

Chapter 13

A Multiplayer Team Performance Task: Design and Evaluation

Henry H. Emurian
UMBC, USA

Gerald C. Canfield
UMBC, USA

Peter G. Roma
Institutes for Behavior Resources, USA

Zabecca S. Brinson
Institutes for Behavior Resources, USA

Eric D. Gasior
Institutes for Behavior Resources, USA

Robert D. Hienz
Johns Hopkins University School of Medicine, USA

Steven R. Hursh
Johns Hopkins University School of Medicine, USA

Joseph V. Brady
Johns Hopkins University School of Medicine, USA

ABSTRACT

This chapter describes a Team Performance Task (TPT) that has been designed to assess the status of a three-person team operating a game-like multiplayer task requiring inter-player cooperation to achieve optimal performance effectiveness. The objective of the TPT is to extract features of an operational setting that may be integrated into a task scenario that will yield multi-dimensional indices of both individual and team performances that are sensitive to alterations in the workload parameters and to the skill level and cohesion of the players. The design of a prototype task is described in detail, and evaluative results based on observations of five groups of three players are presented to show the individual and team metrics of performance effectiveness that are made available with this task. Future applications of the TPT are suggested, to include its potential to diagnose and support the cohesiveness and operational readiness of teams operating within space-based and other challenging environments.

INTRODUCTION

The Team Performance Task (TPT) presented within this chapter operationalizes teamwork

processes that relate to both team performance and group cohesion (LePine, Piccolo, Jackson, Mathieu, & Saul, 2008). Its conceptualization is consistent with a classic definition of a computer

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game (Crawford, 1982): “A [computer] game is a closed formal system that subjectively represents a subset of reality.” The task to be described shows how such a conceptualization and formal definition were applied to capture significant aspects of the operational status of a team. The task is deployed on the Internet, but its design intentionally did not require consideration of usability problems typically found in multiplayer features associated with network computer games (Pinelle, Wong, Stach, & Gutwin, 2009). The present work is directed primarily to assessing the status of space-dwelling crews in response to NASA’s continuing emphasis on the development of tools to monitor crewmember and crew-ground interactions¹, although the design and validation of a task that can diagnose the status of a team could have wide applicability in both basic research and applied settings.

BACKGROUND

Where the successful accomplishment of an organization’s mission requires the coordinated contributions of two or more individuals collectively identified with the achievement of a common objective, the conditions for a team are operationally defined (Emurian, Brady, Ray, Meyerhoff, & Mougey, 1984). This definition is consistent with Salas, Rosen, Burke, Nicholson, and Howse (2007) who emphasize teams to be units of people having (1) task interdependencies and dynamic social interactions, (2) shared valued goals, (3) a limited lifespan, (4) distributed expertise, (5) and clearly defined participant roles. Eliciting and evaluating teamwork within distributed multiplayer game-based settings have been acknowledged to show great potential for engaging players in immersive and simulated environments in which to observe complex behaviors having direct relevance to the mission of an organization, to include the U.S. military (Hussain, Weil, Brunye, Sidman, Alexander, & Ferguson, 2008) and the National Aeronautics and Space Administration (Emurian,

Canfield, Roma, Gasior, Brinson, Hienz, Hursh, & Brady, 2009; Hienz, Brady, Hursh, Gasior, Spence, & Emurian, 2008). Related research documents the applications of online computer games to support collaborative and distributive communications, peer interactions, and resource sharing to achieve learning objectives (Papastergiou, 2008), and guidelines for the development of collaborative educational videogames overlap with several of the five features of a team given above (Zea, Sanchez, Gutierrez, Cabrera, & Paderewski, 2009). Finally, Mayo (2009) noted that an attractive dimension of game-based assessment is its potential to track sequences of user actions and communications that can be mapped onto higher-order skills and abilities.

Although the range of settings to which such definitions and game-based scenarios might be applied is obviously broad and encompassing (Salas, Stagl, Burke, & Goodwin, 2007), identifying a common conceptual framework is anticipated to facilitate the ongoing study of factors related to team performance effectiveness (Salas, Cooke, & Rosen, 2008). In that regard, Hess, MacMillan, Serfaty, and Elliot (2005) addressed some of the challenges associated with bringing critical aspects of operational team performance within the scope of laboratory-based analyses, and the TPT and evaluative research presented in this chapter fall within the recommended tactic of abstracting functional properties of teams that may lend themselves to empirical study within the context of controlled experiments. The research will show how a multiplayer and distributed computer game may be designed and deployed to assess the operational status and cohesiveness of a three-person team under varying conditions of workload. The approach taken addresses several research questions posed by Letsky and Warner (2008) with particular emphasis upon the development of metrics to assess inter-member collaborative performance within teams. The background of this work also includes recent analyses of three-person teams undertaking collaborative decision

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