Computational Cognition Laboratory

MIAMI UNIVERSITY
OXFORD OHIO

http://www.users.muohio.edu/johnsojg/lab/

Dr. Joseph G. Johnson, Director

Research focus: We use behavioral experiments to collect data on human cognition (primarily, decision making) and then develop formal models of this behavior. This includes attention to not only the observable behavior, but more importantly the *underlying processes* that give rise to the overt behavior. Subsequent experiments serve to fine tune the candidate models and provide a diagnostic means to rigorously compare alternative explanations.

Measuring attention and information acquisition. We are developing new metrics and analyses for considering "process-tracing" data, such as attention and information use, as well as new methods for quantitative model comparison using process and RT data. This work includes novel technologies such as tracking eye movements.

Decision making under stress. People are often required to make decisions while subject to multiple stressors such as time pressure, performance pressure, or distraction from secondary tasks. These circumstances are ubiquitous in both trivial decisions as well as those with significant consequences. We are conducting research to understand how different stressors affect decision making, how individual differences in working memory interact with different stressors, and the impact of changes in task complexity.

Motivation and decision making. This line of research investigates the influence that various types of motivation have on deliberation and decision making, and includes the development of a new psychometric scale to measure six distinct types of motivation. The results of this project will then be used to formally incorporate motivational influences into models of decision making.

Modes of thought. Decision researchers have proposed "intuitive" and "analytic" means for arriving at a decision. We conjecture that a single information sampling model can more parsimoniously describe decision making behavior, and that behavior attributed to separate processes can both arise from this common model.

Reference-dependent valuation. Perhaps the most popular descriptive theory of risky choice, prospect theory, suggests valuation is relative rather than absolute. We propose that *multiple* reference points in fact determine valuation of outcomes. Specifically, we propose that individuals simultaneously consider minimum requirements, current levels, and goals. This theory makes strong testable predictions regarding valuation and choice, which we have formalized in a mathematical model and are testing empirically.

Decision making in sports. We have a longstanding collaboration investigating various aspects of athletes' decision processes. This research has provided an applied setting for testing the theoretical models we have developed, including a model for how people generate options in real, dynamic situations, and how they select from among them.

Representative publications:

Raab, M., & **Johnson, J. G.** (2007). Expertise-based differences in search and option generation strategies. *Journal of Experimental Psychology: Applied,* 13, 158-170.

Busemeyer, J. R., Jessup, R. K., **Johnson, J. G.**, & Townsend, J. T. (2006). Building bridges between neural models and complex decision making behavior. *Neural Networks, 19,* 1047-1058.

Hanoch, Y., **Johnson, J. G.**, & Wilke, A. (2006). Domain specificity in experimental measures and participant recruitment: An application to risk-taking behavior. *Psychological Science, 17*, 300-304.

Johnson, J. G. (2006). Cognitive modeling of decision making in sports. *Psychology of Sport and Exercise, 7*, 631-652.

Johnson, J. G., & Busemeyer, J. R. (2005). A dynamic, stochastic, computational model of preference reversal phenomena. *Psychological Review, 112,* 841-861.

Busemeyer, J. R. & **Johnson, J. G.** (2004). Computational models of decision making. In D. Koehler & N. Harvey (Eds.), *Blackwell Handbook of Judgment and Decision Making*. Oxford, UK: Blackwell Publishing Co. 133-154.

Johnson, J. G. & Raab, M. (2003). Take the first: Option generation and resulting choices. *Organizational Behavior and Human Decision Processes, 91,* 215-229.