

MONITORING TEAM DYNAMICS THROUGH PHYSICAL AND PHYSIOLOGICAL INDICATORS

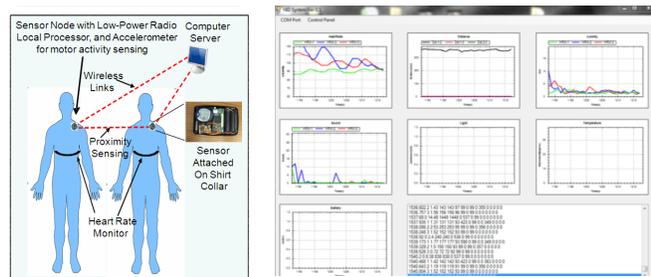
S. K. Baard, S. Lorenz, M. Pearce, D. Bo, C. Kermond, S. Golden, S. Biswas, C.-H. Chang, S. W. J. Kozlowski
Michigan State University

OUR PURPOSE AND IMPORTANCE

It is common practice in the organizational psychology literature to examine team effectiveness and its antecedents at a single point in time. However, cross sectional methodology does not allow for the investigation of how team characteristics and processes develop and change *over time*¹. When this is attempted, it is typically done so through surveys or (video) behavioral observations. In ICE environments (i.e., isolated, confined and extreme), teams face special circumstances that inhibit the use of repeated survey or continuous video recording methods. Therefore, we are developing and validating an alternative method, using *unobtrusive behavioral indicators of team psycho-social health* that will provide unique insights into teamwork and effectiveness.

THE TECHNOLOGY

We have developed a wearable wireless sensor (e.g., clipped to clothing or worn around your neck). A heart rate monitor is also worn around the chest (see figure on the left). Data (heart rate, physical movement and proximity to others, vocal frequency and intensity, light level, room temperature, and “face time” collaboration) is compiled wirelessly and stored on a local computer server, where data streams can be monitored and analyzed in real-time (see figure on the right).



EMPIRICAL RESULTS

We have completed a series of validation efforts and have found that the devices accurately capture interactions. In study one, 132 participants from a large Midwestern university worked in teams of three. Results show that there was 99% accuracy between the monitoring devices and video coding for which individuals are interacting, the length of the interaction, who initiated and who disengaged (see figure below). In study two, 28 individuals worked



in 3-person teams and we asked how they felt (i.e., their affect) during each interaction in one of two conditions: anxiety provoking or control. Results show that more participants in the anxiety condition rated their interactions as anxious (16%) or excited (13%) than those in the control condition (4% and 10%, respectively), whereas more control participants rated their interactions as calm (34%) or bored (21%) compared to those under the stress induction (31% and 11% for calm and bored; $\chi^2(4) = 97.14, p < .001; \phi = .22$). In addition, heart rate data from the monitoring devices show that

participants in the anxiety provoking condition had significantly higher heart rates (max=113.57, min=86.41, average= 98.64) during the interaction compared to those in the control (Max=111.16, $F(1, 1843) = 4.35, p < .05$; Min=82.38, $F(1, 1843) = 26.37, p < .001$; Average = 95.89, $F(1, 1843) = 10.25, p < .001$). In the third study of 411 individuals working in 137 three-person teams, we continued the investigation of affect during interactions through manipulating which individuals were the focus of a series of stressors. Dynamic analyses (i.e., vector autoregression) are currently underway that will capture the cyclical relationship between affect responses and heart rate variables.

FURTHER RESEARCH EFFORTS AND CONCLUSIONS

Continuously monitoring team effectiveness in real-time is a primary goal of this research. These sensor devices provide a novel and valid means of gathering continuous data, that allows for quick feedback to be provided to team members without first requiring a researcher to sift through survey or video data. In order to extend the research, this paradigm now being applied in analog environments (i.e., HERA and HI-SEAS). Examining the effectiveness of the devices in extreme environments will further our ability to develop an understanding of the patterns of team dynamics in order to create algorithms for real-time feedback. Real-time status feedback, will allow teams in “extreme” environments to increase their efficiency by effectively adjusting their strategies and behaviors, which result in higher performing teams.

[1] Kozlowski, S. W. J. and Ilgen, D. (2006). Enhancing the effectiveness of work groups and teams. *Psychology Science in the Public Interest*, 7(3), 77-124.