Computational Process Theorizing

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Is HR Important to Organizations?

that it's the companies that employees say are great workplaces that demonstrate stronger financial performance, reduced turnover, and better customer and patient satisfaction than their peers. The annual ranking, produced in collaboration with

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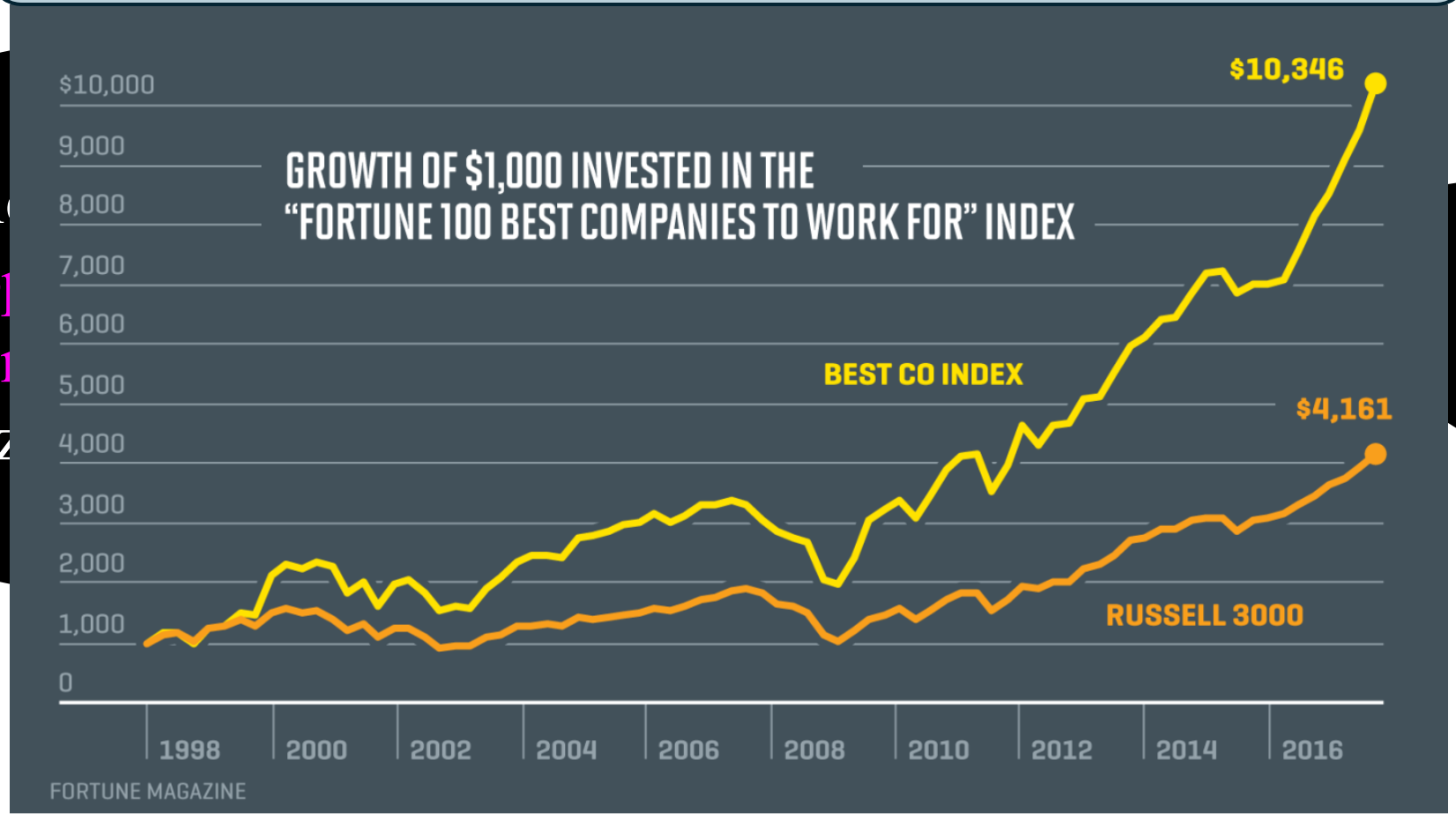


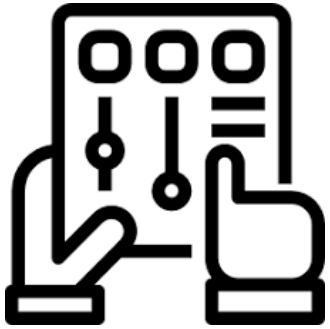
Yoshimoto & Frauenheim, *Fortune, 2018*

It Begs the Question: What Kind of Knowledge Does Organizational Science Accumulate?

To what extent does our accumulated knowledge help us explain how something works, functions, or operates?

To what extent does our accumulated knowledge help us predict what will happen?

To what extent does our accumulated knowledge help us control/direct what will happen?



Narrative Construct Theories Versus Computational Process Theories

Contents lists available at ScienceDirect

The Leadership Quarterly

Table 1
A Typology for Theory Development.

Theory Focus	Theory Modality: Narrative	Theory Modality: Computational
Constructs	**Definition:** Uses narrative rationale to predict how constructs covary **Example:** [illegible] (2010) **Note:** Most common form of theorizing in organizational science	**Definition:** Uses mathematics and logic to highlight consequences of construct relationships, especially consequences over time **Example:** Park et al. (2015) **Note:** Commonly comes in the form of what-if scenario analyses
Processes	**Definition:** Uses a narrative rationale to describe how actors think, feel, behave, and socialize with each other in pursuit of pertinent goals **Example:** Klein et al. (2006) **Note:** Qualitative research investigating work processes	**Definition:** Uses mathematics, logic, and computer programs to describe how actors think, feel, behave, and socialize with each other in pursuit of pertinent goals **Example:** [illegible] **Note:** Explicit, formal specification of operational processes; we argue the benefits of developing these types of theories for organizational science

Narrative Construct Theories

Computational Process Theories

process model we develop, to explicitly demonstrate the differences between construct and process thinking. We then discuss how computational process theories advance theory development. We conclude with a discussion of the long-term benefits of computational process theories for organizational science.

Organizational Science Accumulates Construct Knowledge

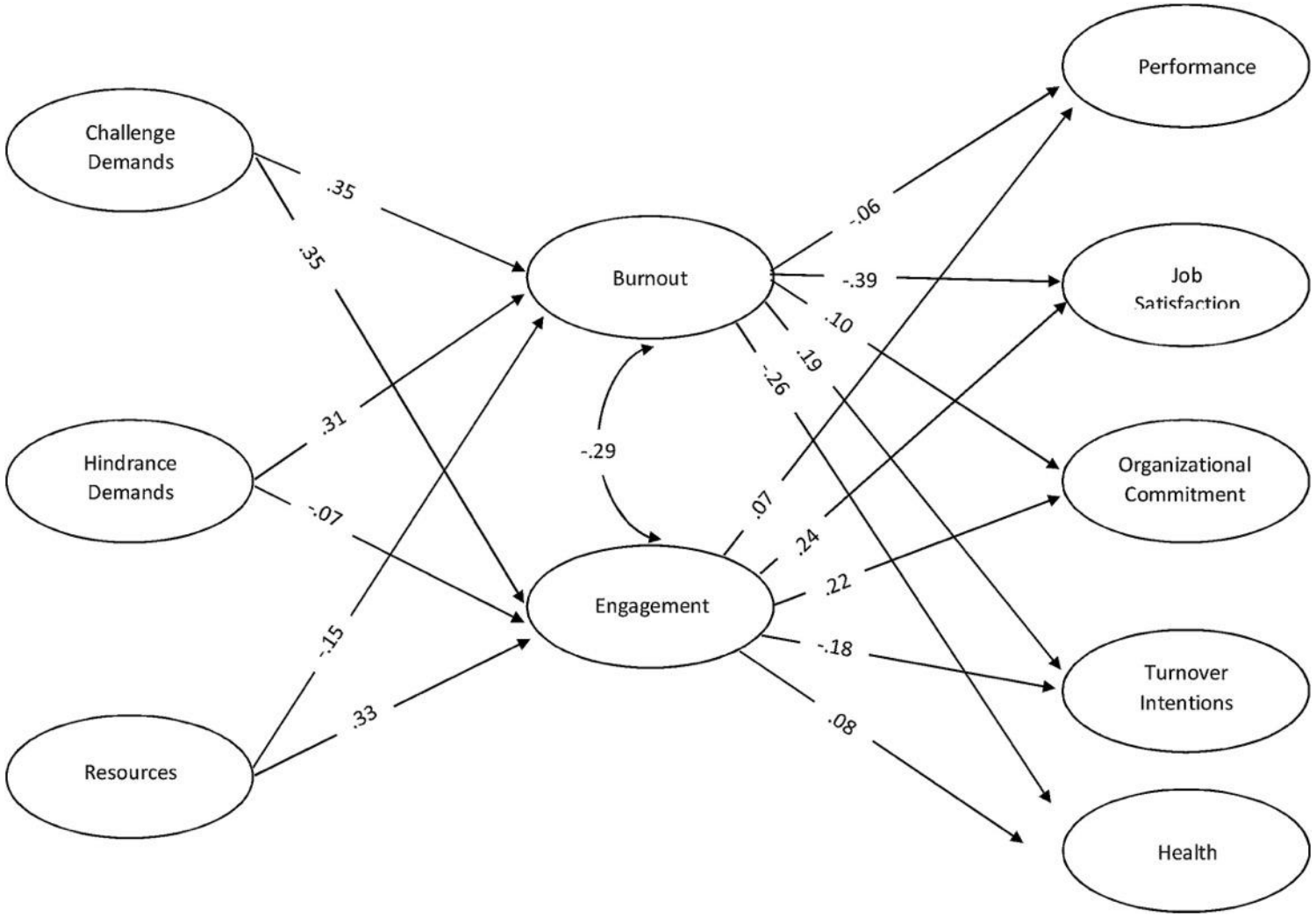
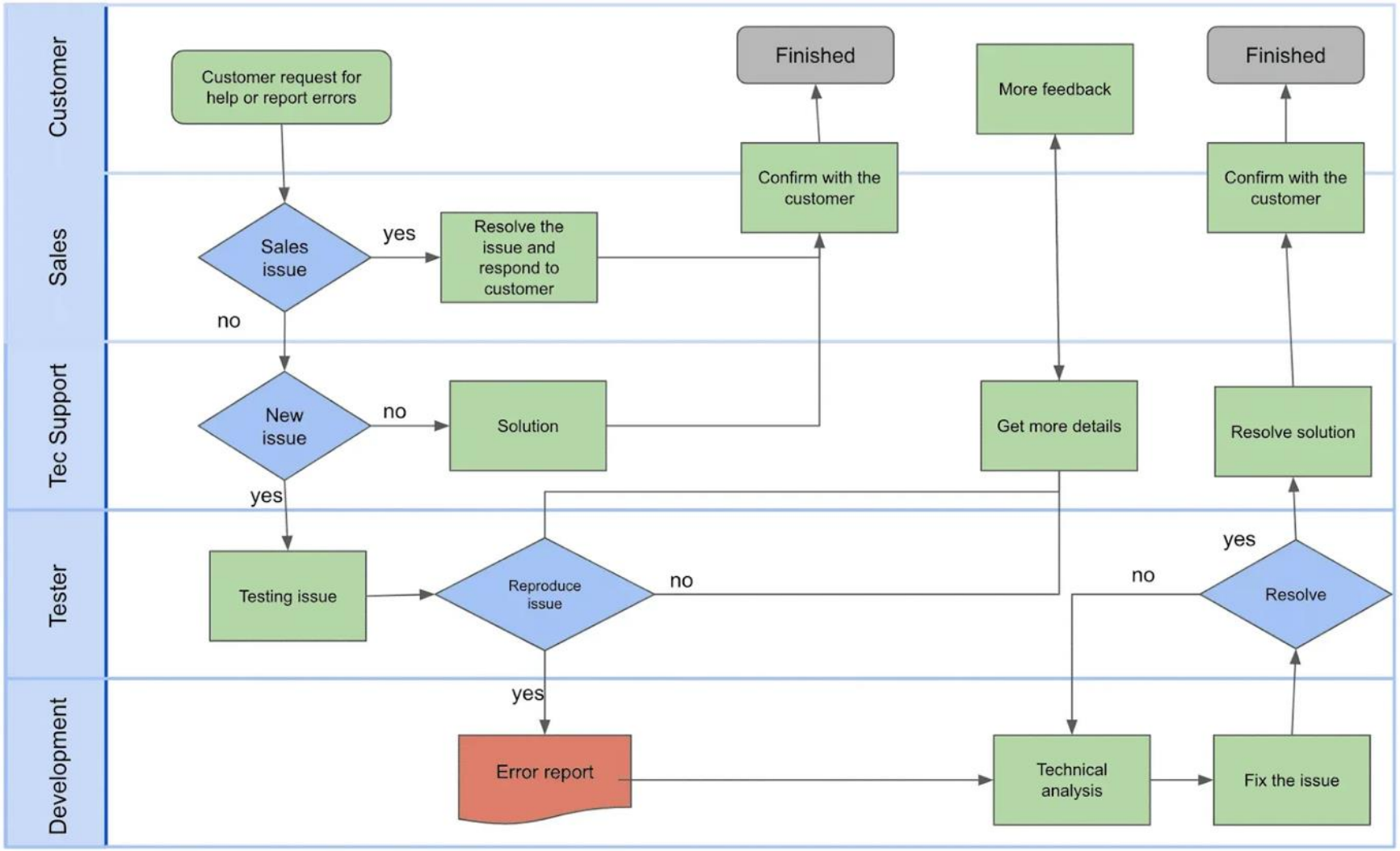


Fig. 2. Results of MASEM Mean Average ß Model of Differentiated JD-R Framework

Note. Values are average standardized beta coefficients for the entire population distribution of possible values.

Source: Goering, D. D., Shimazu, A., Zhou, F., Wada, T., & Sakai, R. (2017). Not if, but how they differ: A meta-analytic test of the nomological networks of burnout and engagement. *Burnout Research, 5,* 21-34.

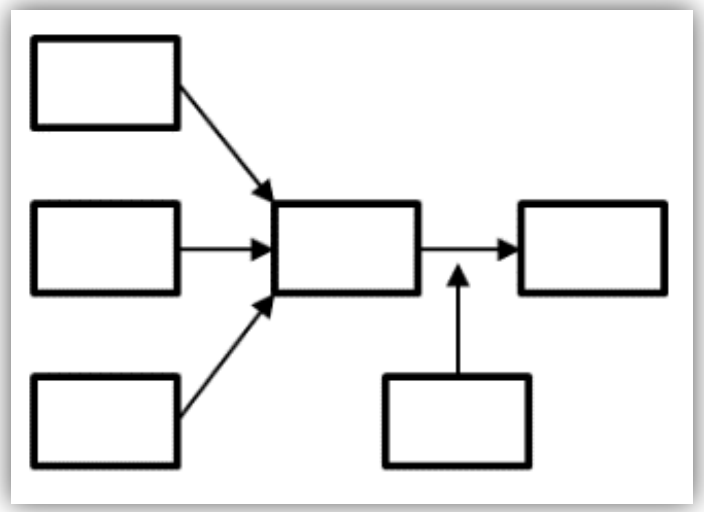
Example of Accumulated Process Knowledge



Source: https://trailhead.salesforce.com/content/learn/modules/business-process-mapping/understand-universal-process-notation

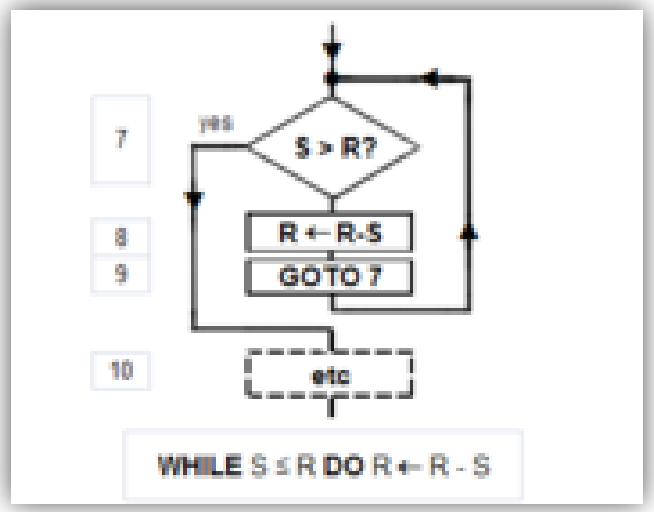
Knowledge Comes in Different Forms

Construct Knowledge



- Focus on Relations Among Variables
- Mediation as Explanation
- Moderation as Contingencies
- Aggregates the Details

Process Knowledge



- Focus on Actors Enacting Sequences of Actions
- Mechanisms/Rules Applied to Actors as Explanations and Generators of Actions
- Explicates the Details: Who, What, Where, When, Why, and How

Fundamental Law of Organizations

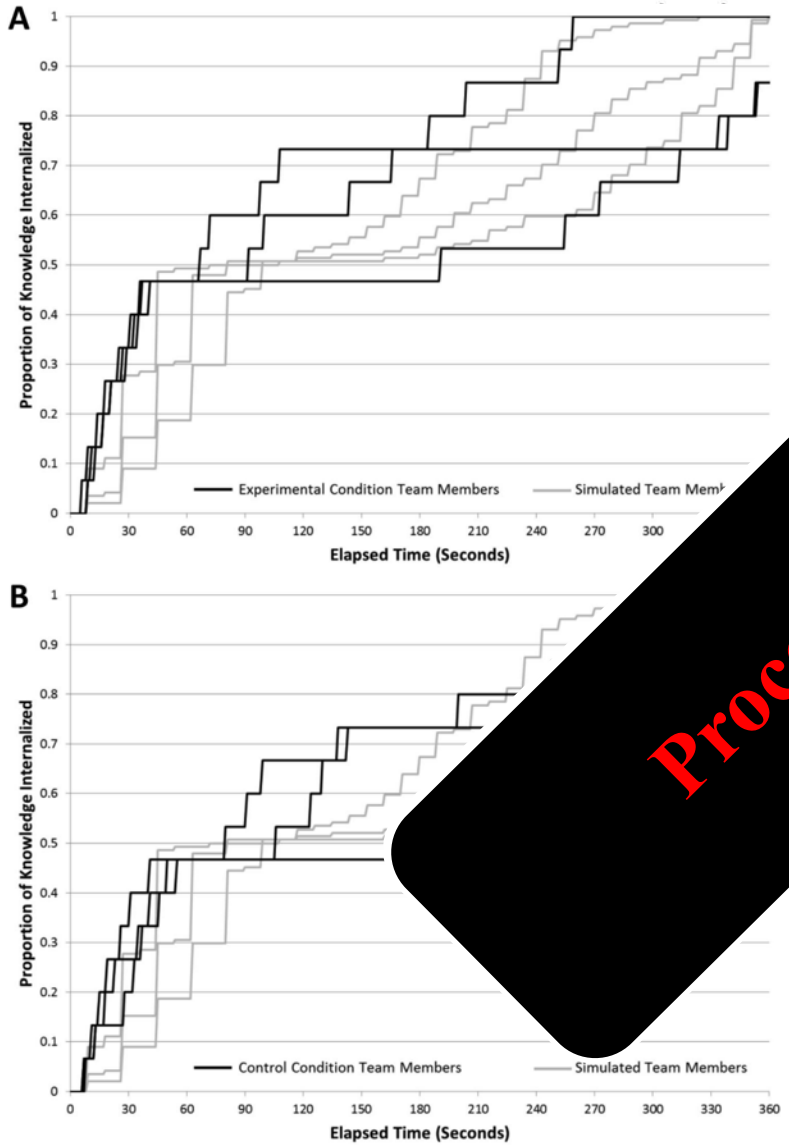
The People Make the Place Expressed More Explicitly Into Its Three Components:

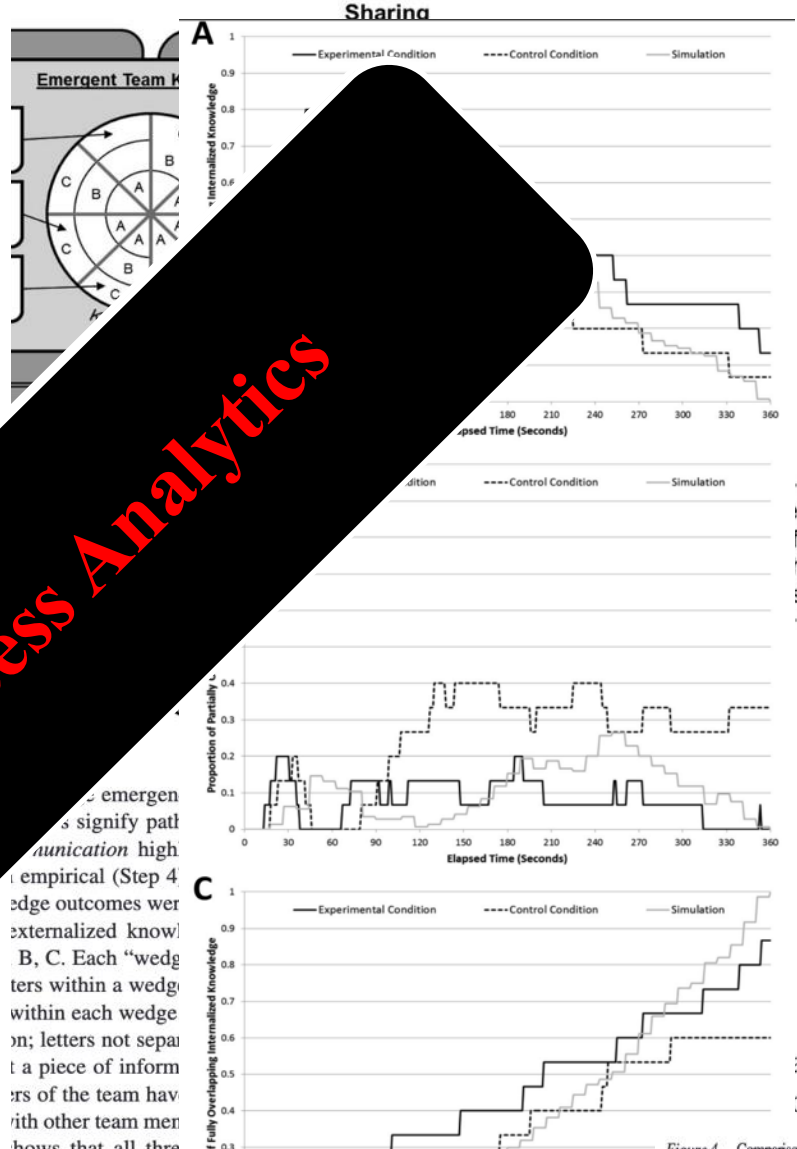
(1) Heterogeneous actors…

(2) think, feel, behave, and socialize…

(3) to create and evolve their (physical, task, social) environments in a bottom-up fashion.

Computational Process Theories





Process Analytics

Figure 3. Comparison of individual knowledge internalization for a single trial between (A) a simulated team and a representative experimental condition team and (B) a representative control condition team (Step 4). The same simulated team is shown in both panels. Agents in the simulated team had heterogeneous information processing skills, equal speaking rates, and operated in an environment with high specialization (75% unique information). Data from the control and experimental teams were from Trial 10.

Figure 4. Comparison of changes in internalization distribution for (A) nonoverlapping, (B) partially overlapping, and (C) fully overlapping knowledge for simulated, experimental, and control condition teams for a single trial (Step 4). Agents in the simulated team had heterogeneous information processing skills, equal speaking rates, and operated in an environment with high specialization (75% unique information). Data from the control and experimental teams were from Trial 10.

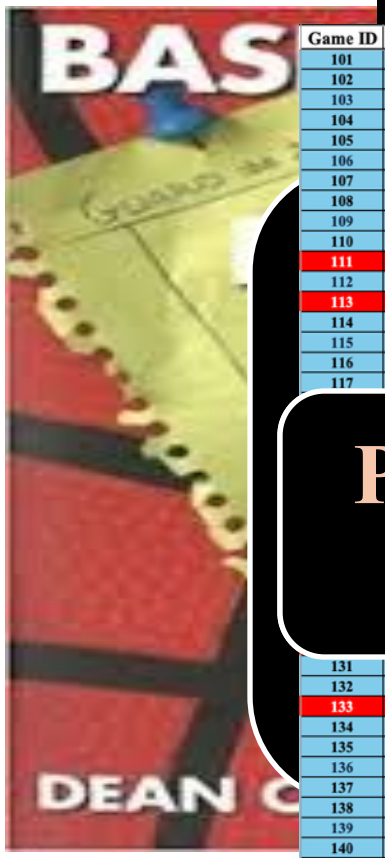
Managing a Professional Basketball Team

This management adviser seeks to support the front-line manager.

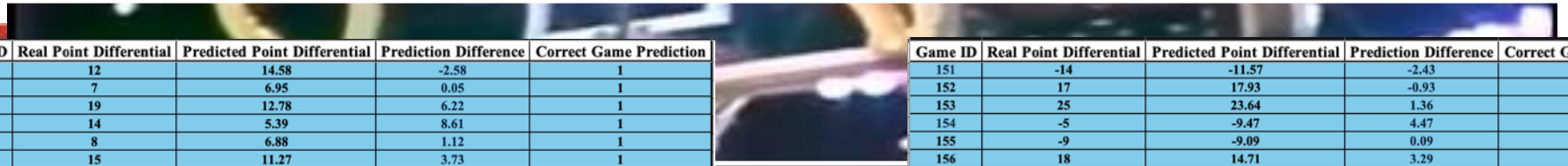
This front-line manager seeks advice on how to manage team human capital.

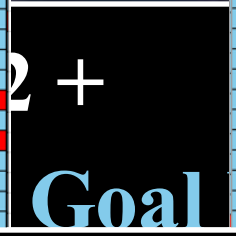
How to Win Basketball Games?

Actual Predictions on the Testing (Holdout) Data



Game ID	Real Point Differential	Predicted Point Differential	Prediction Difference	Correct Game Prediction
101	12	14.58	-2.58	1
102	7	6.95	0.05	1
103	19	12.78	6.22	1
104	14	5.39	8.61	1
105	8	6.88	1.12	1
106	15	11.27	3.73	1
107	-8	-9.13	1.13	1
108	28	26.35	1.65	1
109	-12	-15.28	3.28	1
110	8	9.72	-1.72	1
111	3	-0.50	3.50	0
112	-18	-17.77	-0.23	1
113	-1	0.33	-1.33	0
114	16	12.23	3.77	1
115	-9	-8.02	-0.98	1
116	-19	-14.67	-4.33	1
117	9	0.97	8.03	1





Game ID	Real Point Differential	Predicted Point Differential	Prediction Difference	Correct Game Prediction
151	-14	-11.57	-2.43	1
152	17	17.93	-0.93	1
153	25	23.64	1.36	1
154	-5	-9.47	4.47	1
155	-9	-9.09	0.09	1
156	18	14.71	3.29	1
157	-16	-12.00	-4.00	1
158	16	15.94	0.06	1
159	-3	-3.88	0.88	1
160	7	5.83	1.17	1
161	11	8.94	2.06	1
162	-3	-0.31	-2.69	1
163	12	4.97	7.03	1
164	5	3.23	1.77	1
165	12	13.44	-1.44	1
166	-6	-15.28	9.28	1
167	6	2.50	3.50	1

2 +

Goal

Percentage of Correct Predictions: 93/100 = 93%!!!

Mean Absolute Error: 2.96 Points!!!

131	-11	-10.42	-0.58	1
132	12	12.79	-0.79	1
133	1	-2.53	3.53	0
134	-19	-12.42	-6.58	1
135	18	14.33	3.67	1
136	-10	-5.58	-4.42	1
137	18	20.81	-2.81	1
138	28	29.29	-1.29	1
139	-22	-22.70	0.70	1
140	-14	-11.29	-2.71	1
141	-7	-7.80	0.80	1
142	11	10.33	0.67	1
143	-6	0.68	-6.68	0
144	12	8.06	3.94	1
145	-11	-12.43	1.43	1
146	41	34.11	6.89	1
147	15	11.85	3.15	1
148	18	13.41	4.59	1
149	-4	-1.92	-2.08	1
150	-1	-0.12	-0.88	1

181	21	19.54	1.46	1
182	-1	-0.69	-0.31	1
183	34	31.01	2.99	1
184	-6	-5.95	-0.05	1
185	-2	-2.15	0.15	1
186	21	29.10	-8.10	1
187	-8	-5.59	-2.41	1
188	-11	-7.04	-3.96	1
189	3	5.68	-2.68	1
190	-3	-4.22	1.22	1
191	2	1.22	0.78	1
192	1	2.55	-1.55	1
193	-15	-3.63	-11.37	1
194	23	20.80	2.20	1
195	-8	-7.02	-0.98	1
196	8	5.50	2.50	1
197	-22	-19.91	-2.09	1
198	8	3.74	4.26	1
199	-4	1.17	-5.17	0
200	-11	-8.06	-2.94	1

Utility of Using the Four Factors of Basketball

Pay Attention to the Action!

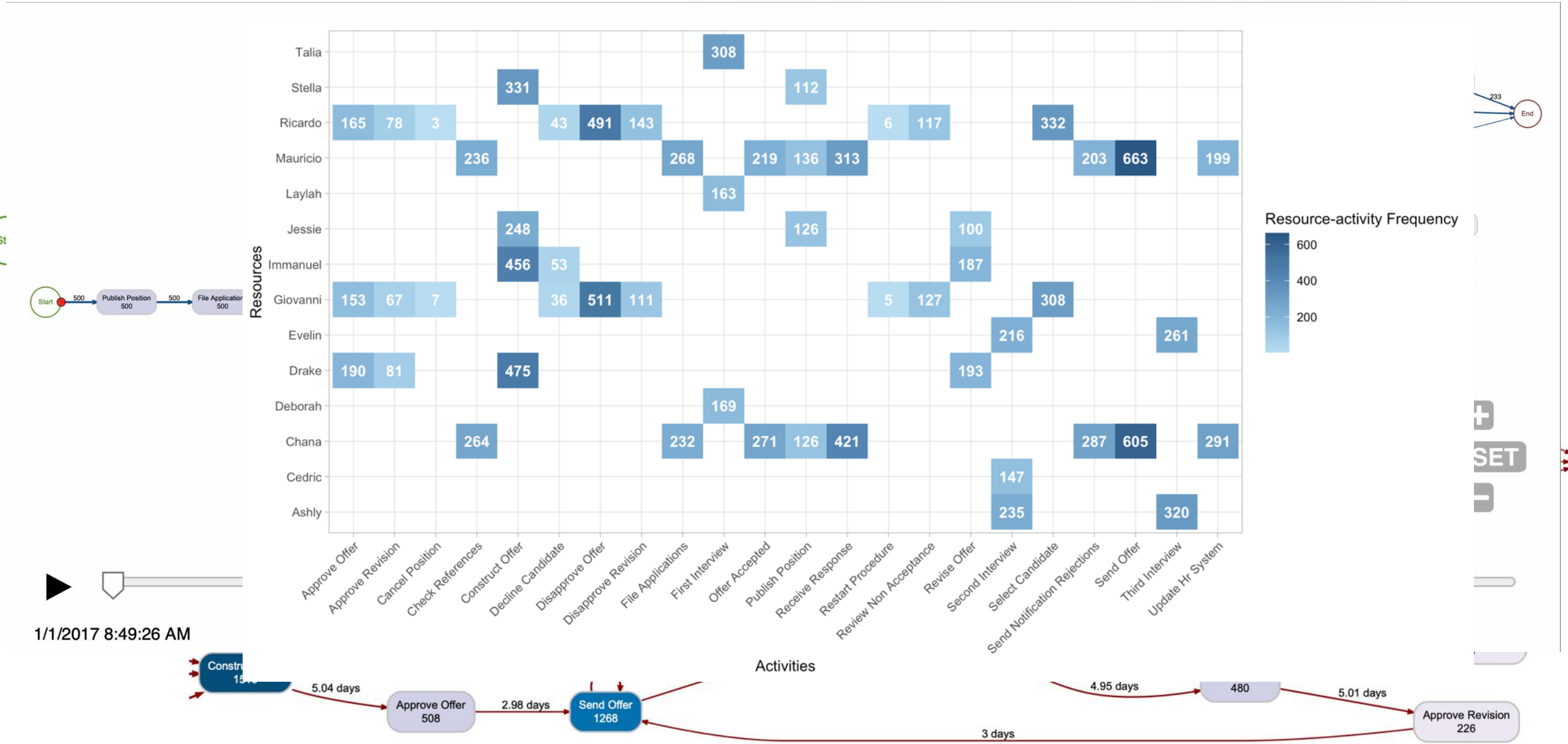
The four factors of basketball miss (aggregate over) the action!

By focusing on the action, one can better explain, predict, and control the outcomes of basketball games!

Example of Process Data

	vacancy	vacancy_department	vacancy_type	vacancy_duration	vacancy_salary_range	activity	resource	time
41	2	Purchasing	Full-time	Permanent	25000-50000	Disapprove Offer	Giovanni	2018-02-21 09:31:40
42	2	Purchasing	Full-time	Permanent	25000-50000	Construct Offer	Immanuel	2018-02-24 10:58:35
43	2	Purchasing	Full-time	Permanent	25000-50000	Approve Offer	Ricardo	2018-03-10 10:48:01
44	2	Purchasing	Full-time	Permanent	25000-50000	Send Offer	Mauricio	2018-03-13 18:01:41
45	2	Purchasing	Full-time	Permanent	25000-50000	Send Offer	Mauricio	2018-03-20 17:24:57
46	2	Purchasing	Full-time	Permanent	25000-50000	Send Offer	Mauricio	2018-03-27 17:06:58
47	2	Purchasing	Full-time	Permanent	25000-50000	Receive Response	Mauricio	2018-04-02 15:41:47
48	2	Purchasing	Full-time	Permanent	25000-50000	Offer Accepted	Mauricio	2018-04-03 20:37:16
49	2	Purchasing	Full-time	Permanent	25000-50000	Send Notification Rejections	Mauricio	2018-04-08 13:45:20
50	2	Purchasing	Full-time	Permanent	25000-50000	Update Hr System	Chana	2018-04-11 18:52:57
51	3	Production	Full-time	Fixed term	25000-50000	Publish Position	Jessie	2017-12-20 18:09:23
52	3	Production	Full-time	Fixed term	25000-50000	File Applications	Mauricio	2018-01-22 17:08:27
53	3	Production	Full-time	Fixed term	25000-50000	Check References	Mauricio	2018-02-01 12:52:45
54	3	Production	Full-time	Fixed term	25000-50000	Select Candidate	Giovanni	2018-02-09 14:23:40
55	3	Production	Full-time	Fixed term	25000-50000	First Interview	Talia	2018-02-22 11:06:14
56	3	Production	Full-time	Fixed term	25000-50000	Second Interview	Evelin	2018-03-09 12:10:37
57	3	Production	Full-time	Fixed term	25000-50000	Third Interview	Ashly	2018-03-25 13:52:25
58	3	Production	Full-time	Fixed term	25000-50000	Decline Candidate	Ricardo	2018-04-10 13:45:32

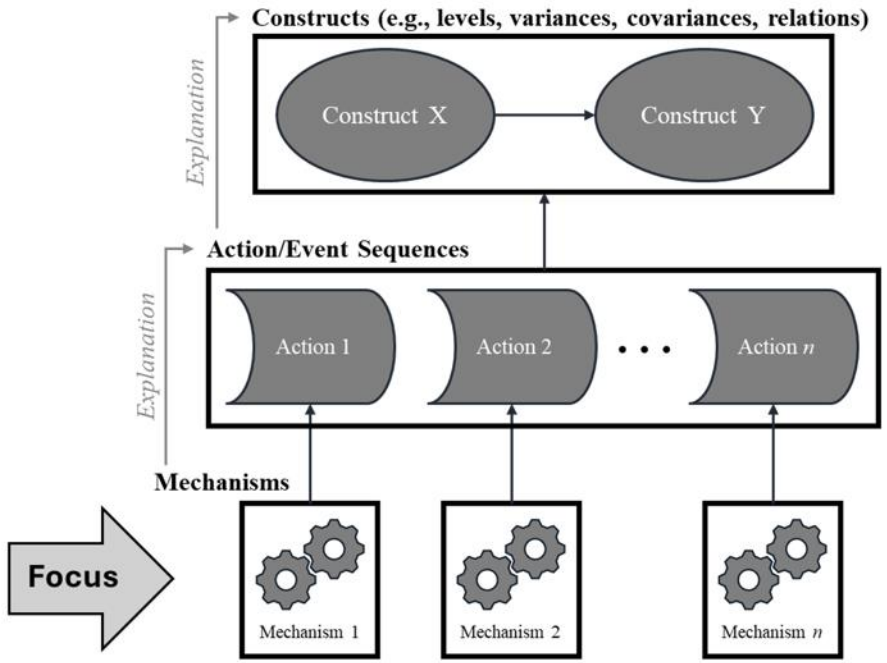
Insights From Process Data



Integrating Construct and Process Knowledge

Figure 2c

Explanatory Process Theorizing



Critical Points

- **(3)** Action sequences can be summarized / aggregated to examine construct relations; can compare to construct-based empirical findings
- **(2)** Process action sequences emerge from, are a consequence of generative mechanisms operating in a given context, time frame, for specific entities
- **(1)** Fundamental focus of theorizing; operations of affect, behavior, cognition underlying the phenomena
- Computational process theorizing enables precise specification
- *May* be qualitative or narrative based, but then precision is challenged

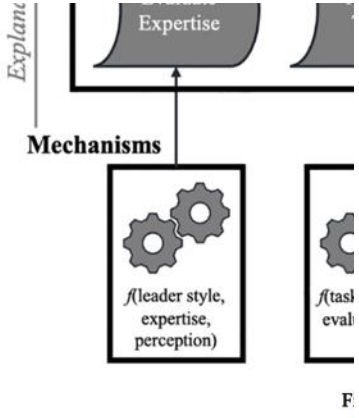
Adapted with permission from: Kuljanin, G., Braun, M. T., Grand, J. A., Olenick, J. D., Chao, G. T., & Kozlowski, S. W. J. (2024). Advancing organizational science with computational process theories. *The Leadership Quarterly, 35,* 101797. https://doi.org/10.1016/j.leaqua.2024.101797

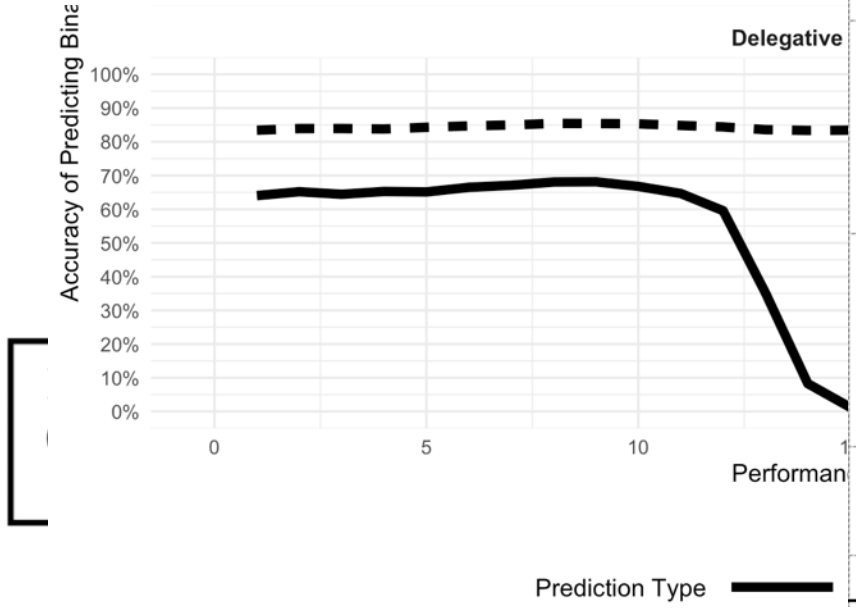
A Leadership Example

Computational Process Theories improve our ability to explain, predict, and control phenomena of interest.

Work motiva *proach to decision-making in* *. Team Performance*

performance-relevant behaviors (Kanfer et al., 2008). Highly motivated individuals are energized by and engaged in their work, leading them to proactively and consistently contribute to task completion in ways that meet or exceed what is expected of them (Cerasoli et al., 2014). In team contexts, this increased activity directly translates into the effort that members expend towards taskwork and teamwork demands necessary for completing job-relevant tasks, and therefore is a key determinant of how effectively teams perform (Burke et al., 2006; Salas et al., 1992).





Step	Description
1	Team members and leaders formulate perceptions of each member's performance expertise
2	Team members are ranked from most to least capable based on perceptions of expertise: • IF team is operating under an autocratic leadership style, THEN the leader relies solely on their perceptions of member expertise to determine rank ordering • IF team is operating under a delegative leadership style, THEN members collectively determine rank ordering using aggregate (average) perceptions of member expertise
3	Team members are allocated to tasks by assigning the most capable member to the most valuable/important task, second most capable member to the second most valuable/important task, etc. until all members and tasks are assigned
4	Team members determine how they will work on their assigned task based on their actual expertise: • IF team is operating under an autocratic leadership style, THEN the leader uses their expertise to identify how each member should perform their assigned task • IF team is operating under a delegative leadership style, THEN each member uses their own expertise to identify how they should perform their assigned task
5	Team members decide whether they will work on their assigned tasks given its priority relative to other external/non-work task demands • IF a team member chooses to work, they execute their chosen task behavior and accumulate performance on their assigned task based on its effectiveness • IF a team member chooses not to work, they do nothing and contribute no performance to their assigned task
6	Team members' attributes (actual expertise, work task priority) and their evaluations of other team members (social influence, perceived expertise) update based on the resultant outcomes of members' behavior for team task performance
7	Repeat steps 1-6 until end of task or deadline

Does Organizational Science Matter?

People make organizations…

…but also, organizations make bigger collectives.

With organizational science focused on how entities function for phenomena of interest to emerge…

…organizational scientists and practitioners can change the world!

A Few Background References

- Kuljanin, G., Braun, M. T., Grand, J. A., Olenick, J. D., Kozlowski, S. W. J., & Chao, G. T. (2024). Advancing organizational science with computational process theories. *The Leadership Quarterly, 35(4)*, 101797, https://doi.org/10.1016/j.leaqua.2024.101797
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Thank You!

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