Understanding Elective Task Switching

Patrick Park, Leslie A. DeChurch, & Noshir S. Contractor

Northwestern University

Introduction

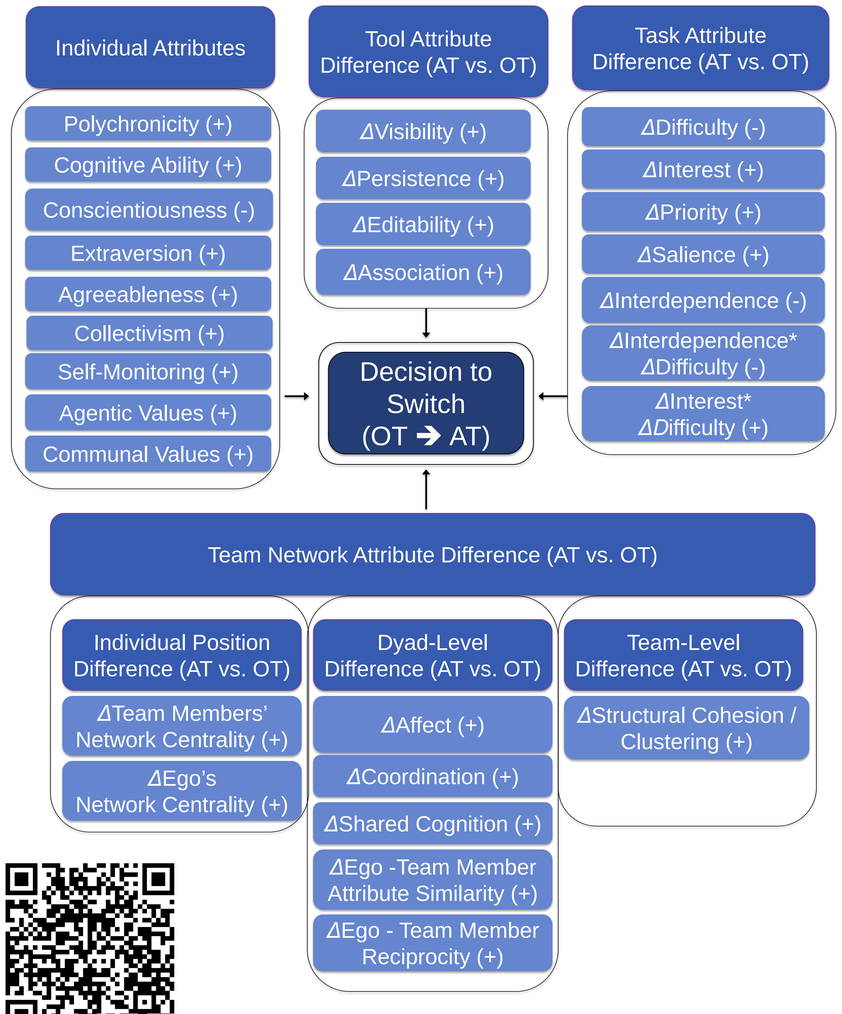
Purpose: Interviews with astronauts suggest performance decrements can occur when individuals transition between independent and interdependent work.

The smoothness of task transitions are determined by the relative "stickiness" of the current, on-going task (OT), and the "attractiveness" of the next alternative task (AT).

We explore the relative importance of (a) individual, (b) team, (c) task, and (d) technology factors in determining the stickiness and attractiveness of a task.

Conceptual Model

Factors that Determine Stickiness & Attractiveness



Agent-Based Model

We translate the conceptual model into an agent-based model that estimates the stickiness of an on-going task and the attractiveness of an alternative task to derive the "choice probability (Wickens et al 2013)" $Pr(i, m, n)_{t+1}$ that individual *i* switches from ongoing task *m* to alternative task *n* at time *t+1.*

$$Pr(i,m,n)_{t+1} = (1 - forced_{t+1}) * [AT(i,n)_t - ST(i,m)_t] + forced_{t+1}$$

Stickiness of member *i*'s current task *m* at time *t* ($ST(i,m)_t$):

$$ST(i,m)_t = \mathrm{X}_i\beta_{indiv} + \mathrm{Y}_m\beta_{task} + \mathrm{Z}_m\beta_{tool} + g_m\mathrm{X}_{network,t}\theta_{network}$$

X_i: Vector of individual *i*'s attributes (e.g. polychronicity)

Y_m: Vector of attributes of current task *m* (e.g. difficulty)

Z_m: Vector of attributes of tool(s) used in *m* (e.g. viability)

g_m: 1 if non-individual task, 0 otherwise

$X_{network,t}$: Vector of network characteristics at the individual, dyad, and team levels involving individual *i* in team *m*

Attractiveness of member *i*'s alternative task *n* at time *t* ($AT(i,n)_t$):

$$AT(i,n)_t = \mathrm{X}_i\beta_{indiv} + \mathrm{Y}_n\beta_{task} + \mathrm{Z}_n\beta_{tool} + g_n\theta_u E[u(N_n)_t]$$

g_n: 1 if *n* is non-individual task, 0 otherwise

X_i, Y_m, Z_m are defined the same way as in stickiness

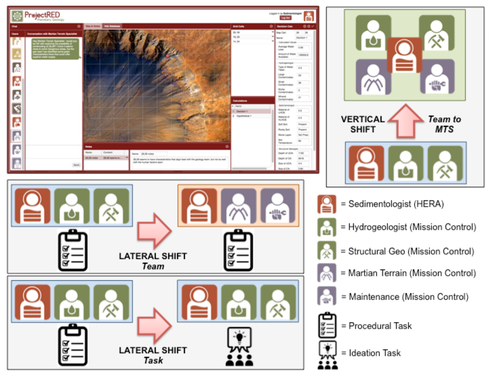
$E[u(N_n)_t]$: Expected utility of collaborating with members in task *n*.

SONIC advancing the science of networks in communities

ATLAS ADVANCING TEAMS, LEADERS, & SYSTEMS

Empirical Validation

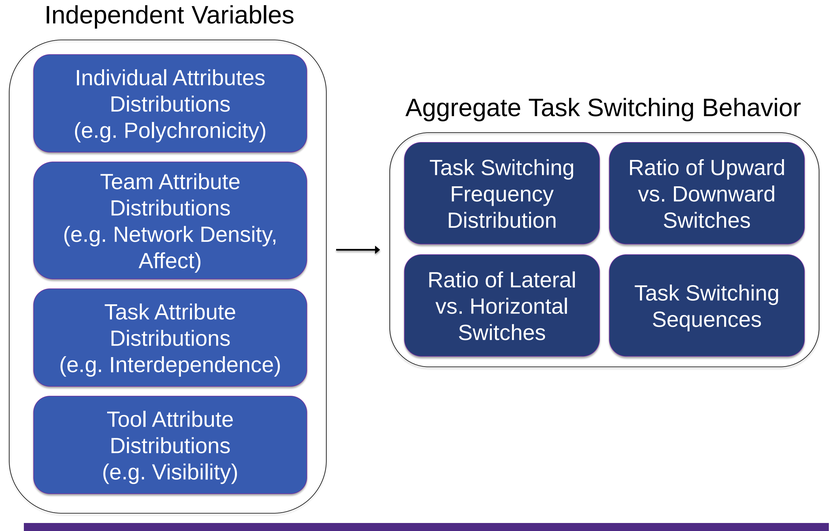
Project RED: Distributed Multiteam System (MTS) task management experiment where
12 people (4 in HERA and 8 at NU) work together on tasks to develop a water well that can support future colonies on Mars.



Apply genetic algorithm ("Behavior Search") to experimental data from Project RED to validate ABM parameters.

Virtual Experiments

Conduct virtual experiments based on parameter estimates to evaluate aggregate task switching behavior under various scenarios (i.e. initial conditions).



References & Acknowledgements

Wickens, C. D., Santamaria, A., & Sebok, A. (2013). A Computational Model of Task Overload Management and Task Switching. In Proceedings of the Human Factors and Ergonomics Society Annual Meeting (Vol. 57, pp. 763-767). SAGE Publications.

The material is based upon work supported by NASA under award No. NNX15AK73G. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Aeronautics and Space Administration. We thank our collaborators Jessica Mesmer-Magnus, Ashley Niler, and Gabe Plummer for many ideas & suggestions.