Multilevel Theory and Dynamics
PSYC 798K
Fall 2024
Syllabus

Professor: James A. Grand
Course Time: Monday 1:00-3:30pm
Location: 1110 Martin Hall (EGR)
Office: 3147A Biology-Psychology
Office Hours: By appointment
Contact: xxxxxxxxxx

Course Description

This Ph.D. level seminar will explore and critically examine principles, methodologies, and analytical approaches for research involving systems and dynamics that span multiple levels of analysis (e.g., time, individual, dyad, team, organization, society). *The primary orientation of this course is theoretical and conceptual*. That is, my main goal is to equip you with foundational knowledge and interpretive skills for helping you think about and capture how human behavior, cognition, and affect changes and unfolds across time, and how those processes emerge and exhibit influence across levels in ways that shape interactions and psychological outcomes. In doing so, we will explore a variety of methodological techniques, analytic approaches, and applications.

Course Objectives and What You Can Expect

I consider this a course on "advanced fundamentals." The topics we will cover are "fundamental" in the sense that they are intended to be tools/perspectives that can be generalized to multiple substantive topics. The "advanced" portion of this course lies in the fact that the material we will cover is intended to move beyond cross-sectional and single-level approaches for conducting research and solving problems. Consequently, we will spend relatively little time focusing on specific content areas or domains (e.g., "What are mental models?") or summarizing "what we know" about them (e.g., "What is the relationship between mental models and performance?"). Instead, our discussions will center on how to conceptualize and operationalize multilevel and dynamic phenomena relevant to various content areas or domains (e.g., "What are the processes through which mental models form and how can I represent/capture them?") and the implications such information holds for influencing human and system outcomes (e.g., "How can I shape certain processes to influence the development of mental models?"). Again, my hope is that this course introduces you to *new ways and techniques for thinking* that improve your ability to describe, research, and apply concepts of interest to you in your own work.

The course is designed as a seminar; a guided self-learning experience. You will be encouraged to think about and share with the class how the topics we cover could be meaningfully applied to substantive content areas that are of interest to you. Active class participation and preparation is a major component of this course and is expected of everyone. A large component of our class discussion will focus on making sense of the main principles from the readings and collaboratively discussing how these ideas can be applied and/or inform topics relevant to psychology. Your task is to *critically evaluate* the readings and be prepared to *discuss and share your observations* during our meetings. My role will be to facilitate the learning process: *what YOU get out of the course will ultimately be determined by what YOU put into it*. My hope is that this seminar promotes an open discussion of ideas, thoughts, and exchanges that will benefit all involved as well as stimulate new ideas in our scientific community.

Course Management

I will use Canvas (www.elms.umd.edu) to post all materials and grades for the course. Unless otherwise instructed, you will upload all documents that you are required to turn into me using Canvas as well. If you have any troubles accessing this space, please let me know ASAP

Evaluation and Course Requirements

1. *Class Engagement (30%)*
   Active participation is a key component of the learning experience in this course—you need to acquire content, make sense of it, and then be prepared to engage in and contribute to the sense-making of all members in the course. All students are expected to attend each class meeting, read all assigned materials prior to class, and actively discuss and critically decompose the focal topic. We will focus our discussions on identifying the critical concepts and themes from each week and the utility of this content for researchers and practitioners. It is not important that every comment you make or question you raise be a deep insight or ground-breaking revelation; what is more important is that you attempt to make consistent contributions to our collective learning. This evaluation criterion will be used to capture your engagement in active, high-quality participation and critical evaluation of primary topics in the class. If necessary, I will provide a mid-semester review of class participation to give you an idea of how you are doing and identify any areas upon which you could improve.

2. *Team Project (50%)*
   The capstone product for this course will be a team project in which you will propose, extend, and describe results from a computational model that elaborates an emergent phenomenon unfolding in a multilevel system. Details on the structure and requirements for the project are provided on the next page. The purpose of the assignment is to give you an opportunity to apply the concepts, perspectives, and skills you will learn in the course to inform a topic of substantive interest. This evaluation criterion captures your ability to develop expertise as a researcher, as well as demonstrate your capacity to integrate knowledge, theory, and methodology to the study of social and organizational systems.

3. *Presentation (20%)*
   In Week 15 (and possibly Week 16) of the course, you and your team will present your final project to the class. The presentation will describe the model you constructed, the questions you examined in your model simulation, and the results/interpretations of your work. This exercise provides an opportunity to share your project with the class, educate your colleagues on the specific theories and perspectives upon which you are drawing, and to receive and provide constructive feedback. Unless otherwise instructed, plan on preparing a ~20 minute presentation plus time for questions. This evaluation criterion reflects the development of your presentation and communication skills.

Final course grades will be calculated by weighting the total number of points earned within each of the four assignment categories by their respective percentages:

$$Final\ Grade = .3(Class\ engagement) + .5(Project) + .2(Presentation)$$

The table below will be used to assign grades in the course based on the above computation based on the 100% maximum. If you accumulate the percentage points listed below, you are guaranteed that grade in the course. When required, percentage points get rounded to the nearest whole number.

Final Grade Conversions		
Percentage	**Grade**	**GPA**
97%+	**A+**	**4.0**
94%-96.9%	**A**	**4.0**
90%-93.9%	**A-**	**3.7**
87%-89.9%	**B+**	**3.3**
84%-86.9%	**B**	**3.0**
80%-83.9%	**B-**	**2.7**
77%-79.9%	**C+**	**2.3**
74%-76.9%	**C**	**2.0**
70%-73.9%	**C-**	**1.7**
67%-69.9%	**D+**	**1.3**
64%-66.9%	**D**	**1.0**
60%-63.9%	**D-**	**0.7**
0%-59.9%	**F**	**0.0**

Team Project

The overarching goal I have for this course is to both help and challenge you to explore psychological phenomena from the perspective of dynamic social/organizational systems. Multilevel theory (MLT) loosely refers to a set of "meta-theoretical" and methodological principles for conducting research in contexts in which units can be organized into nested hierarchical levels (e.g., individuals nested within dyads, dyads nested within teams, teams nested within organizations). The assumptions, recommendations, and implications of MLT have been widely adopted throughout many areas of the social/organizational sciences and thus plays a significant role in the research, theory, and norms of the research community.

Nevertheless, there are several important challenges to the study of phenomena involving social/organizational systems that the conceptual and methodological principles of MLT are less well-equipped to handle. In addition to learning the foundational tenets and tools of MLT, a significant focus of this class will thus also involve understanding these limitations and how we can continue to advance research involving social/organizational systems. To this end, the final project for this course is intended to introduce several key concepts as well as learn how to implement these concepts to study dynamic social/organizational systems that push beyond MLT. Consequently, our project will (perhaps) be a little different than the types you typically complete for your graduate courses.

In brief, *your task for the project is to develop, code, run, interpret, and write up the results from a computational model and computer simulation that captures an emergent phenomenon unfolding and playing out over time in a social/organizational system.* If this is the first time you have ever heard of computational modeling or had to program a computer simulation—don't worry, you will learn what you need to know to do this. I also recognize that coming up with an idea for a model, coding it, running simulations, analyzing/interpreting results, and writing up your findings is probably more than you'd be asked to do for a final project in a typical graduate class—don't worry, we will do several things to (hopefully) make this a less stressful and worthwhile learning experience:

- To lighten the load and spread out the work, the project will be completed in pairs or small groups (~2-3 people per team).

- Rather than come up with a completely new computational model, your team will be tasked with extending an existing computational model that we will first replicate in class. Although this will somewhat limit the topic scope of the team project, it has the added benefits of (a) giving everyone a "common ground" from which to work, (b) allowing me and your classmates to more easily troubleshoot and problem solve conceptual and coding issues, and (c) provide an opportunity for us to explore how different assumptions, choices, and operationalizations—the building blocks of all theories—may (or may not!) lead to different predictions, conclusions, and interpretations. For these purposes, we will use the following as our focal computational model:

  Dionne, S.D., Sayama, H., Hao, C., & Bush, B.J. (2010). The role of leadership in shared mental model convergence and team performance improvement: An agent-based computational model. *The Leadership Quarterly, 21*, 1035-1049.

- To make team assignments and help identify unique topics for each group to work on, you will each contribute several ideas for ways that the focal model could be extended. I will compile those ideas into a list, have you rank order your preferences for each topic, and then make team assignments based on those preferences. In this way, you will have some influence in shaping the team project in a direction that is hopefully aligned with your personal interests.

An overview of the timeline I anticipate for completing the project and associated benchmarks is provided below. There is some flexibility in when and how certain of these tasks can be completed, but sticking to this timeline will help keep your team on track:

- **Week 7:** Read the paper describing the focal computational model. We will not yet discuss the model nor do I expect you to understand how the formal model "works" at this point. Instead, your goal should be to read the paper and develop an understanding of the model *to the point where you can state in words what and how the proposed process happens*.
- **Week 8:** Generate and submit one idea for something that could be added to and/or extended in the focal computational model that would allow one or more new questions to be explored. In other words, I want you to fill in the blank to the following prompt: "I wonder what would happen if _____ was included in this model/idea?" For example, you might be interested in exploring how the presence of specific attributes/individual differences; how individuals perceive, make decisions, or react to others; or how specific properties of the physical, social, or cultural environment affect what happens in this system. You will submit your ideas for topics and extensions to the model by **Monday 10/14**. I will compile the list of topics and then send out for you to review/rank by **Wednesday 10/16**. Assignments to your team and project topic will be made in class on **Monday 10/21**.
- **Weeks 10-12:** We will work on replicating the focal computational model during our class meetings; however, we will likely not finish all the coding in class. Your goal for these weeks should be to ensure that you/your team has (a) successfully replicated the focal model and (b) identified and begun working on adding the needed revisions/extensions to your model for the team project **by the start of Week 13 (11/18)**.
- **Weeks 13-15:** Finalize the revisions/extensions to the computational model for your team project and begin identifying the simulations you will conduct and data/analyses you will use to examine your model **by the end of Week 13 (11/22)**. The class meeting during Week 14 (11/25) is a scheduled project day. We will NOT meet as a class, but I will be available to help any group wanting assistance with their project on that day. If possible, try to complete your simulations **by the start of Week 15 (12/2)**.
- **Weeks 16-17:** Each team will present their model and discuss/share their simulation results in class. We will attempt to do all presentations during our Week 16 class meeting (12/9). However, presentations may be moved to Week 17 (12/16) depending on how things proceed. In either case, the final model and project papers will be due by **Monday 12/16**. The final materials you turn in for the project and paper should include everything described in the sections below.

Paper & Project Requirements

You will submit two items for your final project—a paper and your final model/simulation code.

Paper requirements
There are no strict page length requirements for the paper, though I anticipate that it will take around 10-15 pages to adequately summarize your model and results. The structure for the paper can vary, but it should contain the following "core" elements:

1. A *conceptual* description of the extensions/revisions you made to the original model, the supporting logic/rationale for these extensions, and the research questions you want to explore in the model (i.e., why did you make these extensions, what unique insights or questions do you want to examine, how are these relevant/valuable to the literature, etc.)
2. A descriptive summary of your model's "pseudocode" (i.e., summary of how the model "works" that is sufficient for a reader to grasp what is occurring as the model plays out)
3. A summary of the simulation(s) you conducted that describes and justifies (a) the parameters manipulated and (b) the data recorded/examined for analysis
4. A summary of your simulation findings and analyses that provides insights into your research questions of interest
5. A (brief) summary of the predictions generated by your model, future directions for empirical research based on your simulations, and potential extensions/refinements to improve and/or advance your computational theory/model

Project code requirements
You will submit the final model code and simulation scripts used to generate the data reported in your final paper. Ideally, these script files will be clearly commented so that another person could look at your code and easily understand what is happening. You are NOT required to submit any of the data produced by your simulation(s) or any additional files/scripts used to clean and analyze your data, though you may if you want.

Readings

The selected readings for this class are diverse and many are complex both conceptually and analytically. I do not expect you to have perfect comprehension of every article we cover in the course; however, I do expect all readings to be completed prior to each class, for you to understand the basic gist of the reading, and to prepare yourself to ask questions and contribute to class discussions on the topic. In preparing for class, you may want to ask yourself some of the following questions:

- Why was this reading assigned?
- In what way does a multilevel perspective change our thinking on the selected topic?
- What is the "proper" level of analysis? At what level do the authors operate?
- Do the levels of theory, measurement, analysis, and conclusion match?
- What did you find interesting about this article?
- How might you apply the approach, methodology, or conceptualization advanced in this paper to a research topic in which you are interested?

Course Rules and Policies

Class Attendance and Make-up Policy:
Documented attendance records will not be taken for this course; however, all students are expected to attend every class session and failure to attend to class will influence your participation grade.

Policies for missing or late assessments in this class are as follows:

1. *Team Project*—The final paper, presentation, and model code are considered "major scheduled grading events" as defined by the University of Maryland's policy on Attendance and Assessment/Examinations. Because your team's success on all aspects of the project requires every member to contribute, you may only request an alternative grading arrangement if prolonged and documented absences during the semester for university approved reasons impeded your ability to participate in the work needed to complete the team project. In this case, you may turn in the

paper late, but 5% will be deducted from the final grade for each day late UNLESS arrangements have been made PRIOR to the scheduled due date.

Team Project Contributions

All decisions regarding how members allocate work/responsibilities and contribute to the team project are left to the discretion of each team. However, should a situation arise in which one or members of a project team do not contribute to the team's work in a manner that all members of the team agree is appropriate, I reserve the right to differentially grade team members based on my evaluation of each individual's contributions, efforts, and the overall quality of the final team project.

Academic Honesty:

Unless authorized by me, all assessments (including the project paper, model code, and presentation) must represent each student's own knowledge and ideas in his/her own words. Students who violate the University of Maryland's rules and policies may receive a penalty to their grade, including but not limited to a failing grade on the assignment or in the course.

Overview of Topics (Subject to change)

Week	Date	Topic	Unit
1.	8/26	Introduction & course overview	
2.	9/2	NO CLASS – Happy Labor Day!	
3.	9/9	Social and organizational systems	**MLT Principles**
4.	9/16	Principles of MLT: Levels	
5.	9/23	Principles of MLT: Aggregation & emergent constructs ***Guest speaker**: Gilad Chen* (University of Maryland)	
6.	9/30	Principles of MLT: Relationships within and between levels	
7.	10/7	Generative mechanisms and processes ***Guest speaker**: Goran Kuljanin (DePaul University)*	**Advancing the Study of ML Systems**
8.	10/14	Emergence and complex systems ***DUE 10/14: SUBMIT PROJECT IDEAS*** ***DUE 10/16: SUBMIT TOPIC/PROJECT RANKINGS***	
9.	10/21	Networks ***Guest speaker:** Michael Braun (DePaul University)*	
10.	10/28	Computational modeling fundamentals	**Building & Evaluating Computational Process Theories**
11.	11/4	Agent-based model building	
12.	11/11	Agent-based model building	
13.	11/18	Simulating agent-based models Analyzing, interpreting, and visualizing models	
14.	11/25	NO CLASS – Happy Thanksgiving! ***Scheduled project day to meet/work with me on your model***	
15.	12/2	Simulating agent-based models Analyzing, interpreting, and visualizing models	
16.	12/9	***Project presentations***	
17.	Finals Week	***Project presentations (if needed)*** ***DUE 12/16: FINAL PAPER & PROJECT MATERIALS***	

Reading List & Course Schedule (Subject to change)

1. **Introduction & course overview**

   No readings

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2. **NO CLASS**

   Happy Labor Day!

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3. **Social and organizational systems**

   von Bertalanffy, L. (1950). The theory of open systems in physics and biology. *Science, 111*, 23-29.

   von Bertalanffy, L. (1972). The history and status of general systems theory. *Academy of Management Journal, 15*, 407-426.

   Katz, D., & Kahn, R.L. (1978). *The social psychology of organizations*. New York, NY: Wiley (Chapters 1-2, pp. 1-34).

   Roberts, K.H., Hulin, C.L., & Rousseau, D.M. (1978). *Developing an interdisciplinary science of organizations*. San Francisco: Jossey-Bass (Chapters 1-2, pp. 1-47).

   Weick, K.E. (1976). Educational organizations as loosely coupled systems. *Administrative Science Quarterly, 21*, 1-19.

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4. **Principles of MLT: Levels**

   Rousseau, D.M. (1985). Issues of level in organizational research: Multilevel and cross-level perspectives. In L.L. Cummings & B. Staw (Eds.), *Research in organizational behavior* (Vol. 7, pp. 1-37). Greenwich, CT: JAI Press.

   Klein, K.J., Dansereau, F., & Hall, R.J. (1994). Levels issues in theory development, data collection, and analysis. *Academy of Management Review, 19*, 195-229.

   House, R., Rousseau, D.M., & Thomas-Hunt, M. (1995). The meso paradigm: A framework for integration of micro and macro organizational behavior. In L.L. Cummings & B. Staw (Eds.), *Research in organizational behavior* (Vol. 17, pp. 71-114). Greenwich, CT: JAI Press.

   Gully, S.M., & Phillips, J.M. (2019). On finding your level. In S.E. Humphrey & J.M. LeBreton (Eds.), *The handbook of multilevel theory, measurement, and analysis* (pp. 11-38). Washington, DC: American Psychological Association.

   [optional: The following two commentaries provide a brief and interesting back and forth on several of the points raised by Klein et al. (1994) – worth a read!]

   George, J.M., & James, L.R. (1994). Levels issues in theory development. *Academy of Management Review, 19*, 636-640.

   Klein, K.J., Dansereau, F., & Hall, R.J. (1995). On the level: Homogeneity, independence, heterogeneity, and interactions in organizational theory. *Academy of Management Review, 20*, 7-9.

5. **Principles of MLT: Aggregation and emergent constructs**

Kozlowski, S.W.J., & Klein, K.J. (2000). A multilevel approach to theory and research in organizations: Contextual, temporal, and emergent processes. In K.J. Klein & S.W.J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations: Foundations, extensions, and new directions* (pp. 3-90). San Francisco, CA: Jossey-Bass.

Campbell, D. T. (1958). Common fate, similarity, and other indices of the status of aggregates of persons as social entities. *Behavioral Science, 3*, 14-25.

Freeman, J. (1980). The unit problem in organizational research. In W.M. Evan (Ed.), *Frontiers in organization and management* (pp. 59-68). New York, NY: Praeger.

Chen, G., Mathieu, J.E., & Bliese, P.D. (2004). A framework for conducting multilevel construct validation. In F.J. Yammarino & F. Dansereau (Eds.), *Research in multilevel issues: Multilevel issues in organizational behavior and processes* (Vol. 3, pp. 273-303). Elsevier: Oxford, U.K.

Krasikova, D.V., & LeBreton, J.M. (2019). Multilevel measurement: Agreement, reliability, and nonindependence. In S.E. Humphrey & J.M. LeBreton (Eds.), *The handbook of multilevel theory, measurement, and analysis* (pp. 279-304). Washington, DC: American Psychological Association.

[optional] Morgeson, F.P., & Hofmann, D.A. (1999). The structure and function of collective constructs: Implications for multilevel research and theory development. *Academy of Management Review, 24*, 249-265.

[optional] Chan, D. (1998). Functional relations among constructs in the same content domain at different levels of analysis: A typology of composition models. *Journal of Applied Psychology, 83*, 234-246.

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6. **Principles of MLT: Relationships within and between levels**

Before class, install the base R program for your OS (http://cran.us.r-project.org) and install the `multilevel`, `nlme`, *and* `lme4` *packages. I also recommend downloading and using RStudio (http://www.rstudio.com/products/rstudio/download) when using R, but it is not required.*

Jebb, A.T., Tay, L., Ng, V., & Woo, S. (2019). Construct validation in multilevel studies. In S.E. Humphrey & J.M. LeBreton (Eds.), *The handbook of multilevel theory, measurement, and analysis* (pp. 253-278). Washington, DC: American Psychological Association.

Gonzalez-Roma, V., & Hernandez, A. (2017). Multilevel modeling: Research-based lessons for substantive researchers. *Annual Review of Organizational Psychology and Organizational Behavior, 4*, 183-210.

Enders, C.K., & Tofighi, D. (2007). Centering predictors in cross-sectional multilevel models: A new look at an old issue. *Psychological Methods, 12*, 121-138

Scherbaum, C.A., & Pesner, E. (2019). Power analysis for multilevel research. In S.E. Humphrey & J.M. LeBreton (Eds.), *The handbook of multilevel theory, measurement, and analysis* (pp. 329-352). Washington, DC: American Psychological Association.

[optional] Preacher, K.J., Zyphur, M.J., & Zhang, Z. (2010). A general multilevel SEM framework for assessing multilevel mediation. *Psychological Methods, 15*, 209-233.

[resource as needed] Bliese, P. (2016). Multilevel modeling in R: A brief introduction to R, the multilevel package and the nlme package

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7. **Generative mechanisms and processes**

**** MODEL FOR TEAM PROJECT ****

Dionne, S.D., Sayama, H., Hao, C., & Bush, B.J. (2010). The role of leadership in shared mental model convergence and team performance improvement: An agent-based computational model. *The Leadership Quarterly, 21*, 1035-1049.

Kuljanin, G., Braun, M.T., Grand, J.A., Olenick, J., Chao. G.T., & Kozlowski, S.W.J. (in press). Advancing leadership and organizational science with computational process theories. *The Leadership Quarterly.*

Macy, M.W., & Willer, R. (2002). From factors to actors: Computational sociology and agent-based modeling. *Annual Review of Sociology, 28*, 143-166.

Epstein, J. M. (1999). Agent-based computational models and generative social science. *Complexity, 4*, 41-60.

Davis, J.P., Eisenhardt, K.M., & Bingham, C.B. (2007). Developing theory through simulation methods. *Academy of Management Review, 32*, 480-499.

Harrison, J.R., Lin, Z., Carroll, G.R., & Carley, K.M. (2007). Simulation modeling in organizational and management research. *Academy of Management Review, 32*, 1229-1245.

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8. **Emergence and complex systems**

Strauss, J.A., & Grand, J.A. (2022). Applying systems science to advance research on team phenomena. In B. Murray, J. Dulebohn, & D. Stone (Eds.), *Managing team centricity in modern organizations* (pp. 17-52). IAP.

Goldstein, J. (1999). Emergence as a construct: History and issues. *Emergence, 1*, 49-72.

Corning, P.A. (2002). The re-emergence of “emergence”: A venerable concept in search of a theory. *Complexity, 7*, 18-30.

Kozlowski, S.W.J., Chao, G.T., Grand, J.A., Braun, M.T., & Kuljanin, G. (2013). Advancing multilevel research design: Capturing the dynamics of emergence. *Organizational Research Methods, 16*, 581-615.

Page, S.E. (2012). Aggregation in agent-based models of economies. *The Knowledge Engineering Review, 27*, 151-162.

[optional: The following papers describe alternative perspectives to accounting for the dynamics of social/organizational systems relative to the “bottom-up” emergence that is the primary focus of this class. Recommend reading if you’re interested in systems science!]

Aiken, J.R., Hanges, P.J., & Chen, T. (2019). The means are the ends: Complexity science in organizational research. In S.E. Humphrey & J.M. LeBreton (Eds.), *The handbook of multilevel theory, measurement, and analysis* (pp. 115-140). Washington, DC: American Psychological Association.

Gorman, J.C., Dunbar, T.A., Grimm, D., & Gipson, C.L. (2017). Understanding and modeling teams as dynamical systems. *Frontiers in Psychology, 8*, 1053.

9. **Networks**

Brass, D.J., & Borgatti, S.P. (2019). Multilevel thoughts on social networks. In S.E. Humphrey & J.M. LeBreton (Eds.), *The handbook of multilevel theory, measurement, and analysis* (pp. 187-200). Washington, DC: American Psychological Association.

Paruchuri, S., Goossen, M.C., & Phelps, C. (2019). Conceptual foundations of multilevel social networks. In S.E. Humphrey & J.M. LeBreton (Eds.), *The handbook of multilevel theory, measurement, and analysis* (pp. 201-221). Washington, DC: American Psychological Association.

Kalish, Y. (2013). Harnessing the power of social network analysis to explain organizational phenomena. In J.M. Cortina & R.S. Landis (Eds.), *Modern Research Methods for the Study of Behavior in Organizations* (pp. 99-135). New York, NY: Routledge.

Contractor, N.S., Wasserman, S., & Faust, K. (2006). Testing multitheoretical, multilevel hypotheses about organizational networks: An analytic framework and empirical example. *Academy of Management Review, 31*, 681-703.

Carter, D.R., DeChurch, L.A., Braun, M.T., & Contractor, N.S. (2015). Social network approaches to leadership: An integrative conceptual review. *Journal of Applied Psychology, 100*, 3, 597-622.

[optional] Mathieu, J.E., & Luciano, M.M. (2019). Multilevel emergence in work collectives. In S.E. Humphrey & J.M. LeBreton (Eds.), *The handbook of multilevel theory, measurement, and analysis* (pp. 163-186). Washington, DC: American Psychological Association.

10. **Computational modeling fundamentals**

Smaldino, P. E. (2020). How to translate a verbal theory into a formal model. *Social Psychology, 51*, 207–218.

van Rooij, I., & Blokpoel, M. (2020). Formalizing verbal theories: A tutorial by dialogue. *Social Psychology, 51*, 285–298

Grand, J.A., Braun, M.T., & Kuljanin, G. (in press). Hello world! Building computational models to represent social and organizational theory. *Organizational Research Methods*.

Rand, W., & Rust, R.T. (2011). Agent-based modeling in marketing: Guidelines for rigor. *International Journal of Research in Marketing, 28*, 181-193.

[optional] Smith, E.R., & Conrey, F.R. (2007). Agent-based modeling: A new approach for theory building in social psychology. *Personality and Social Psychology Review, 11*, 87-104.

[optional] Macal, C.M., & North, M.J. (2010). Tutorial on agent-based modeling and simulation. *Journal of Simulation, 4*, 151-162.

11-15. **Computational modeling papers**

The readings below offer several examples of published computational modeling papers that explore dynamic, emergent, and multilevel phenomena in the social and organizational sciences. ***Except for the Dionne et al. (2010) paper,*** *these are optional readings that will not be a direct focus of discussion in class. However, I recommend that you read or do a deep skim of at least a*

few of these to get a sense for computational models used to study/understand emergence and dynamics in complex social/organizational systems.

Coen, C.A. (2006). Seeking the comparative advantage: The dynamics of individual cooperation in single vs. multiple-team environments. *Organizational Behavior and Human Decision Processes, 100*, 145-159.

Dionne, S.D., Sayama, H., Hao, C., & Bush, B.J. (2010). The role of leadership in shared mental model convergence and team performance improvement: An agent-based computational model. *The Leadership Quarterly, 21*, 1035-1049.

Grand, J.A., Braun, M.T., Kuljanin, G., Kozlowski, S.W.J., & Chao, G.T. (2016). The dynamics of team cognition: A process-oriented theory of knowledge emergence in teams [Monograph]. *Journal of Applied Psychology, 101*, 1353-1385.

Flache, A., & Mäs, M. (2008). How to get the timing right. A computational model of the effects of the timing of contacts on team cohesion in demographically diverse teams. *Computational & Mathematical Organization Theory, 14*, 23–51

March, J.G. (1991). Exploration and exploitation in organizational learning. *Organization Science, 2*, 71-87.

Nowak, A., Gelfand, M.J., Borkowski, W., Cohen, D., & Hernandez, I. (2016). The evolutionary basis of honor cultures. *Psychological Science, 27*, 12-24.

Samuelson, H.L., Levine, B.R., Barth, S.E., Wessel, J.L., & Grand, J.A. (2019). Exploring women's leadership labyrinth: Effects of hiring and developmental opportunities on gender stratification. *Leadership Quarterly, 30*, 101314.

16-17 **Class presentations**

Final project and papers due

16-17. **Class presentations**

Final project and papers due