

Software-Supported Collaborative Problem Structuring in the Context of Morphological Analysis

Bachelor's Thesis Final Presentation

Louisa Schermuly

Software Engineering für betriebliche Informationssysteme (sebis)
Fakultät für Informatik
Technische Universität München

www.matthes.in.tum.de

Software-Supported Collaborative Problem Structuring in the Context of Morphological Analysis

I. Introduction

- Morphological Matrix
- Application of Morphological Matrix
- Research Questions

II. Relevant Process Losses and Gains

III. Concept

IV. Prototype – Live Demo

V. Evaluation

VI. Future Work

Finding solutions for **Wicked Problems**

- complex, essentially unique problems
- no “best” solution



Example: Design of a table

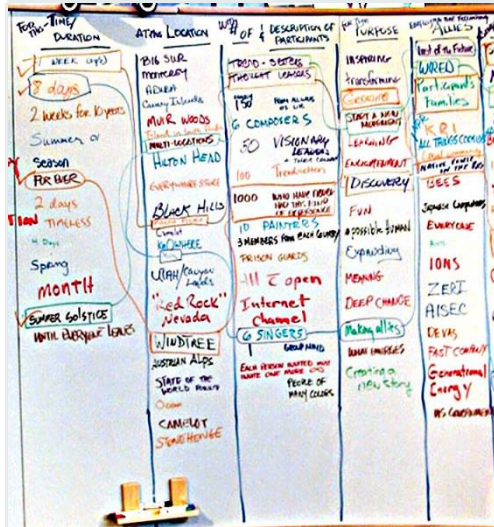
Problem **Structuring** and **Decomposition**

1. Identification of components (**parameters**)
2. Collection of possible alternatives for each parameter (**values**)

<i>Color</i>	<i>Shape</i>	<i>Number of Legs</i>	<i>Height</i>	<i>Material</i>
<i>black</i>	<i>oval</i>	<i>0</i>	<i>< 0,9 m</i>	<i>wood</i>
<i>brown</i>	<i>round</i>	<i>1</i>	<i>0,9 m</i>	<i>glass</i>
<i>green</i>	<i>quadratic</i>	<i>2</i>	<i>1 m</i>	<i>cork</i>
<i>blue</i>		<i>3</i>	<i>> 1 m</i>	<i>metal</i>
<i>mixed color</i>		<i>4</i>	<i>adjustable</i>	
		<i>> 4</i>		

Images from: <http://mdhomehealth.com/wp-content/themes/mdhh/images/complex-problem.jpg>

Creativity tool in the context of innovation and product management



- + **Interactive** idea generation
- Unstructured and confusing **Visualization**

- Group work (up to 10 members)
- Paper-and-Pen or Whiteboard

Artifact of Morphological Analysis (MA)

Geographic priority	Functional priorities	Size and cramming	New construction	Maintenance	General philosophy
Metropolises	All socio-tech. functions	Large, not cramped	With new construction	More frequent maintenance	All get same shelter quality
Cities + 50,000	Tech support systems	Large & cramped	Compensation	Current levels	All take same risk
Suburbs and countryside	Humanitarian aims	Small, not cramped	New only for defence build up	No maintenance	Priority: Key personnel
No geo-priority	Residential	Small & cramped			Priority: Needy

- Morphological Matrix constructed in the first stage of MA (**Analysis Stage**)
- Software support

- + Improved **Visualization**
 - No **Collaboration Support**
- **Group performance is reduced by process losses!**



1. Which **process losses** and **process gains** can affect the group performance in creating a Morphological Matrix?



2. How to **design the process** of the „Analysis Stage“ to minimize process losses and maximize process gains?



3. What are the functional requirements an **implementation** of the extended process model should meet?



4. Do the experimental findings conform to the defined hypotheses?

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$$\begin{aligned} \text{Group Performance} &= \text{Group Potential} \\ &+ \text{Process Gains} \\ &- \text{Process Losses} \end{aligned}$$



Hackman, Morris, 1975 in Brodbeck, Guillaume, 2010, p. 33

Divergent Thinking

Generating ideas freely

Process Gains

- Cognitive Stimulation
- Social Competition

Process Losses

- Social Loafing & Free Riding
- Production Blocking
- Cognitive Restrictions
- Evaluation Apprehension

Convergent Thinking

Selecting the best ideas

Process Gains

- More Objective Evaluation
- More Information

Process Losses

- Domination
- Hidden Profiles
- Evaluation Apprehension

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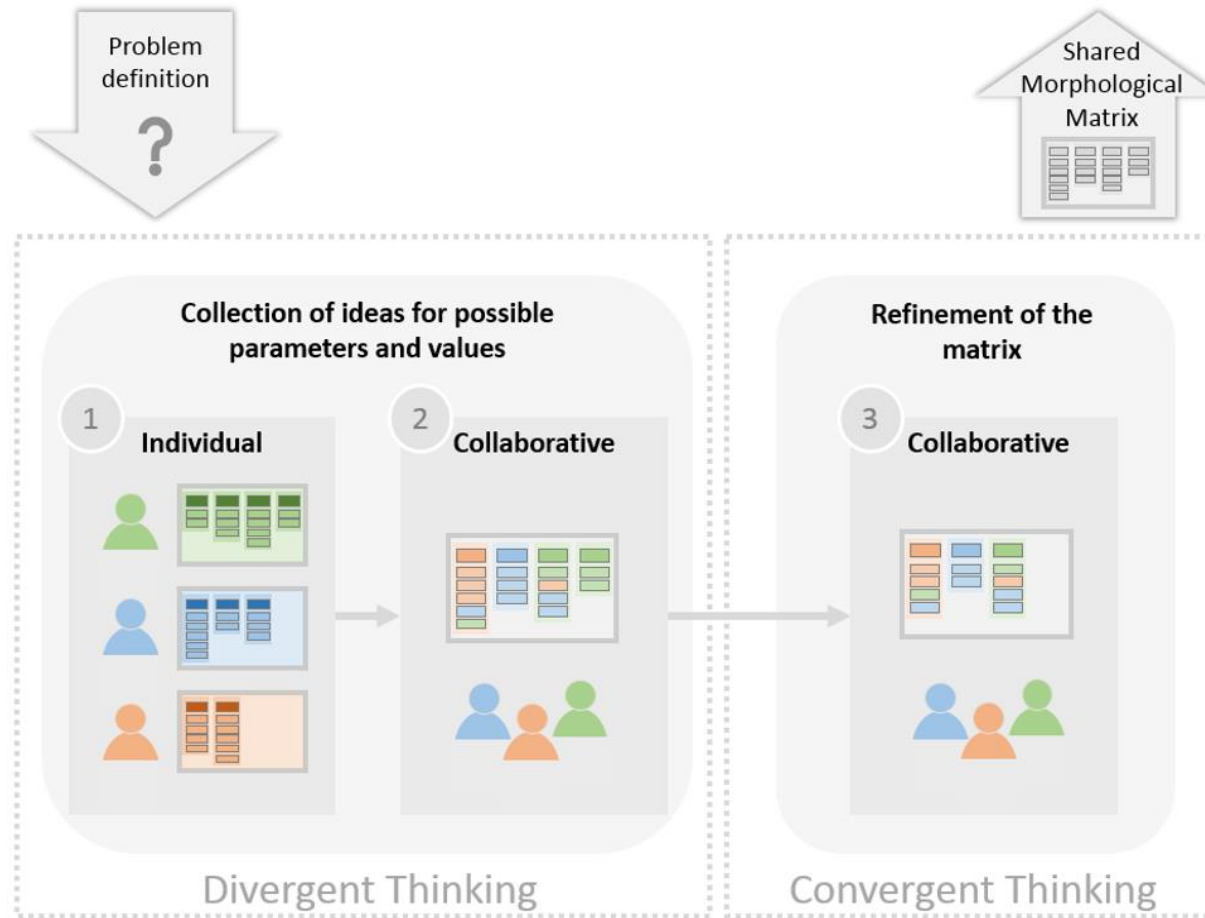
III. **Concept**

IV. Prototype – Live Demo

V. Evaluation

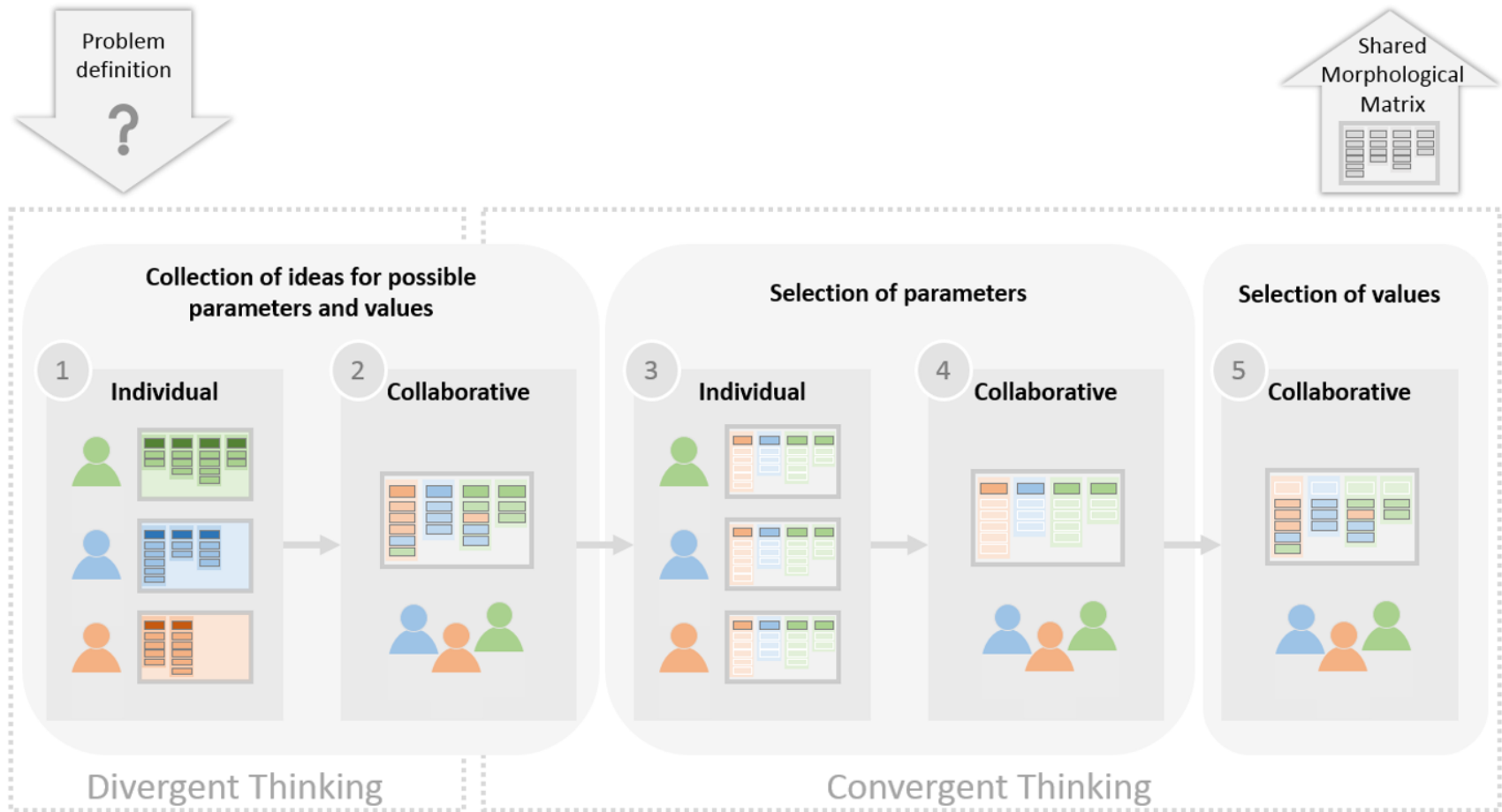
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Concept: Basic Process Model



- ✓ Prevention of **Production Blocking & Cognitive Restrictions** (step 1)
- ✓ Enabling **Cognitive Stimulation** (step 2)
- x **No Support for Group Decision Making** (step 3)

Concept: Extended Process Model



- ✓ Prevention of **Social Loafing, Evaluation Apprehension, Domination & Hidden Profiles** (step 3 & 4)
- ✓ Sharing **More Information** (step 3 & 4)

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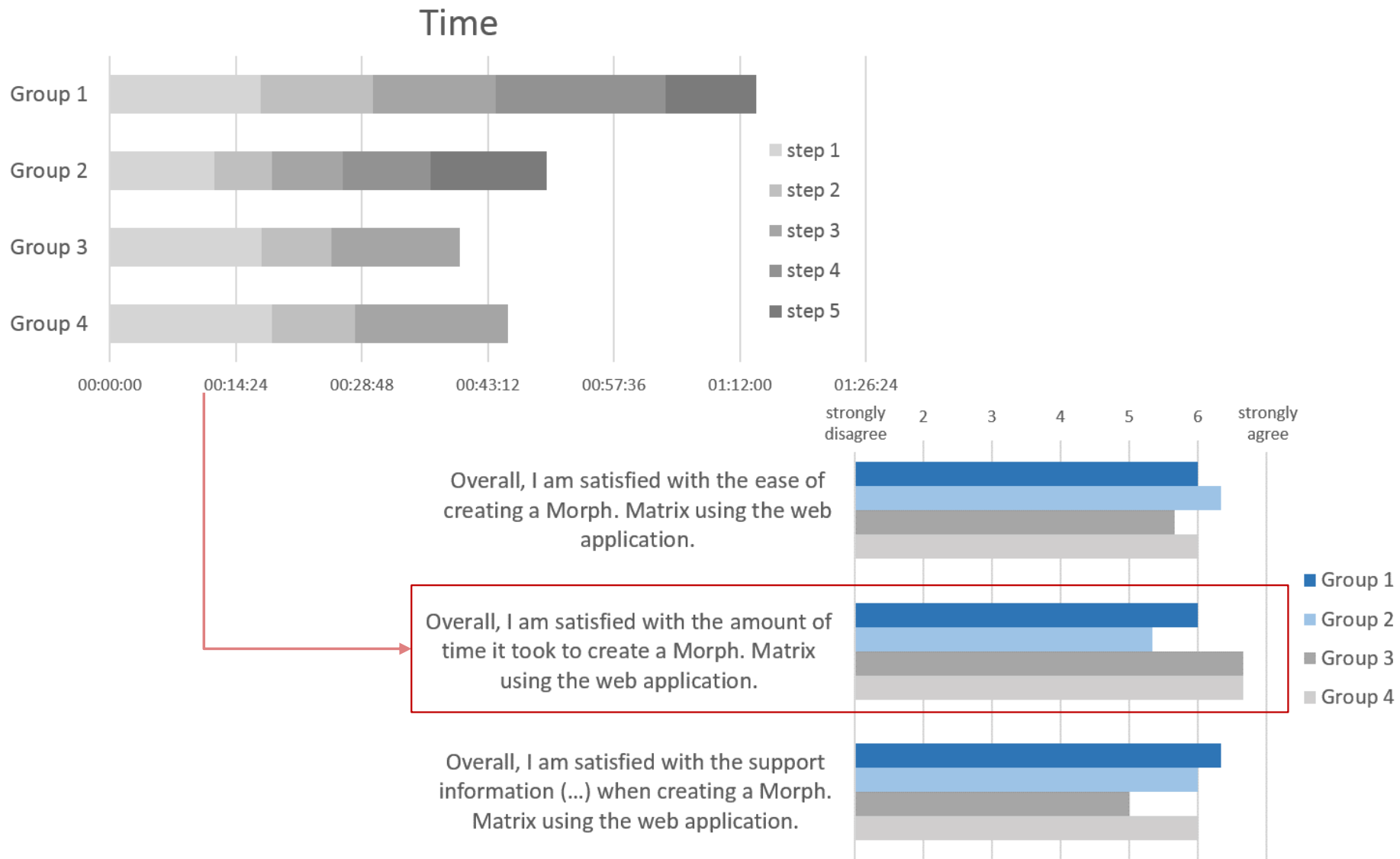
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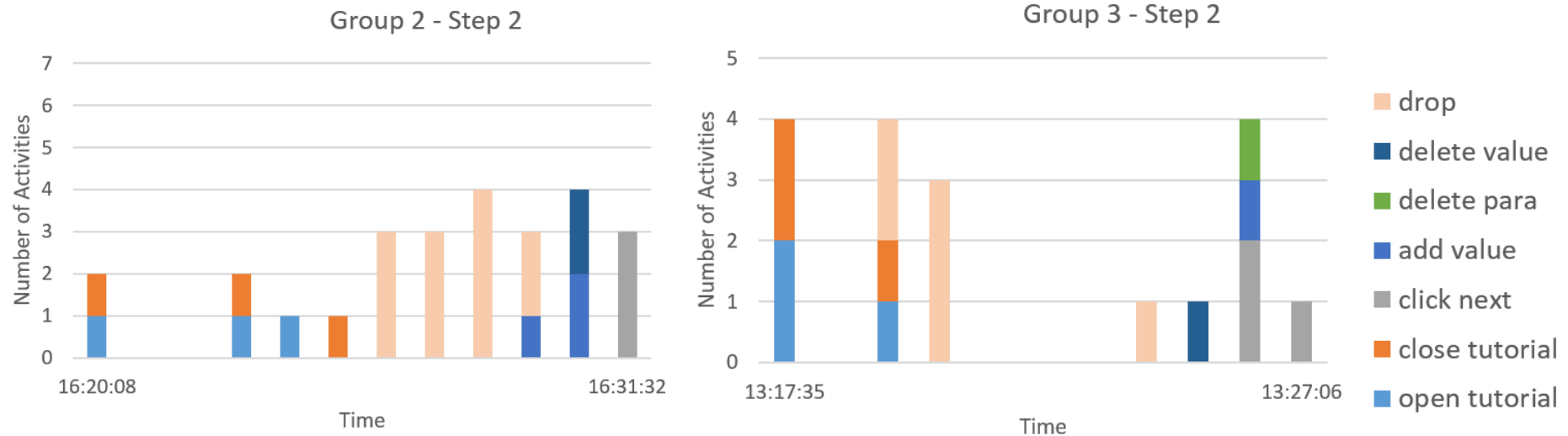
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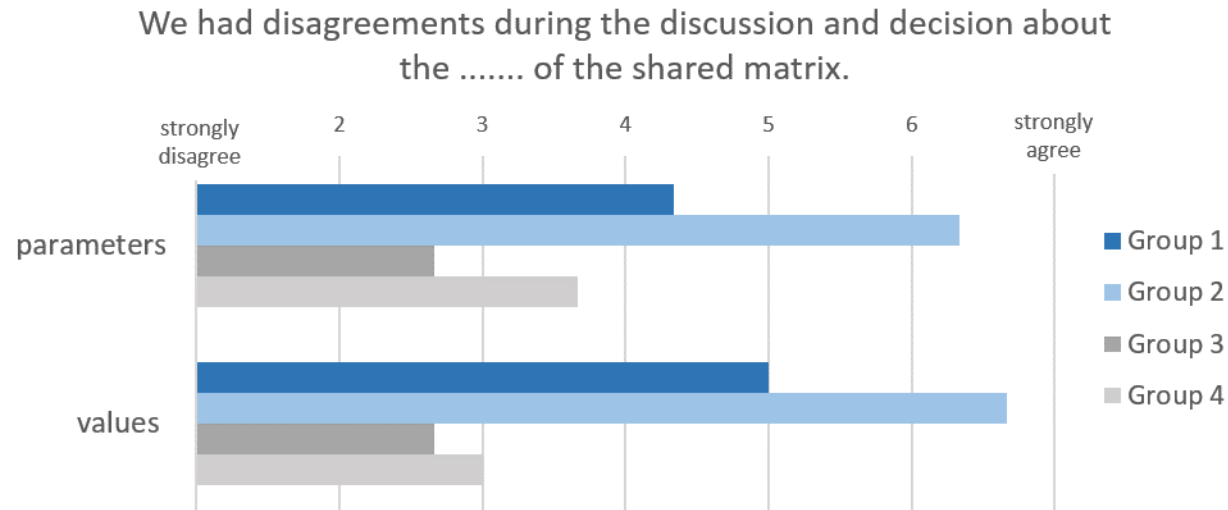
Controlled Laboratory Experiment

- 4 **groups of 3** students (2 basic process, 2 extended process)
- **Presentation** of „How to create a Morphological Matrix“
 - *Example: Design of a table*
- Using the **prototype** to create & agree on a **shared Morphological Matrix**
 - *Problem: Organizing an “Erasmus Event”*
 - *Guideline: ~7 parameters, 2-7 values for each parameter*
- **Questionnaire**
- Evaluation of logged data and questionnaire





- **Focus:** merging parameters
- Almost **no idea generation** (no cognitive stimulation)



More disagreements in groups applying the extended process

→ Indicator: voting procedure reduce domination and “solve” issue of hidden profiles

Shortcomings of the Prototype and Process Model

- **Usability of Drag & Drop feature**
- **Less cognitive stimulation** (step 2)
- **Lack of Scalability** (individual rating in step 3)
- **No Anonymity** (evaluation apprehension)

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Revising Web Application

- **Add Functionalities** (voice-to-voice communication, event timeline, restructure parameters/values)
- **Improve Usability and User Interface** (e.g. Drag & Drop)

Further Evaluation

- **Experiments with More Participants** (experienced participants, comparing to groups using the standard “whiteboard” scenario)
- **Audio and Screen Recording**
- **Monetary Incentives**

Thank you for your attention

Any questions?

Guilford, Joy Paul (1956). „The structure of intellect.“ In: *Psychological bulletin* 53.4, pp. 267–293.

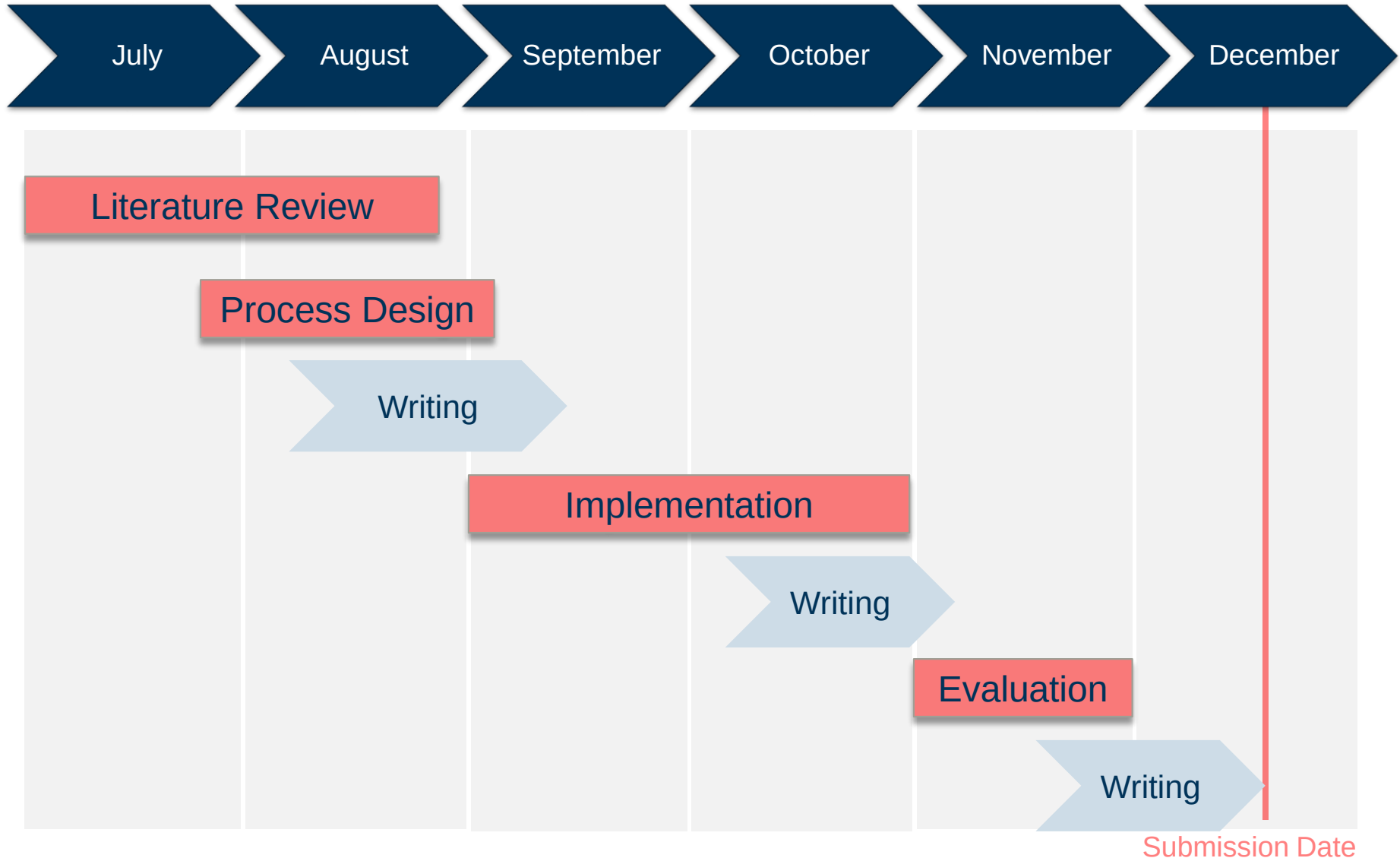
Hackman, J. R. and C. G. Morris (1975). „Group tasks, group interaction process and group performance effectiveness: A review and proposed integration“. In: *Advances in experimental social psychology* 8, pp. 47–99.

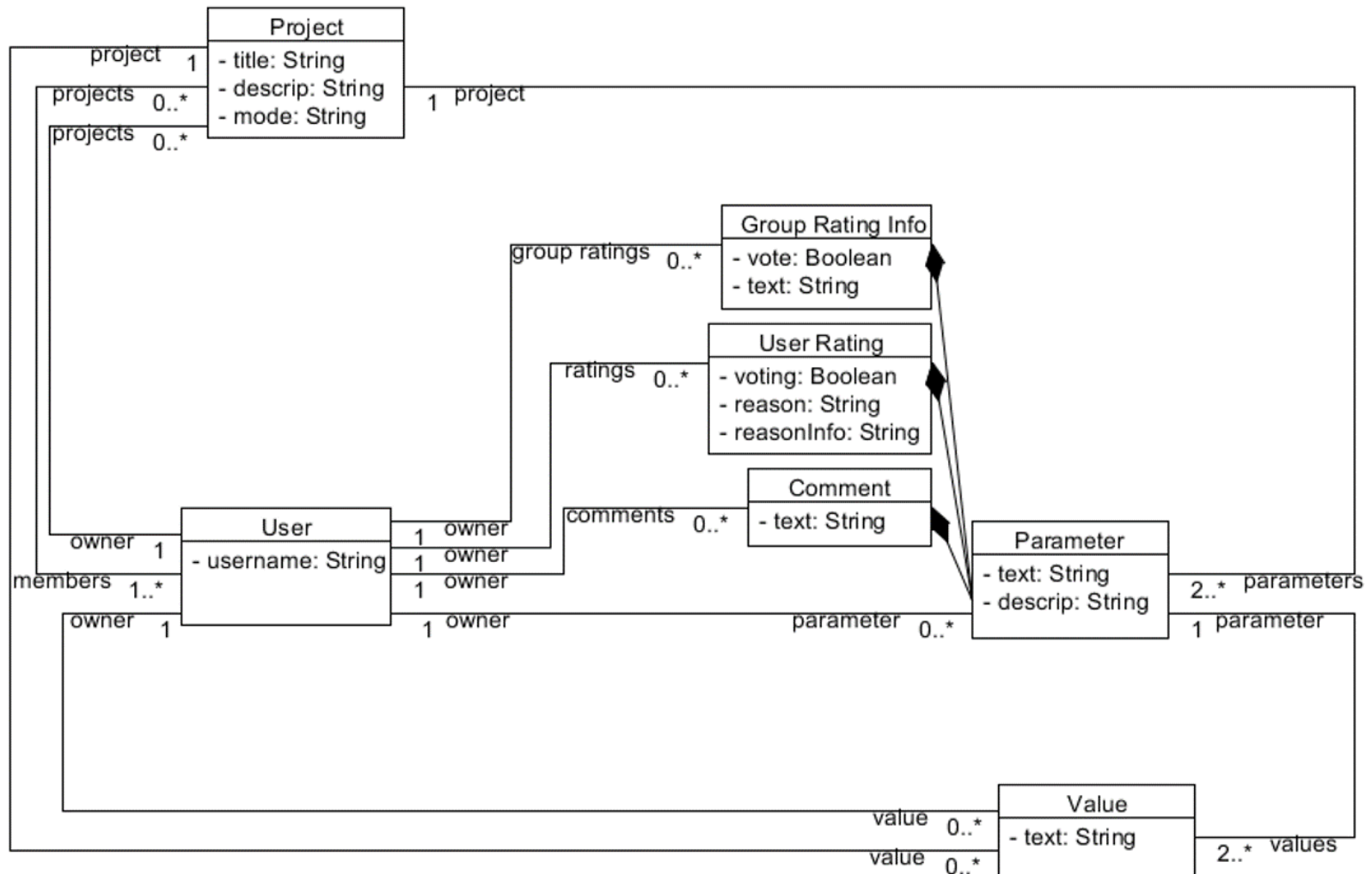
Ritchey, Tom (1998). „Fritz Zwicky, Morphologie and Policy Analysis“. In: *16th EURO conference on operational analysis, Brüssel*.

Zec, Marin, Alexander W. Schneider, and Florian Matthes (2015). „Towards a Process Model for Computer-Supported Collaborative Morphological Analysis“. In: *Proceedings of the 21st Americas Conference on Information Systems (AMCIS)*. Puerto Rico.

Thank you for your attention

Backup





ProjectList	ProgressList	RatingList	LogDataList
- _id - title: String - descrip: String - mode: String - membersInfo: [{user: _id, color: String}] - createdAt: Date - owner: _id	- _id - step1: Boolean - step2: Boolean - step3: Boolean - step4: Boolean - step5: Boolean - member: _id - project: _id	- _id - voting: Boolean - reason: String - reasonInfo: [String] - owner: _id - project_id: _id - p_id: _id	- _id - activity: String - infoText: String - infoID: _id - currentStep: Number - date: Date - user: _id - project: _id
ParameterList			
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ValueList			
- _id - text: String - partOfFinalMatrix: Number - createdInStep: Number - createdAt: Date - project_id: _id - p_id: _id - owner: _id			