### Behavior Analysis of Team Performance: A Case Study of Membership Replacement

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&

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### Précis

 Extended stays by human groups in extraterrestrial vehicles and habitats will be common in this century.

 Ensuring participants' behavioral health requires consideration of innovative approaches to microsociety assessment and management.

### Life in Space Will Not Be Easy



- The detection of impending performance degradation requires innovative approaches to monitor and measure both individual and team performances that relate to the operational status of a crew.
- The introduction of effective **countermeasures** to degradation is complementary to detection.
- Potential solutions to these two challenges will benefit from a technology that can integrate both considerations within a common conceptual framework with respect to task performance.





Fig. 1. A schematic diagram of the programmed environment.



"The Alluisi"

### Brave New World?



### Team Performance Task (TPT)

C     Image: Section and a request to reveal a barrier.         You are User!     Barrier?         Target accord         User! Score = 0	fain × 🕀			
Resource     Resource       Barrier3       Barrier4       Barrier5       Barrier5	C Szaad.umbc.edu:88888//tpt9jtb/tpt6v9.php?	var=vart.100.js		1
Barrier3 Barrier4 Barrier5 Barrier5 Barrier5 Barrier6 Barrier5 Barrier9 Send a request to reveal a barrier. Request Send a request to reveal a barrier. Request Send a request to reveal a barrier. Request Send a request to reveal a barrier. Total Score = 0 Total Score = 0	Resource	Resource	Resource	
Barrier 3 Barrier 4 Barrier 5 Barrier 5 Barrier 5 Barrier 9 You are User 1 Barrier 1000 Points = 60 for Team User 1 Score = 0 User 3 Score = 0 User 3 Score = 0 Total Score = 0				
Barrier S Barrier S Barrier S Barrier S Barrier S Carget score=0 Vau are User I Barrier = 1000 Points = 60 for Team User1 Score = 0 User2 Score = 0 User2 Score = 0 Total Score = 0	Barrier4	Barrier3		-1
Barrier3         Barrier3         Target score=0         You are User1       Send a request to reveal a barrier.         Barrier=1000 Points=60 for Team       Request         User1 Score = 0       User3 Score = 0         User3 Score = 0       Total Score = 0	Barrier6			-0
Barrier9         You are User1       Send a request to reveal a barrier.         Barrier= 1000 Points= 60 for Team       Request         User1 Score = 0       User2 Score = 0         User3 Score = 0       Total Score = 0	Ban	ier8		
You are User1       Send a request to reveal a barrier.         Barrier= 1000 Points= 60 for Team       Request         User1 Score = 0       User2 Score = 0         User3 Score = 0       Total Score = 0	Ī	3arrier9		
Total Score = 0	You are User1 Barrier= 1000 Points= 60 for Team User1 Score = 0 User2 Score = 0 User3 Score = 0	Target score=0	Send a request to reveal a barrier. Request	
	Total Score = 0			

Main × 🔿	
C Szaad.umbc.edu:8888//tpt9jtb/tpt6v9.php?var=vari.25.js	
Resource Resource User3 has requested that you reveal your Barriers.	ource
	Barrier 1
	Barrier2
	Barrier3
	Barrieró
	Barrier8
Barrier9	
Target You are User2 Barrier= 250 Points= 20 for Individual User1 Score = 0 User2 Score = 1 User3 Score = 0	t score=1 Send a request to reveal a barrier. Request
Total Score = 1	

Resource	Resource	Resource
You hit Barrier2		
	Barrier1	
	Barrier2	
Barrier3		
	Barrier6	
Barrier8		
	Barrier9	
	Target score=0	Send a request to reveal a barrier
You are User2 Barrier= 250 Points= 20 for Individual		Request
User1 Score = 0		
User3 Score = 0		
Total Score = 0		

# • Individual fixed ratios (I)

- Each team member was required to accumulate 20 points to complete each of three successive session components.
  - .25 sec barrier reveal delay
  - 1 sec barrier reveal delay
  - 4 sec barrier reveal delay

## • Team fixed ratio (T)

- The team was required to accumulate 60 points to complete each of three successive session components.
  - .25 sec barrier reveal delay
  - 1 sec barrier reveal delay
  - 4 sec barrier reveal delay

- Day 1: I-T
- Day 2: T-I
- Day 3: I-T
- Day 4: T-I
- Day 5: I-T with S2 replaced
- Day 6: T-I
- Day 7: I-T after team meeting
- Day 8: T-I after team meeting

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<b>S</b> #	Status	Major	Sex	Age	Game Experience	Computer Experience
1	Junior	Health Administration	F	19	8	8
2	Junior	Social Work	F	19	2	6
3	Junior	Health Administration	М	20	7	7
2*	Sophomore	Biology	F	18	8	9





































- Performance differences observed between the individual and team ratio conditions were evident in the range of barrier reveals and barrier hits during the 4sec component.
  - The mean range of barrier reveals was higher in the individual condition in comparison to the team condition
  - The mean range of barrier hits was higher in the individual condition in comparison to the team condition.
- The debriefing statements suggest that the individual and team ratio conditions differentially affected the way that team members perceived the task scenario and undertook to fulfill the ratio requirements under the two conditions.

- Destabilization of teamwork
- Lowered team morale

- Shared "mental model"
- Rule-governed performance
- Optimal performance exemplar

 In what ways may team-oriented tasks such as the TPT be used not only as diagnostic markers of the status of a crew, but also as tools to affirm and maintain social cohesion and role differentiation and identification among crew members and between crew members and mission control?

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### Thank You!



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### References

- Brady, J.V. (2007). Behavior analysis in the space age. *The Behavior Analyst Today, 8(4),* 398-413. URL: <u>http://www.baojournal.com/</u>
- Emurian, H.H., & Brady, J.V. (2007). Behavioral health management of space dwelling groups: Safe passage beyond earth orbit. *The Behavior Analyst Today, 8(2),* 113-135. URL: <u>http://nasa1.ifsm.umbc.edu/cv/Emurian\_Brady\_2007.pdf</u>
- Emurian, H.H., Brady, J.V., Ray, R.L., Meyerhoff, J.L., & Mougey, E.H. (1984). Experimental analysis of team performance. *Naval Research Reviews*, *36*(1), 3-19. URL: <u>http://nasa1.ifsm.umbc.edu/cv/NRR1984.pdf</u>
- Emurian, H.H., Canfield, G.C., & Brady, J.V. (2010). Behavior analysis of team performance: A case study of membership replacement. *The Behavior Analyst Today*, *11*(3), 161-185. URL: <u>http://nasa1.ifsm.umbc.edu/cv/EmurianCanfieldBrady\_BAT\_2010.pdf</u>
- Emurian, H.H., Canfield, G.C., Roma, P.G., Brinson, Z.S., Gasior, E.D., Hienz, R.D., Hursh, S.R., & Brady, J.V. (2011). A Multi-Player Team Performance Task: Design and Evaluation. In M.M. Cruz-Cunha, V.H. Carvalho, & P. Tavares (Eds.), *Business, Technological and Social Dimensions of Computer Games: Multidisciplinary Developments* (Ch. 13), IGI Global. URL: <u>http://nasa1.ifsm.umbc.edu/cv/MTPT\_post.pdf</u>
- Emurian, H.H., Canfield, G.C., Roma, P.G., Gasior, E.D., Brinson, Z.S., Hienz, R.D., Hursh, S.R., & Brady, J.V. (2009). Behavioral systems management of confined microsocieties: An agenda for research and applications. *Proceedings of the 39th International Conference on Environmental Systems* (Paper number: 2009-01-2423), Warrendale, PA: SAE International, 2009. URL: <u>http://papers.sae.org/2009-01-2423/</u>

### A Tribute

## **UMBC**

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March 25, 2011

Dr. Joseph V. Brady

Dear Joe,

It was my good fortune to be working for you in the programmed environment when interactions between coffee drinking and cigarette smoking were being investigated. On one occasion, a participant had prepared a cup of coffee for himself, and he put the cup down on a table close to the opening of a cigarette dispenser that was mounted on a wall. There was a button on the dispenser, and a fixed ratio of presses was required to earn a cigarette, which was released through an opening at the bottom of the dispenser. On that particular occasion, when the ratio was completed, the cigarette came flying out of the opening, sailed across the table, and landed in the man's cup of coffee. As I recall, that was the best evidence ever observed of an interaction.

Stay well, Joe. We've got work to do: MARS!

Best to you,



Henry H. Emurian

### **Final Notes**

### We must finally rely, as have the older sciences, on replication. ≻Cohen, 1994, p. 1002

Cited in Cumming, G. (2008). Replication and *p* Intervals: *p* Values Predict the Future Only Vaguely, but Confidence Intervals Do Much Better. *Psychological Science*, *3*(4), 286-300.

### *Keep making responses.* ≻Brady, 2009

BehvWiki interview with Joseph V. Brady: http://web3.unt.edu/behvh/wiki/index.php/Joseph\_V.\_Brady