technische universität
dortmund

Faculty of Business and Economics
Technology Studies Group

Simulation of the Governance of Complex Systems (SimCo)

Modeling transitions in transportation

2nd Workshop of the Dortmund Data Science Center (DoDSC)
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Technology Studies Group

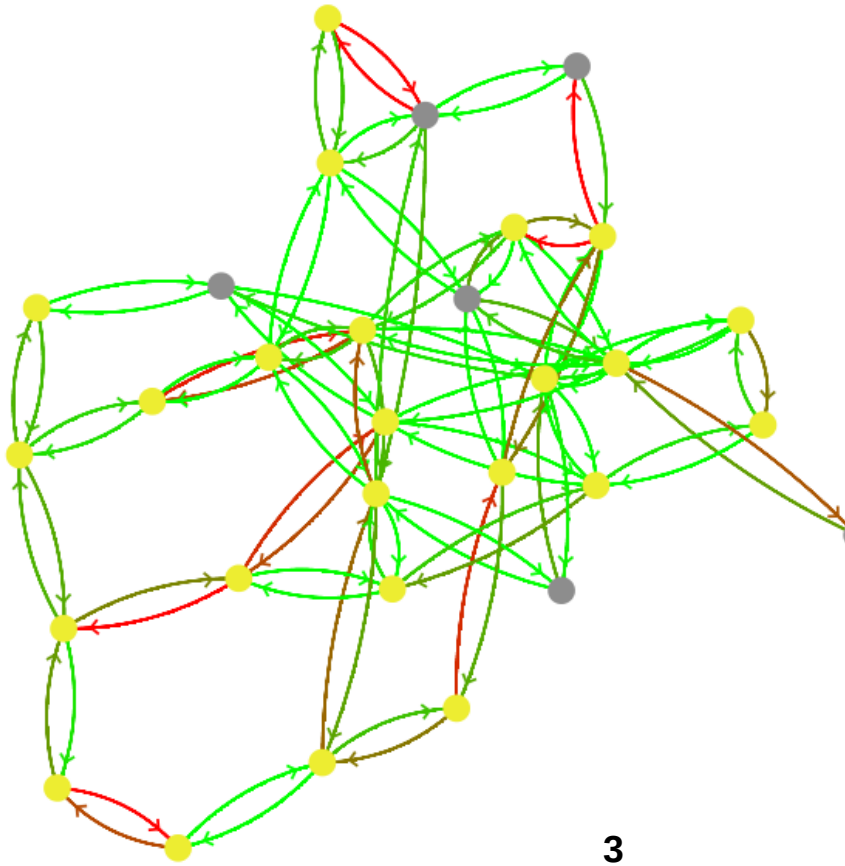
- established in 2002
  - 15 team members
- research projects
  - human-machine interaction
  - risk management in organizations
  - governance of socio-technical systems
  - modeling and simulation
  - digital society

- cooperation with
  - mechanical engineering, computer sciences, electrical engineering ...

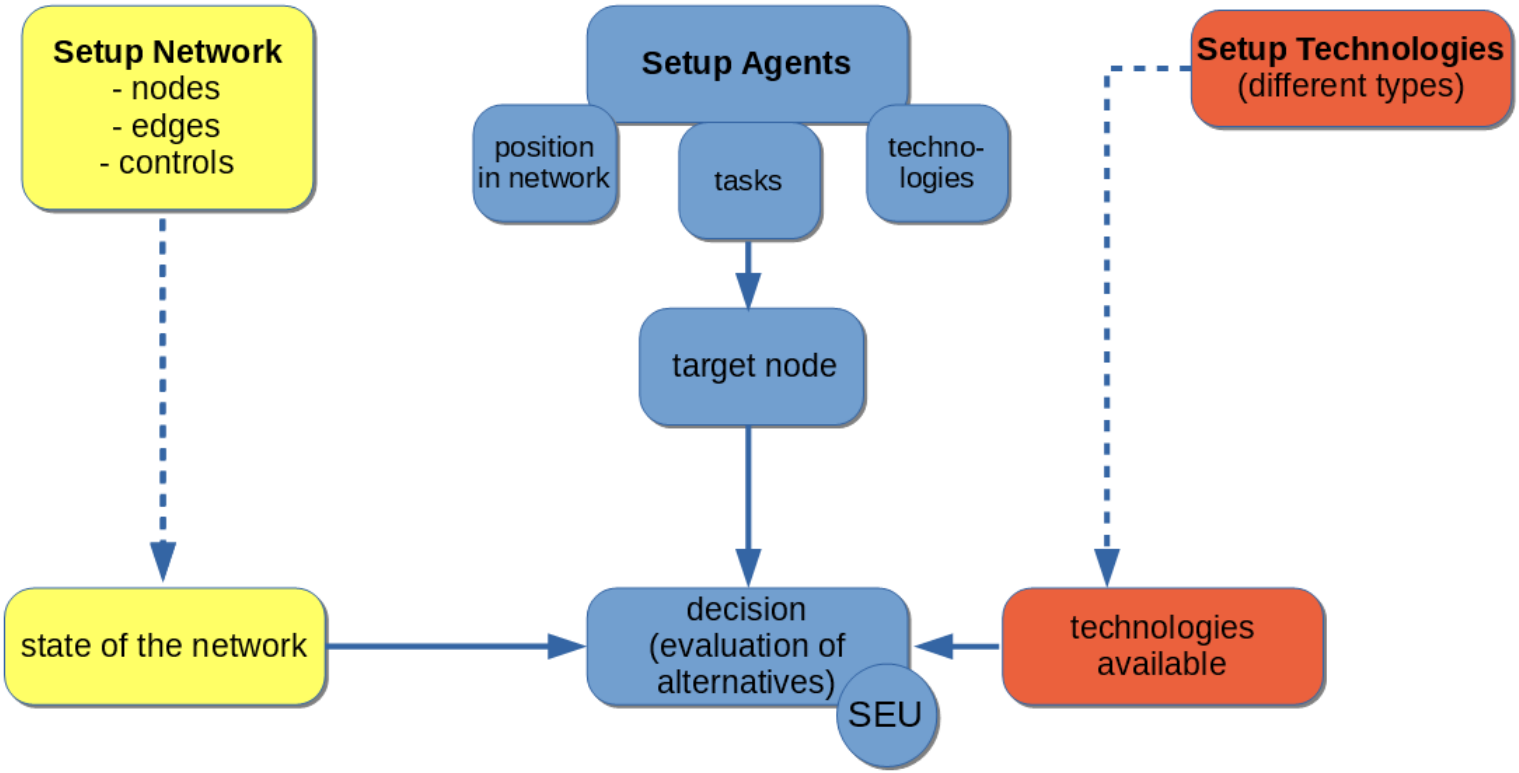
Simulation framework SimCo

SIMULATION OF THE GOVERNANCE OF COMPLEX SYSTEMS

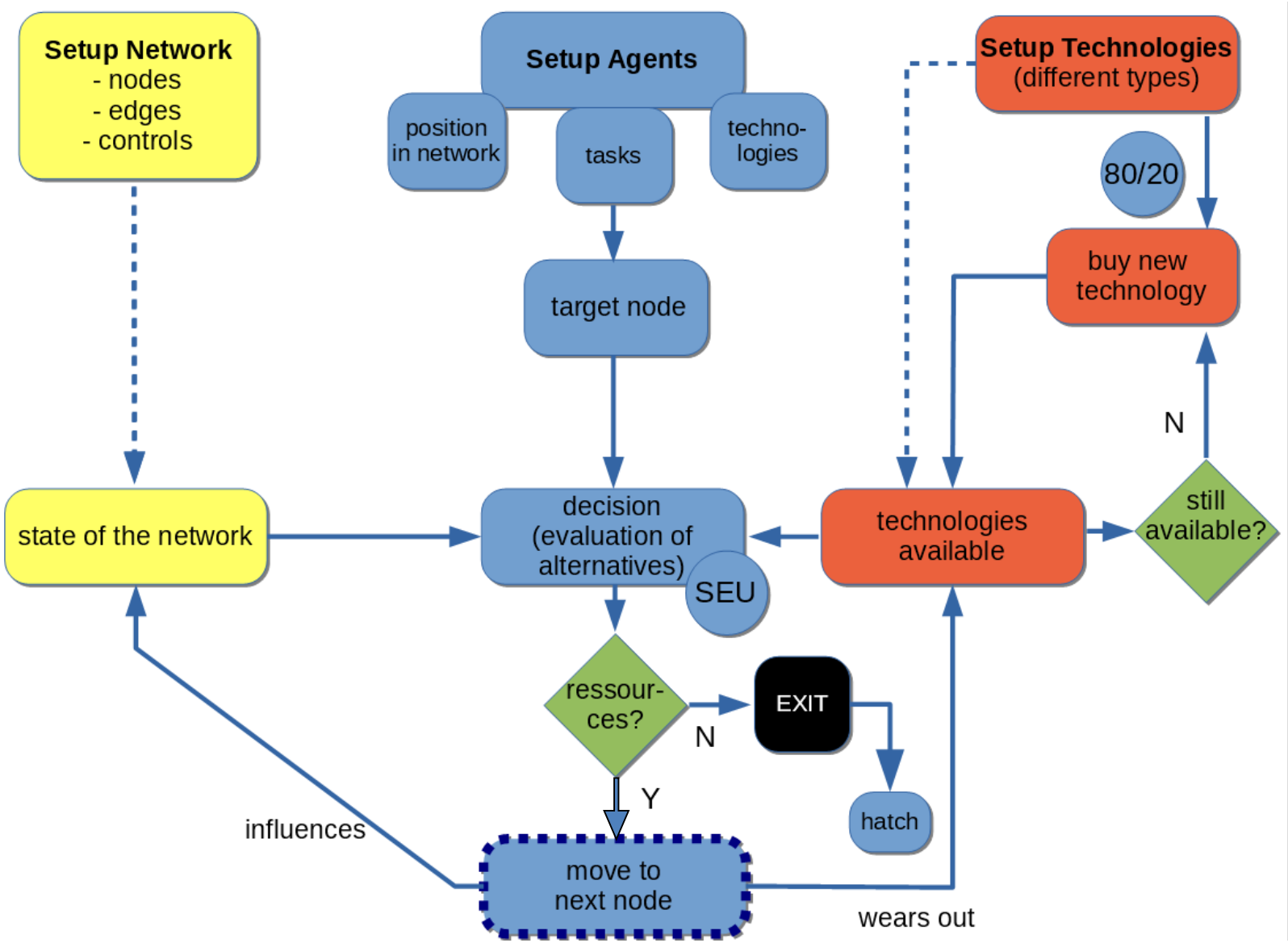
- Agent-based modelling (ABM)
- Rooted in sociology
  - System model
  - Behavioral model
- Simulation experiments
  - Road transportation
  - Energy system



Agents‘ choices

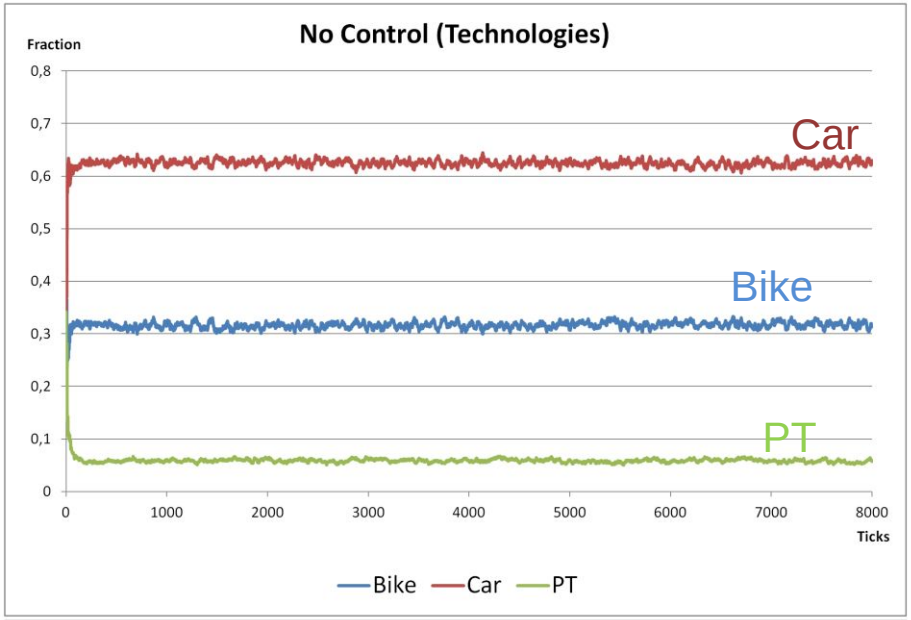


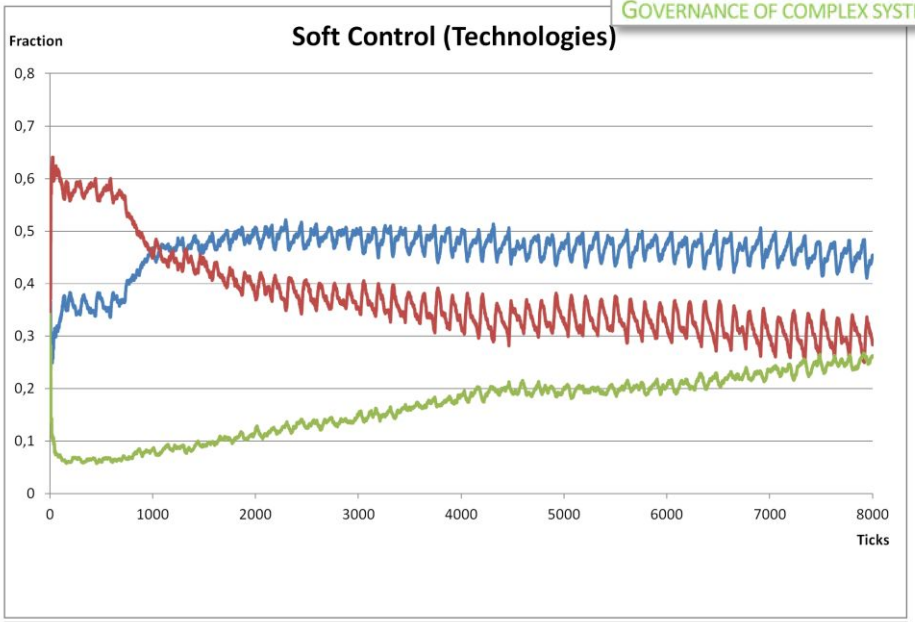
Agents‘ choices

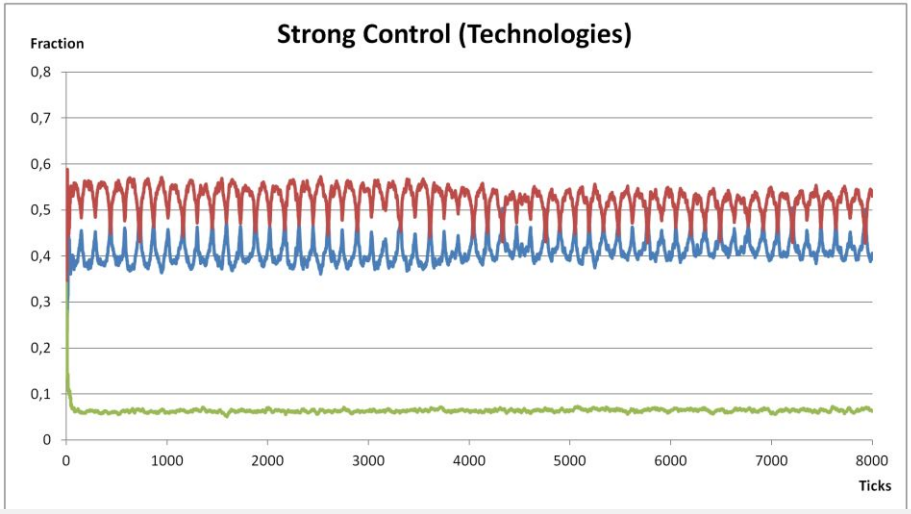


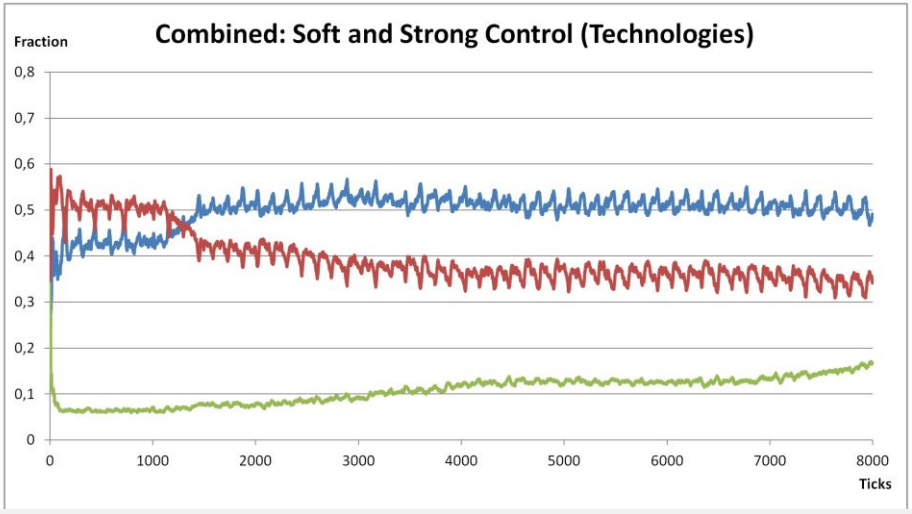
System transformation (urban transportation)

SIM Co
SIMULATION OF THE GOVERNANCE OF COMPLEX SYSTEMS









Adelt, Fabian/Johannes Weyer/Sebastian Hoffmann/Andreas Ihrig, 2018: Simulation of the governance of complex systems (SimCo). Basic concepts and experiments on urban transportation. In: Journal of Artificial Societies and Social Simulation 21 (2), http://jasss.soc.surrey.ac.uk/21/2/2.html.

Static interventions (free public transport)

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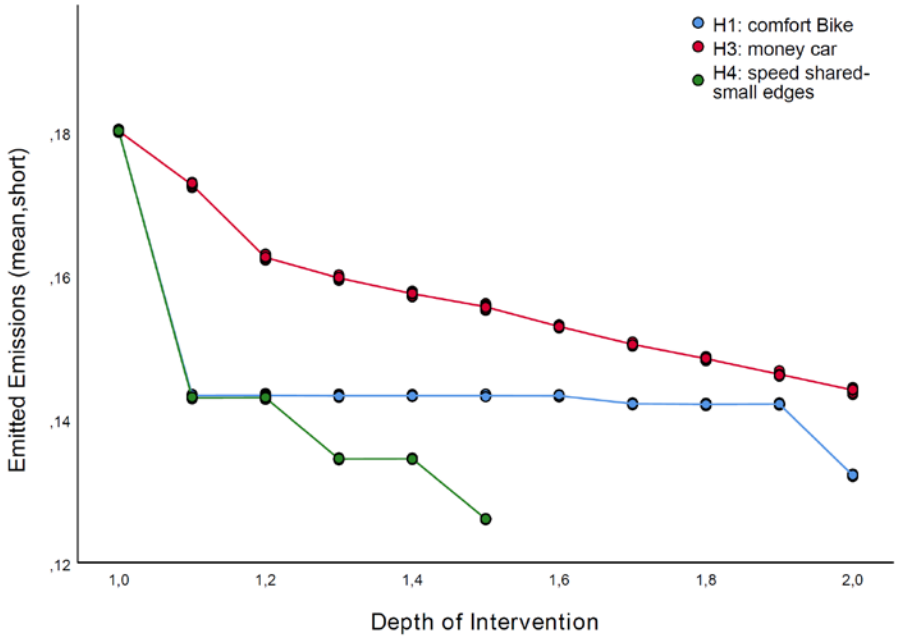

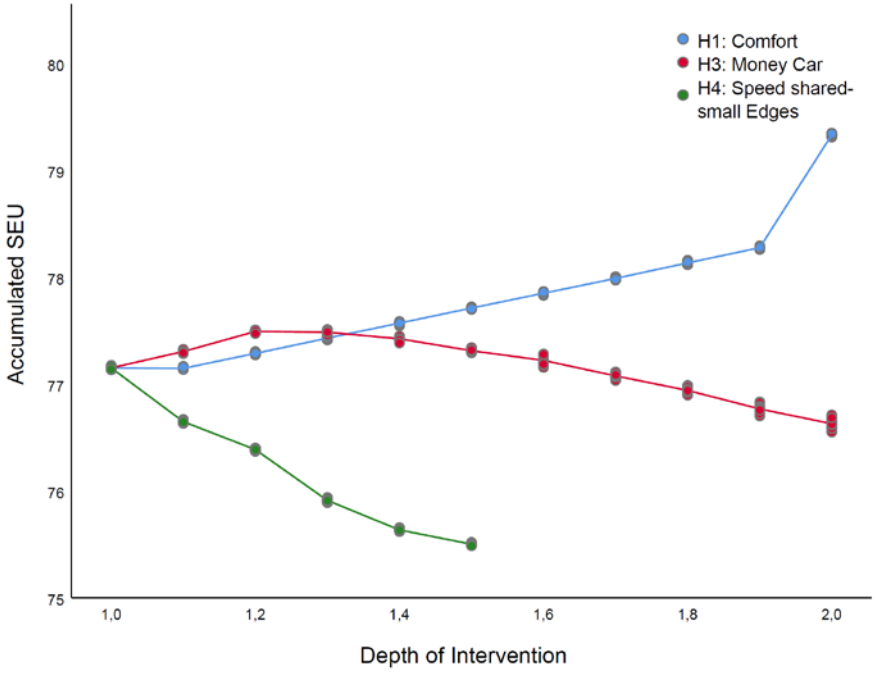

Philipp, Marlon/Fabian Adelt, 2018: Optionen der politischen Regulierung des Personenverkehrs. Ergebnisse einer Simulationsstudie. Soziologisches Arbeitspapier 53/2018, TU Dortmund. Dortmund, http://hdl.handle.net/2003/36806.

Real-time governance
Comparison of scenarios

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Scenarios	Compared to base scenario	macro: Emissions (%)	macro: Capacity utilization (%)	macro: Overload	macro: Agents stuck	macro: Car (%)	macro: Bike (%)	macro: Public transport (%)	micro: Preference fulfillment	micro: Target nodes reached
Fixed		-	-	++	---	--	-	-		--
Smart			+	++	++	-	-			+
Coordinated			+	++	++	-	-			+
	Unit	*PP*	*PP*	*%*	*%*	*PP*	*PP*	*PP*	*%*	*%*

green – positive valuation, **red** – negative valuation

Konrad, Julius/Johannes Weyer/Kay Cepera/Fabian Adelt, 2019: Echtzeitsteuerung komplexer Systeme. Eine Simulationsstudie (Soziologische Arbeitspapiere 57/2019). Dortmund: TU Dortmund *(in print)*.

Real-time governance
Comparison of scenarios

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	macro							micro	
Compared to base scenario	**Emissions (%)**	**Capacity utilization (%)**	**Overload**	**Agents stuck**	**Car (%)**	**Bike (%)**	**Public transport (%)**	**Preference fulfillment**	**Target nodes reached**
Fixed	-	-	++	---	--	-	-		--
Smart		+							
Coordinated		+	++	++	-	-			+
Unit	*PP*	*PP*	*%*	*%*	*PP*	*PP*	*PP*	*%*	*%*

green – positive valuation, **red** – negative valuation

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Smart		+							
Coordinated		+	++	++	-	-			+
Unit	*PP*	*PP*	*%*	*%*	*PP*	*PP*	*PP*	*%*	*%*

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Conclusion

- Governance of complex system
  - Sociological model
  - Behavioral dimension

- Modeling and Simulation
  - Effects of interventions
  - Future mobility?

Thanks for your attention!