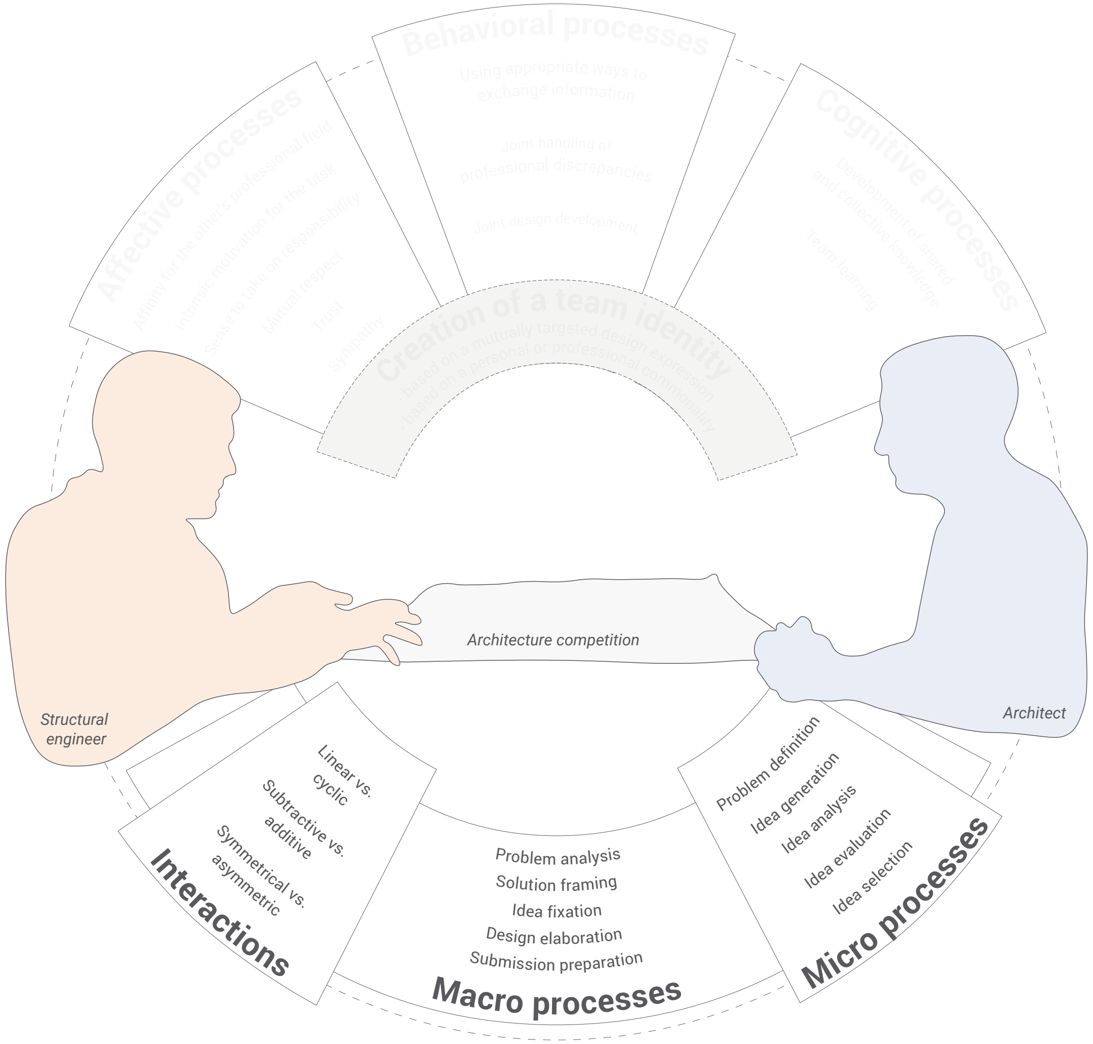
Architects tend to focus more on idea analysis, structural engineers more on idea evaluation

Micro process categories after: Stempfle, J., & Badke-Schaub, P. (2002). Thinking in design teams - An analysis of team communication. Design Studies, 23(5), 473–496.

My model includes insights into task-oriented micro processes

From cognitive maps

- Teams employ up to five task-oriented macro processes to work on a competition
- Teams use different interactions to work through task-oriented processes



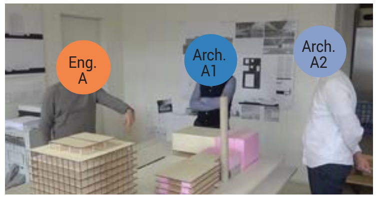
From the observations

- Different teams employ the same micro processes to work on a competition
- Different teams interpret task-oriented processes differently

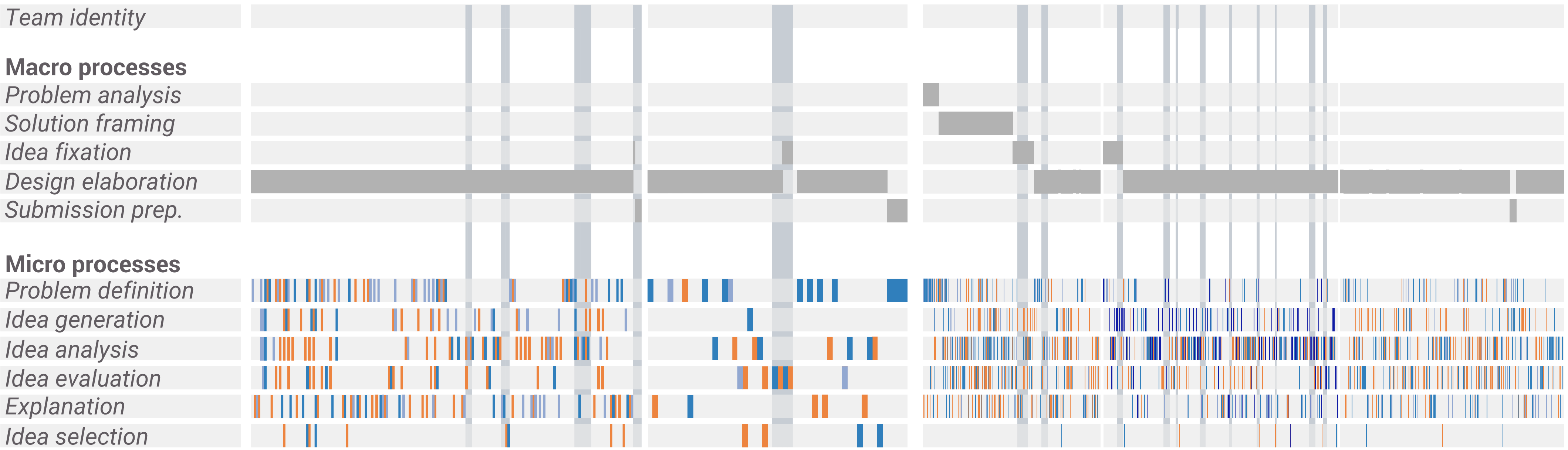
What are my findings about the connection of relationship- and task-oriented processes in teams of architects and structural engineers working on Swiss architecture competitions?

Codes of team identity and task-oriented processes are analyzed

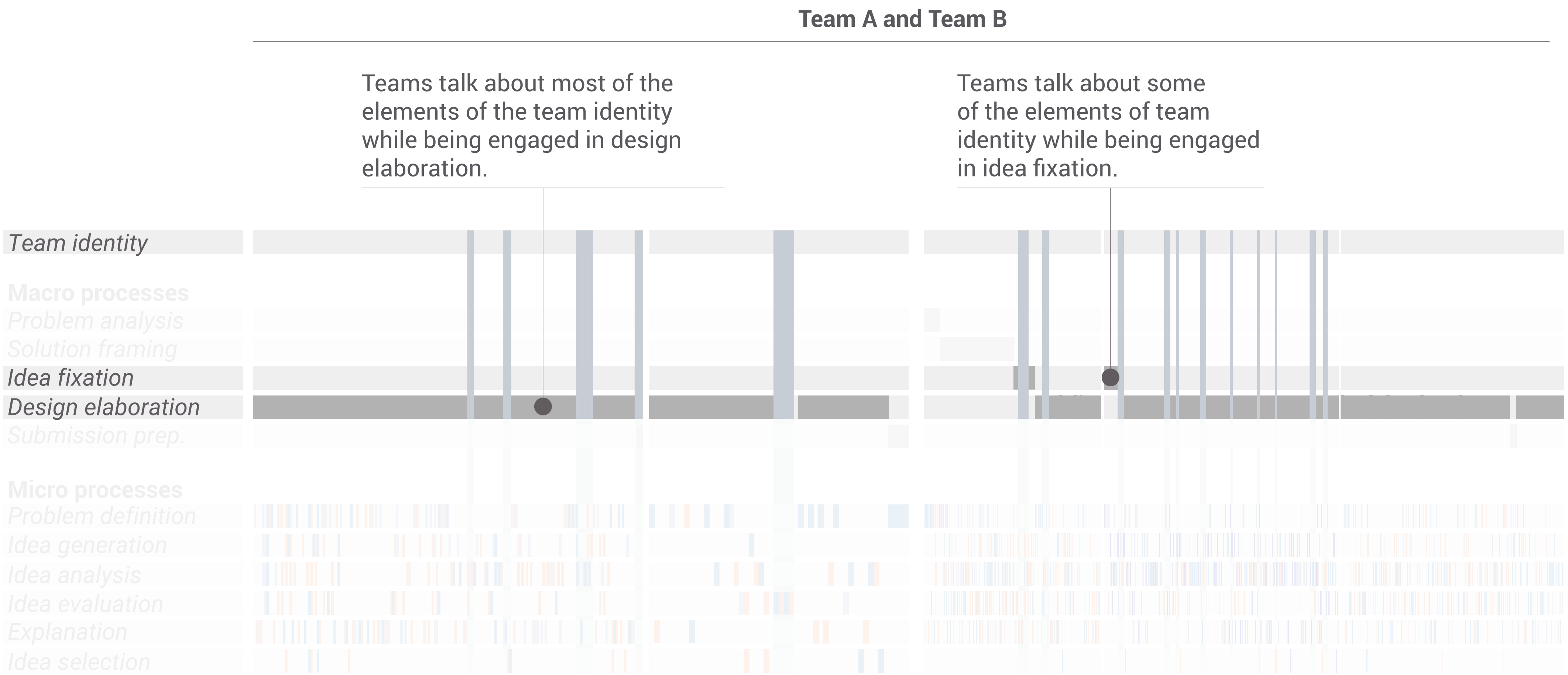
Team A



Team B

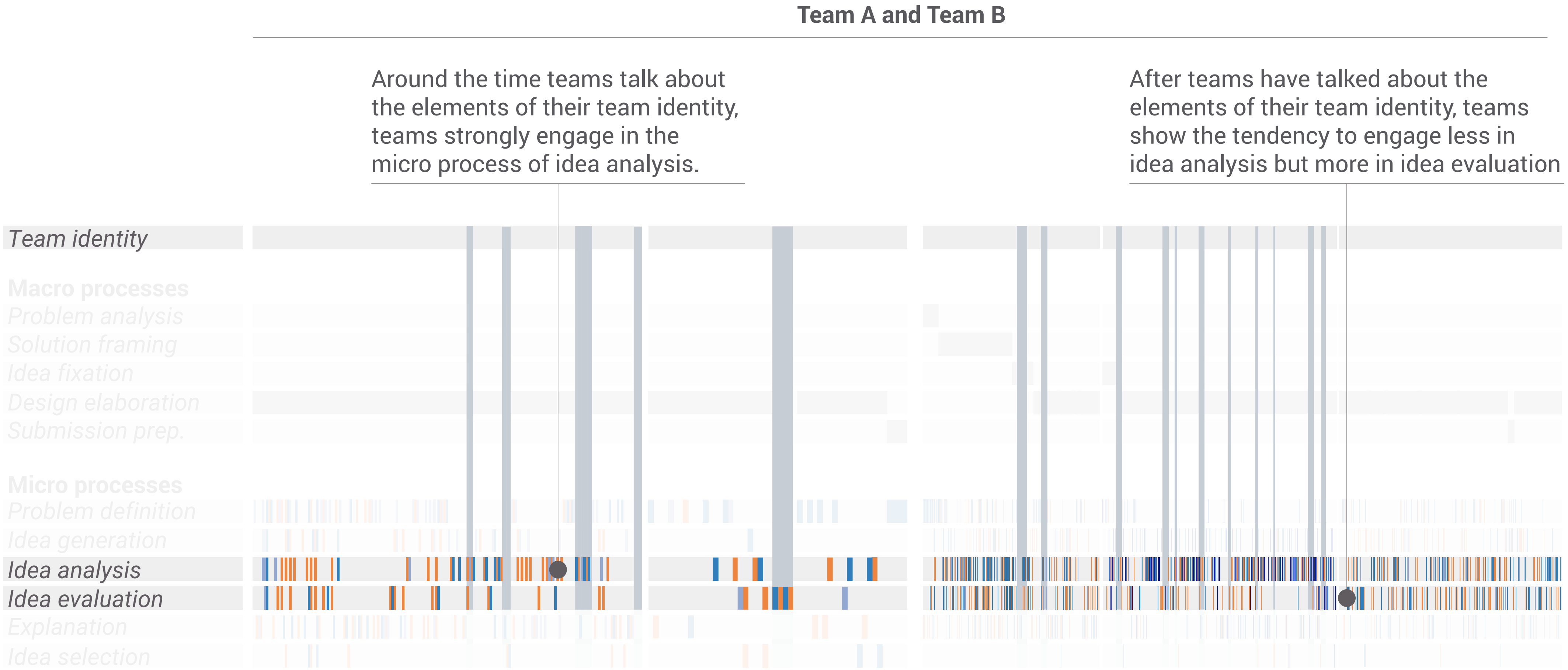


Team identity is elaborated during design elaboration



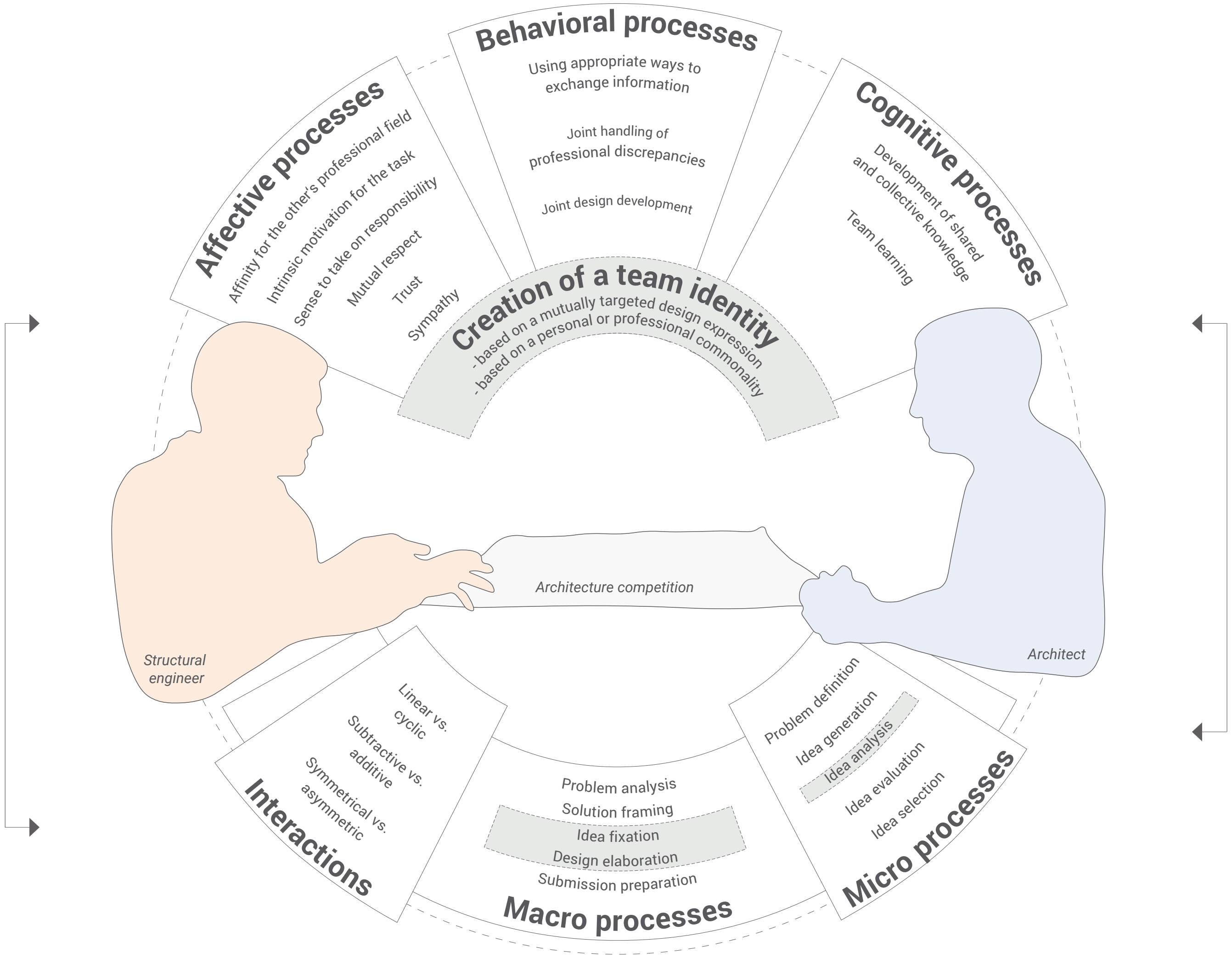
Connection of relationship- and task-oriented processes

Team identity is elaborated when engaging in idea analysis



My final model links relationship- and task-oriented processes

Teams talk about team identity elements during macro processes of design elaboration and idea fixation

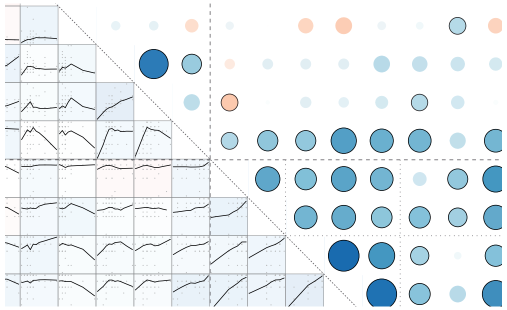


Around the time teams talk about team identity elements, teams strongly engage in micro process of idea analysis

What are applications of the introduced model?

The model is applied inside and outside academia

Inside academia		Outside academia	
Educating team reflection *	**Expanding academic explorations**	**Facilitating team training in practice**	**Supporting industrial software development**



Educating team reflection *

- Course "Exploring Interdisciplinary Design"
- ETH architecture and civil engineering students learn about task- and relationship-oriented processes while designing together

Expanding academic explorations

- Development and execution of closed-ended survey
- Quantitative, statistical analysis of correlations between the elements of the introduced model

Facilitating team training in practice

- Presentations and workshops in architecture and engineering offices
- Transfer of knowledge about the features of the model for future use by practicioners

Supporting industrial software development

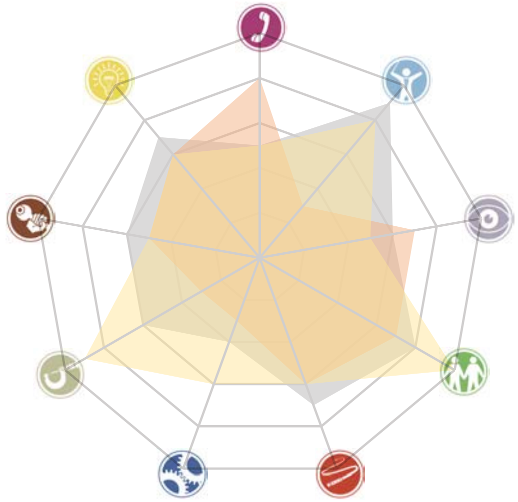
- Exploration of necessary features of digital whiteboard tools for virtual teams of architects and structural engineers

* *more details on next pages*

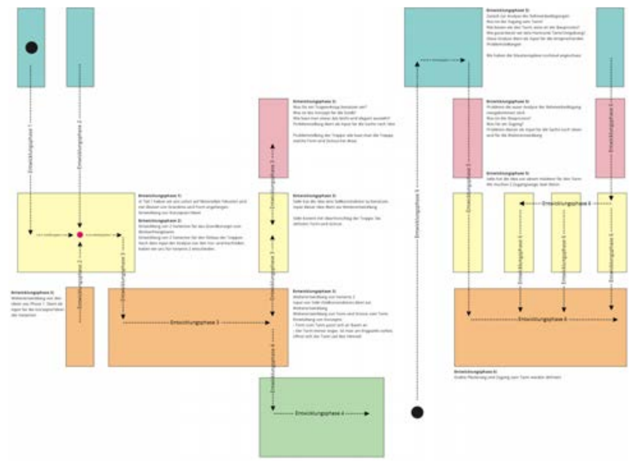
Source: (middle right) Presentation at Foster+Partners, London, 14.11.2019; Belbin, R. M. (2010). Team roles at work (2nd ed.). Elsevier.

Students explore their team processes

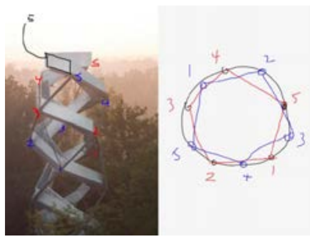
Roles of the team members



Task-oriented processes



Relationship-oriented processes



Authors of work, from left to right: (top row) Tary, Asfour (FS20) Perini, Risi, Zahn (FS21) Oberholzer, Scotoni (FS20)
(bottom row) Frauenfelder, Füssel, Malvetti, Oberholzer (FS20) Li, Schmid, Pejic, Asfour (FS20)

Applications

Students get prepared for the coprofessioal practice of design

"It's great that there's finally a course where civil engineering and architecture students can meet, design together and learn about team processes at the same time. Courses like this not only help to improve our studies, but also to start well-prepared into our working life."

Student feedback on course "Exploring Interdisciplinary Design", spring semester 2021

What are limitations and future research directions of the introduced model?

Inherent limitations are set by focus and research methods

Limitations

- Focus on current teams of architects and structural engineerss in German-speaking part of Switzerland
- Focus on meetings only for observation
- Inherent limitations of qualitative research (amount of interviews, reliance of spoken word)

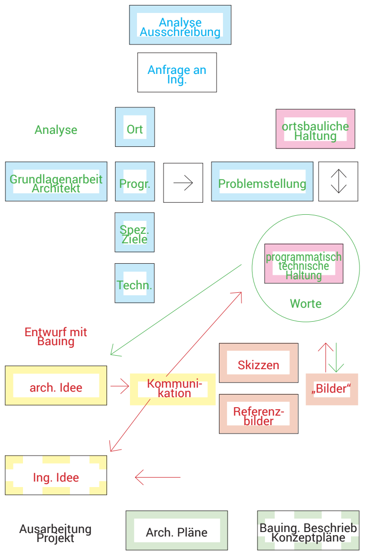
Future Research

- Inclusion of other professions, geographies, and project phases
- Examination of one team over a longer period of time (in-depth case study)
- Inclusion of advanced technologies for measurement and analysis

What are the contributions of my thesis to our existing knowledge?

Knowledge contribution

Research methods show ways to study teams in building design

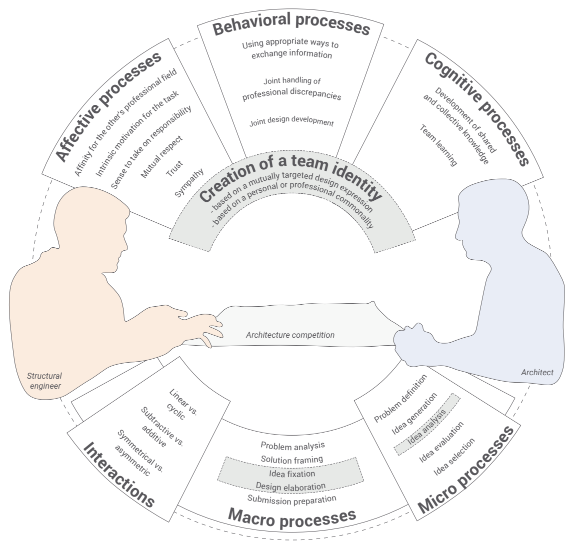


Ways to apply research methods from social psychology for the study of teams in building design

Model for the understanding of relationship- and task-oriented processes in teams of architects and structural engineers working on Swiss architecture competitions

Applications of introduced model inside and outside academia

A model for team processes is introduced



Ways to apply research methods from social psychology for the study of teams in building design

Model for the understanding of relationship- and task-oriented processes in teams of architects and structural engineers working on Swiss architecture competitions

Applications of introduced model inside and outside academia

Knowledge contribution

The model can be applied inside and outside academia

Ways to apply research methods
from social psychology for the study
of teams in building design

Model for the understanding of relationship-
and task-oriented processes in teams of
architects and structural engineers working
on Swiss architecture competitions

Applications
of introduced model
inside and outside academia

That is it?

Ove Arup (1975). Co-Operation between Architects and Allied Professions.

”Talking or writing about collaboration [...] is a necessary preparation. [...] But it is much more important that [collaboration] is done by those that know how to build well.”

Thank you so much!

To my supervisors!
To the direct and indirect contributors to this thesis!
To the supportive environment of colleagues, family, and friends!