



Group Cohesion and Situation Awareness in a Dynamic Decision-Making Task

Cooper Bednarczyk, Ryan Hagan, Camerhon Johnson, Laura Marsicek, Alitza Klapperich, Andrea Coria, Henry Licht, Stephanie Fratila, William Futch, & Stephen J. Guastello
Marquette University

Introduction & Background

In a dynamic decision task, decisions made at one moment have an impact on the environment, which reacts and shapes the options available at the next moment; the decision scope and choices are thus contingent on previous decisions and the results produced [1, 2]. Dynamic decisions typically occur within complex systems and commonly require forecasting ability; both of which are important parts of situational awareness and sense-making processes that are critical to emergency management. Neither cognitive process is well understood which is partially related to the temporal dynamics involved. The problem reaches another level of complexity when team decisions are involved.

Situation Awareness: One's understanding of their current surroundings based on previous experience and information that is immediately present and their ability to anticipate potential future states [3].

Team Cohesion: The shared bond or attraction that drives team members to stay together and to want to work together [4, p. 365]. It arises from a combination of sources such as task and social interaction, belongingness, group pride, and morale.

The SA/Cohesion Hypothesis: Situation awareness and sense-making are often the result of collective efforts. Hypothesis was that team cohesion would have a positive effect on situation awareness and vice versa.

Preliminary Results

- Results indicate a positive correlation between individuals' previous game experience and their situational awareness during the second match.
- SA and Cohesion both improved across matches.
- There was little cross-relationship between cohesion and SA during the first match. Cohesion improved within groups that made a large improvement in their SA between matches.
- For groups in both the ascending and descending difficulty conditions, there was a significant increase in levels of cohesion between group members from when they started the pre-session and by the end of the second match. However, the ascending group had the strongest levels of cohesion by the end of the second session.
- There was a negative correlation ($r = -.36, p < .01$) between an individual's cohesion with a group and their previous experience with firearms.

Preliminary Results

Bivariate Correlations among Research Variables.

	1	2	3	4	5	6
1 Cohesion1	.86	.43***	.44***	-.21	-.12	.02
2 Cohesion2		.66	.69***	-.07	-.06	.10
3 Cohesion3			.85	-.10	-.01	-.16
4 SA1				.81	.69***	.34*
5 SA2					.81	.41**
6 Game Exp.						.77

Reliability coefficients appear on the diagonal.

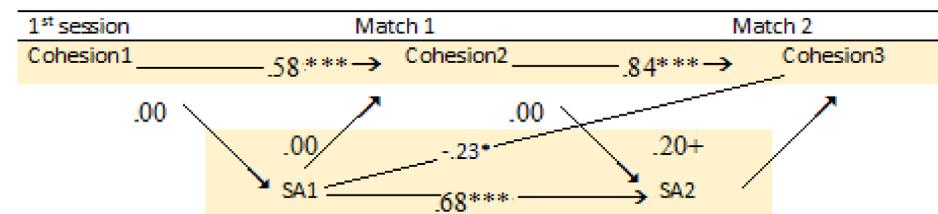
* $p < .05$, ** $p < .01$, *** $p < .001$

Multiple Regression: DV = Cohesion 3.

$R = .887$, $Adj R^2 = .766$, $F(3, 32) = 39.268$ ***

IV	β	t
Cohesion 2	.841	10.12***
SA1	.197	1.75+
SA2	-.230	-2.04*

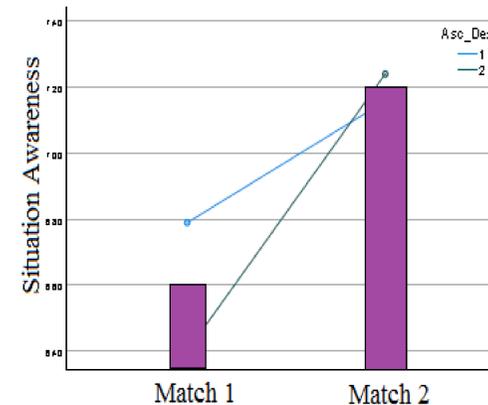
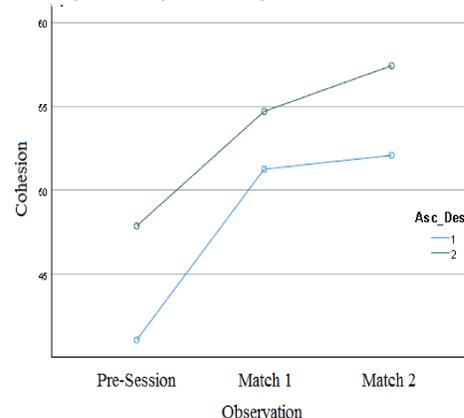
+ $p < .10$, * $p < .05$, *** $p < .001$



Mixed ANOVA for Cohesion and Situation Awareness.

	Cohesion		Situation Awareness	
	df	F	df	F
Ascending-Decending	1	7.19**	1	0.17
Between Ss Error	61		42	
Observation	2	36.14***	1	13.86***
Linear	1	70.90***		
Quadratic	1	8.151**		
Asc-Dec X Obs	2	0.35	1	2.11
Within Ss Error	122		42	

* $p < .05$, ** $p < .01$, *** $p < .001$



Methods



- Participants: 64 individuals in 8 groups in two, two-hour experimental sessions.
- In the first session, they completed several cognitive measures and tests measuring flexibility and rigidity, then learned how to play the online game Counter-Strike.
 - Performance was measured at both individual and team levels.
- In the second session, participants worked as a team, playing the counter-offensive role in the game; they were organized in groups of 5 playing against 5 bots generated by the gaming software.
 - Bots have two levels of difficulty to manipulate workload.
 - They played two matches of 20 short rounds each; performance measures were generated at the end of each round and for the match overall.
 - At the end of round 8, they completed a situational awareness questionnaire based on their current situation in game.
 - After the second match, the participants completed brief questionnaires regarding cognitive and social workload and leadership.
- Participants played matches wearing GSR sensors, which measured autonomic arousal. The GSR data was analyzed through SyncCalc to produce measures of individuals' strengths as drivers or empaths, as well as a measure of group sync.

Forward Thinking

- Results would have implications for emergency response teams and any other groups working for a common goal against competing agents.
- Further research should involve intact groups that have prior histories before the experiment, in contrast to groups composed of individuals meeting each other for the first time.
- Analysis of GSR data for team synchrony and its relationship to cohesion and SA.

References:

- [1] Brehmer, B. (2005). Micro-worlds and the circular relation between people and their environment. *Theoretical Issues in Ergonomics Science*, 6, 73-94.
- [2] Osman, M. (2010). Controlling uncertainty: A review of human behavior in complex dynamic environments. *Psychological Bulletin*, 136, 65-86.
- [3] Endsley, M.R. & Garland, D.J. (Eds.). (2000). *Theoretical underpinnings of situation awareness: A critical review, Situation awareness analysis and measurement*. Mahwah, NJ: Lawrence Erlbaum Associates.
- [4] Salas, E., Grossman, R., Hughes, A. M., Coultas, C. W. (2015). Measuring team cohesion: Observations from the science. *Human Factors*, 57, 365-374.