The Negative Effects of Shared Leadership:
An Application of Agent-Based Modeling Based on Lab Experiment Data

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INGRoup Presentation
Steven Zhou
July 20, 2024

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LEADERSHIP STRATEGY

Bye-Bye, Heroic Leadership. Here Comes Shared Leadership

Carsten Tams Former Cont
I write about organizational

Mar 9, 2018, 03:26pm EST

TWEET THIS

we need a differen organizations.

Leadership is not increase the sense

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leadership is
insights into

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- What is shared leadership?
- Shared leadership vs. traditional leadership
- Why is shared leadership important?
- Examples of shared leadership

Shared Leadership: H Businesses Run Thems

Marisa Sanfilippo

Business News Daily Contributing Writ
Updated Dec 01, 2021

Sharing knowledge keeps compa

Using 50 effect meta-analytic s mance. Employ ated measuren size estimates. Specifically, as compared to studies that conceptualized and employe ments of overall shared leadership from members (i.e., an aggregation approach)

'As Bizarre as It Sounds': At Ohio State, Trustees Will Do the President's Job

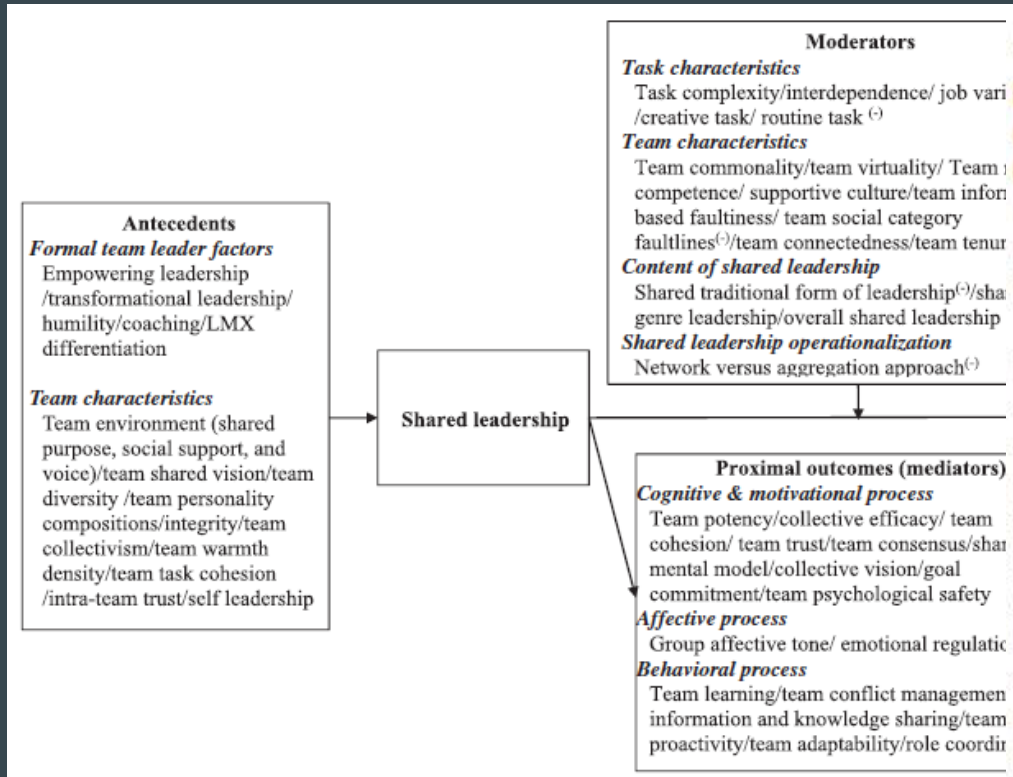
By David Jesse | MAY 5, 2023

COURTNEY HERGESHEIMER/COLUMBUS D

Ohio State's Board of Trustees at a public meeting in 2021

On Monday morning, Ohio State University won't have a president — either interim or permanent. Instead, cabinet-level administrators will report directly to the university's governing-board subcommittees.

Annual Review of SL (Zhu et al., 2018)



6.8 | Potential dark side of shared leadership

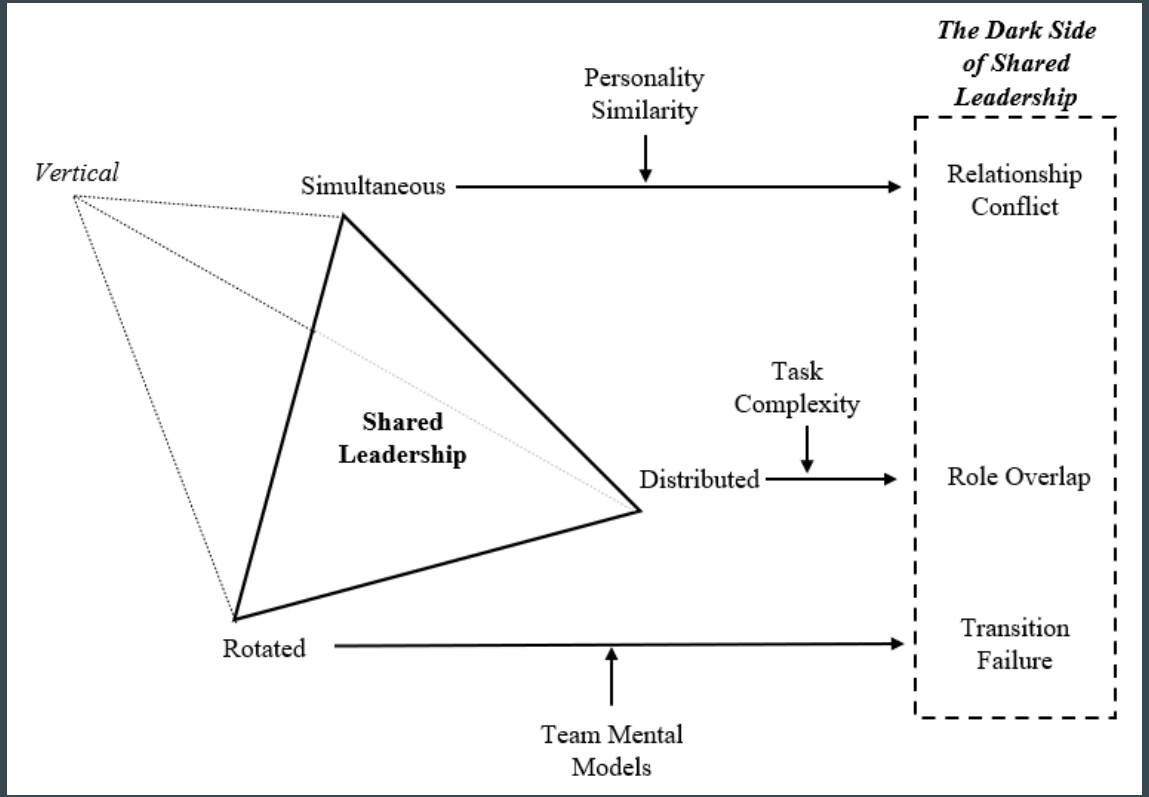
Our review identifies that current research has focused predominantly on the bright side of shared leadership. To date, knowledge on the potential dark side of shared leadership is lacking. Like other positive leadership constructs such as empowering leadership (e.g., Sharma & Kirkman, 2015), we suggest that shared leadership researchers should explore its potential dark side as well.

There is a set of interesting research issues surrounding when and for whom shared leadership is harmful. For example, as shared leadership is a more complex and time-consuming process compared with traditional vertical leadership (Pearce, 2004), teams with high levels of shared leadership may take more time to reach consensus, resulting in lower efficiency in decision-making. This could be a challenge especially in industries with high environmental dynamism. Moreover, shared leadership is associated with dispersion of responsibility; thus, the issues of free riding and social loafing may emerge in shared leadership contexts, especially in large teams. Also, shared leadership might be associated with groupthink, especially in teams with low cognitive diversity.

Core Research Question:

To what degree does shared leadership produce negative outcomes (the “dark side”) and under what conditions are these exacerbated?

Proposed Model of the “Dark Side” of SL

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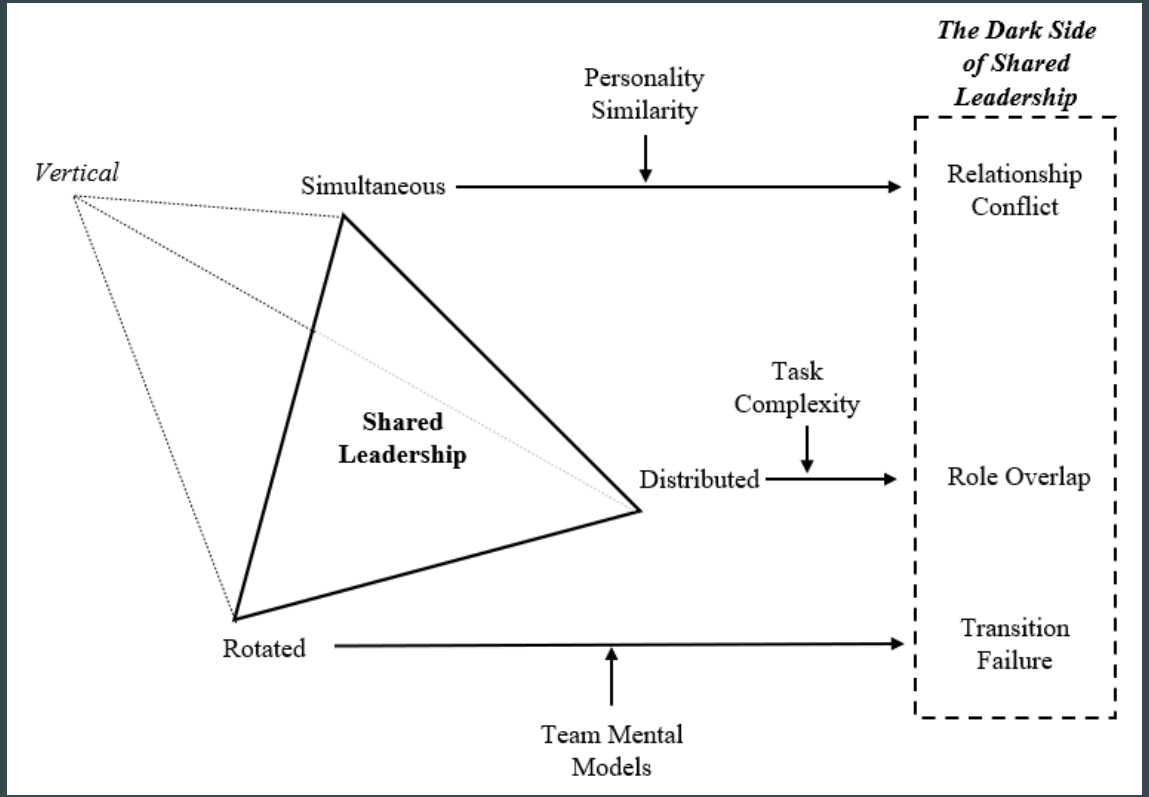
Proposed Model of the “Dark Side” of SL

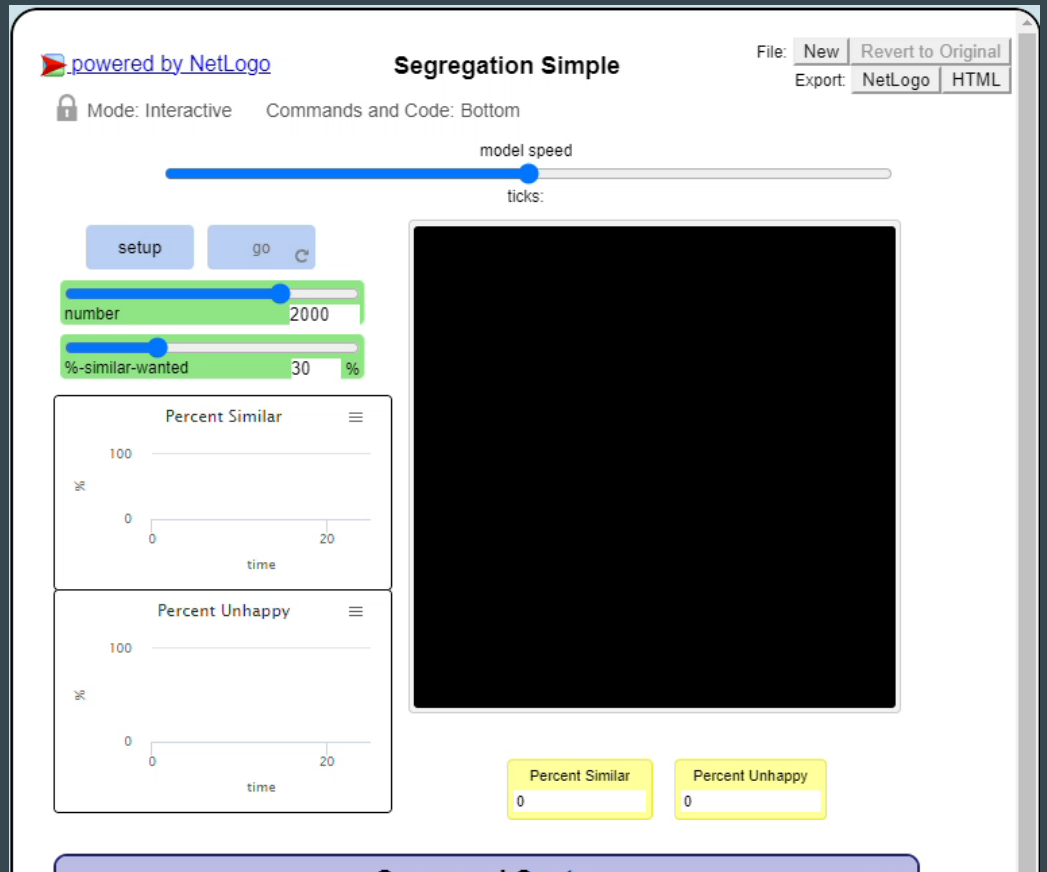


Why computational modeling?

- Growing critique of traditional hypothetico-deductive model of scientific reasoning found in traditional lab experiments (Debrouwere & Rosseel, 2021)
- Teams are a complex combination of complex individuals, which traditional analyses cannot adequately capture (Kozlowski & Chao, 2018)
- Computational modeling allows us to establish simple, micro-level rules and processes (e.g., “if... then...”) to explore how they lead to complex macro-level emergent phenomena
- Agent-based modeling is a specific form that generates simulated “agents” (in this case, SL team members) that interact in a designated space and through designated processes to produce some set of results.

Example of agent-based computational model

Residential Segregation Model (Schelling, 1971): an ABM that shows how individual agents' (i.e., peoples') preferences for living near similar neighbors can lead to large-scale segregation



Three studies using ABMs to study shared leadership

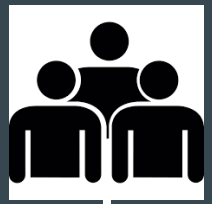
- Sullivan et al. (2015): describes how individual differences (e.g., motivation to lead, personality) and relational variables (e.g., number of friends) influences leadership claim/grant processes at a micro level, then how that aggregates to macro-level SL structures depending on physical space (i.e., how far apart team members are in the model)
- Travers (2018): describes how internal team environment, external team coaching, and vertical transformational and empowering leadership impact the strength and pace of SL emergence over time
- Lungeanu et al. (2022): describes how eight different leadership structures (including SL) impact development of mental models in 4-member crews over the course of 45 days

Summary

- Based on my theoretical model of the dark side of SL...
- The lab experiment (Study One) investigates each form of SL separately (three conditions)
- The ABM (Study Two) explores more complex interactions of blended forms of SL to lead to blended outcomes, with parameters based on lab experiment data
- ABMs can also manipulate additional parameters such as team size, number of team roles/functions, and how many days the SL team is working together

Lab Experiment Overview

Lab Experiment Procedure



HEXACO measures Game-playing ability

Simultaneous SL Condition:
- All team members can take actions at any time
- Teams created to be either high or low personality similarity (average I_{pa}; McCrae, 1993)

Distributed SL Condition:
- Team members can only perform their assigned action
- Opponent "team" script written to be either "difficult" or "easy" to model task complexity

Rotated SL Condition:
- Only one team member can take actions per turn, and this rotates each turn
- Team interactions manipulated through instructions and Zoom restrictions to either allow development of strong mental model or not

Post-Game Measures
- SL density
- Separation by function
- Separation by time
- Perceived difficulty and TMM
- Relationship Conflict
- Role Overlap
- Transition Failures
- Performance

Parameter Estimates

Outcome	Predictor	Standardized Beta	Standard Error
Relationship Conflict with Team Member #1	SL X Team Personality Similarity	-0.141	0.210
Relationship Conflict with Team Member #2	SL X Team Personality Similarity	0.759	2.037
Relationship Conflict with Team Member #3	SL X Team Personality Similarity	1.837	2.288
Role Overlap	SL X Difficulty	0.162	0.121
Transition Failure	SL X TMM	0.632	0.635

Agent-Based Model Input Parameters

Parameter	Values	Description
n	3, 4, 5, 6, 7, 8, 9	Number of people (agents) on the shared leadership team
f	3, 4, 5, 6, 7, 8, 9	Number of functions to which agents can be assigned
P1	0 → 100, increments of 10	Separation by function
P2	0 → 100, increments of 10	Separation by time
probability	low, medium, high	Probability of effect determined by the lab experiment parameter estimates ("low"), estimates derived from the literature review ("high"), or somewhere in between ("medium")

Separation by Function (P1)	Separation by Time (P2)	Type of Shared Leadership
0	0	simultaneous shared
100	0	distributed
0	100	rotated

17,787 different conditions X 30 iterations each = 533,610 simulations

ABM Process Outline

Step 1. Initialize (create) SL team based on input parameters (*n*, *f*, *P1*, *P2*) and randomly drawn personality and team mental model scores

Step 2. For each tick, generate a task (t_i where $i = \{1, 30\}$) with two parameters:
- Task interdependence: number of functions required to adequately complete the task, randomly drawn from between one and *f* functions
- Task duration: how long the task is active, randomly drawn from between 0 and number of days remaining in the simulation

Step 3. Identify which team members will work on the task, depending on:
- Assigned functions: team members that are assigned functions that match the task complexity will work on the task
- Timing: team members who are assigned to lead during that "day" (t_i) will work on the task

ABM Process Outline

Step 4. Compute outcome variables:

- Relationship conflict: compare the personalities of team members working on the task using I_{pa} → based on low/medium/high probabilities, determine % likelihood of one "unit" (SD) increase in relationship conflict
- Role overlap: each instance where the task requires agents to engage in a function "outside" of their assigned area → based on low/medium/high probabilities, determine % likelihood of one "unit" (SD) increase in role overlap
- Transition failure: each instance where a handoff occurs such that a task is passed from person 1 to person 2 → based on low/medium/high probabilities, determine % likelihood of one "unit" (SD) increase in transition failure

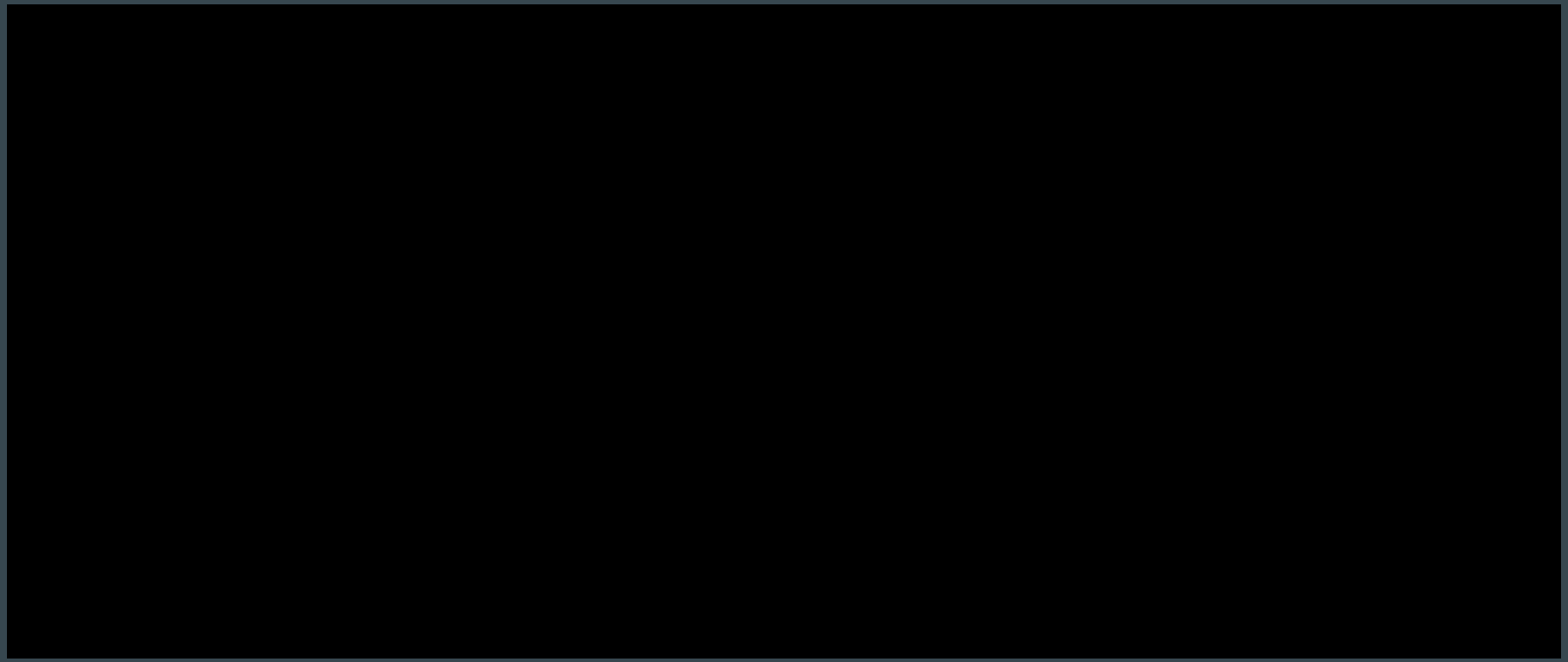
ABM Process Outline

Step 5. Repeat Steps 2-4 for $d = 30$ days, tally up outcome variables at the end of the simulation period

Step 6. Record one row of data: n, f, d, $P1$, $P2$, average I_{pa}, average task complexity, average team mental model scores, total units of each outcome variable

Step 7. Repeat Steps 1-6 for each combination of input parameters, totalling 533,610 rows of data

Running the ABM...



Analyses

533,610 simulations showed:

1. Simultaneous SL predicted relationship conflict: β = -0.32, adj. R^2 = 0.11
   Moderator (personality similarity) was positive: β = 0.30, ΔR^2 = 0.12
2. Distributed SL predicted role overlap: β = 0.44, adj. R^2 = 0.20
   Moderator (task interdependence) was positive: β = 0.80, ΔR^2 = 0.16
3. Rotated SL predicted transition failure, but negligible: β = 0.11, adj. R^2 = 0.01
   Moderator (TMM) was negative, but negligible: β = -0.04, ΔR^2 = 0.03
4. P1 = 10 (low separation by function) and P2 = 0 (no separation by time) produced the best linear combination of outcomes
5. Number of team members, number of functions, differential weighting of outcomes all changed the results

Future Directions

1. Adapting the ABM to focus on performance and efficiency of SL teams
2. Adapting the ABM to disaggregate individual- and team- level variables (e.g., currently team mental model is team-level and identical for all individuals on the team)
3. Adapting the ABM to allow for growth/change of the team

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Thank you!

Find me at www.stevenzhou.us

Table: Correlation matrix from lab experiment data

	Mean	SD	Range	1	2	3	4	5	6	7	8
1. age	26.90	10.86	18-70								
2. games_enjoy	4.39	0.75	1-5	0.01							
3. games_good	3.48	0.78	1-5	-0.08	0.47***						
4. games_freq	3.40	1.08	1-5	0.00	0.64***	0.53***					
5. games_ability	50.97	4.05	6-30	-0.16*	0.33***	0.64***	0.40***	*0.87*			
6. Hon	36.10	6.94	10-50	0.27***	-0.02	0.04	0.04	0.03	*0.75*		
7. Emo	34.25	6.91	10-50	-0.07	-0.02	-0.18*	-0.01	-0.23**	0.05	*0.73*	
8. Ext	31.91	6.99	10-50	0.20**	-0.01	0.15	-0.03	0.06	0.15*	-0.13	*0.78*
9. Agr	33.78	6.82	10-50	0.08	0.02	0.04	0.04	0.01	0.36***	-0.09	0.35***
10. Con	36.40	6.41	10-50	0.41***	-0.07	-0.01	-0.07	-0.02	0.35***	-0.01	0.25***
11. Ope	35.32	6.86	10-50	0.42***	0.26***	0.12	0.18*	0.01	0.10	0.12	0.20**
12. Team_IPA[a]	18.92	2.25	14.16-25.46	0.48***	0.00	0.02	-0.03	-0.09	0.33***	0.04	0.43***
13. SL_distrib	3.14	1.46	1-5	-0.12	0.00	0.04	0.06	0.13	0.10	0.09	-0.01
14. SL_rotated	2.79	1.51	1-5	-0.10	-0.06	-0.02	0.04	0.02	0.10	-0.15*	0.00
15. SL_density	7.59	1.27	2-10	-0.10	-0.05	0.08	0.02	0.06	0.00	-0.07	0.09
16. perform[a]	25.67	14.58	0-46	0.19**	0.07	-0.06	-0.03	-0.04	-0.09	0.00	-0.05
17. difficulty	11.15	3.78	3-21	0.17*	0.06	0.15*	0.12	0.08	0.16*	0.15*	0.09
18. TMM	16.27	3.12	4-20	0.12	-0.03	-0.04	-0.02	-0.02	0.19*	0.06	0.11
19. rc_1	7.23	3.76	6-30	-0.07	-0.05	0.13	0.07	0.08	-0.16	-0.10	0.13
20. rc_2	6.88	2.96	6-30	-0.13	-0.03	0.13	0.15	0.11	-0.07	-0.12	-0.05
21. rc_3	6.65	2.26	6-30	-0.09	-0.01	-0.06	-0.10	-0.02	-0.03	0.09	-0.01
22. ro	5.25	2.48	4-20	-0.03	-0.11	0.03	0.08	0.04	-0.12	-0.02	-0.04
23. tf	4.98	2.04	3-12	0.00	-0.03	0.00	0.01	-0.02	-0.09	0.00	-0.01

Table: Correlation matrix from lab experiment data (cont.)

	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. age														
2. games_enjoy														
3. games_good														
4. games_freq														
5. games_ability														
6. Hon														
7. Emo														
8. Ext														
9. Agr	*0.77*													
10. Con	0.19*	*0.75*												
11. Ope	0.12	0.18*	*0.74*											
12. Team_IPA	0.29***	0.50***	0.37***											
13. SL_distrib	-0.03	0.01	-0.14	-0.02										
14. SL_rotated	0.09	-0.06	-0.04	-0.09	0.28***									
15. SL_density	0.13	-0.05	-0.05	0.03	0.20**	0.23**								
16. performance	-0.05	-0.05	0.08	-0.01	-0.08	0.06	-0.10							
17. difficulty	0.07	0.10	0.06	0.14	0.16*	-0.14	0.13	-0.40***	*0.89*					
18. TMM	0.14	0.10	0.00	0.02	0.29***	0.33***	0.22**	0.27***	0.08	*0.83*				
19. rc_1	-0.05	-0.14	-0.09	0.02	0.06	0.10	0.06	-0.24**	0.04	-0.21*	*0.95*			
20. rc_2	-0.07	-0.10	-0.26**	-0.07	0.04	0.12	-0.08	-0.19*	0.01	-0.14	0.78***	*0.95*		
21. rc_3	-0.11	-0.06	-0.04	-0.07	-0.04	-0.09	-0.26**	0.05	-0.01	-0.05	0.48***	0.46***	*0.95*	
22. ro	-0.18*	0.02	-0.13	0.00	0.03	0.03	-0.02	-0.29***	0.10	-0.23**	0.65***	0.82***	0.31***	0.87
23. tf	-0.11	-0.06	-0.05	0.03	-0.09	-0.13	-0.22**	-0.27***	0.08	-0.46***	0.15	0.15	0.05	0.29***

Table: Correlation matrix from agent-based model data

	1	2	3	4	5	6	7	8	9	10
1. n										
2. f	0.00									
3. P1	0.00	0.00								
4. P2	0.00	0.00	0.00							
5. personality similarity	0.00	0.00	0.00	0.00						
6. task complexity	0.00	0.92***	0.00	0.00	0.00					
7. team mental model	0.00	0.00	0.00	0.00	0.00	0.00				
8. relationship conflict	0.19***	0.03***	-0.11***	-0.48***	-0.27***	0.03***	0.00			
9. role overlap	0.16***	0.31***	0.44***	-0.45***	0.00	0.34***	0.00	0.39***		
10. transition failure	0.32***	0.04***	-0.17***	0.11***	0.00	0.06***	-0.18***	-0.05***	0.04***	