

SPACE LIFE SCIENCES SYMPOSIUM (A1)  
Behaviour, Performance and Psychosocial Issues in Space (1)

Author: Dr. Pete Roma  
IBR and Johns Hopkins Univ, United States, proma@ibrinc.org

Dr. Steve Hursh  
Institutes for Behavior Resources, Inc., United States, shursh@ibrinc.org

Dr. Henry Emurian  
UMBC, United States, emurian@umbc.edu

Dr. Robert Hienz  
The John Hopkins University, United States, bhienz@jhmi.edu

Dr. Joseph Brady  
The John Hopkins University, United States, jvb@jhmi.edu

DEVELOPMENT AND APPLICATION OF A SIMPLE, RAPID, AND OBJECTIVE BEHAVIORAL  
ASSAY OF GROUP COHESION IN SIMULATED ASTRONAUT CREWS

**Abstract**

The ability to monitor, predict, and affect the building, maintenance, and repair of social bonds over extended periods of confinement within diverse crews is a high-priority concern of the international astronautics community. To this end, current methods for actual space missions include psychometric tests, personal diary analysis, and anecdotes, all of which can be informative, but are also inherently subjective and often unreliable and time-consuming. Here we describe the development, parametric testing, and early application of the Team Performance Task (TPT)—a rapid and objective computer-based behavioral assay of the fundamental elements of group cohesion, namely cooperation within this simple yet interdependent task.

During a TPT session, each player earns points (worth a fixed monetary value) by dragging blocks of his/her assigned color across the screen into a deposit bin without hitting any barriers. Barriers are randomly dispersed throughout the field for various intervals, and each barrier strike deducts a point. Each player is assigned an equal number of barriers that only s/he can see; if a team member wishes to help the rest of the crew by revealing a barrier, s/he must click and hold it with the mouse cursor for a fixed interval. This action facilitates the rest of the group's point-scoring efforts, but precludes one's own accumulation of points during that barrier-reveal time. The "price of cooperation" increases during the session as barrier reveal requirements escalate from 0.25 sec to 1.0 sec to 4.0 sec of holding time per reveal. Individual and group-level cohesion can then be expressed through a recently developed behavioral economic model that calculates the rate of change in prosocial behavior across the increasingly costly reveal requirements.

Parametric laboratory studies with simulated astronaut crews confirmed stable levels of prosocial behavior regardless of session length (3, 6, 9, 12, or 15 min). Subsequent work revealed a greater sensitivity to the price of cooperation as a function of payout incentives (less cohesion when based on individual vs. collective point totals). Recent application of a 6-min individual incentive TPT showed remarkable crew-specific sensitivity to scheduled vs. autonomous mission management and circadian phase. In addition to potential Earth-based benefits for research and application to other team-oriented operations, the TPT's simple non-linguistic nature, brief duration, and nominal training requirements along with its apparent sensitivity make it a potentially valuable tool to help the international astronautics community manage the team performance and psychosocial risks inherent to long-duration space missions.