Team Effectiveness in Adventure Racing: The Power of Role Congruency and Role Redundancies

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This study suggests that in high-performance action teams the concept of team role congruence – the shared and explicit knowledge of one's team responsibilities and functions – is a powerful predictor of team effectiveness. A mixed methods study of 89 four-person, co-ed adventure racing teams examined the relationship of key team level input variables (experience, familiarity, roles, goals, skills, etc.) with three team outcomes: final ranking, level of satisfaction and decision to remain with the team for future races. Team role congruence was one of the strongest predictors of team effectiveness, equal in significance to team member familiarity Surprisingly, team experience and shared goals had almost no effect on team effectiveness Rather, having redundant leadership roles and agreed upon pro-social roles were stronger predictors of effective team performance. Implications and future lines of additional inquiry are discussed. [*]

Explaining and predicting team effectiveness under complex and stressful conditions is an elusive endeavor. Action teams, such as firefighters or military units, perform in inherently unpredictable and emergent conditions (Sundstrom, De Muese, & Futrell, 1990). Small mistakes or random coincidences can lead to large, unforeseen outcomes (Roberto, 2002; Weick, 1993). An emerging vein of team research suggests that interpersonal congruence – the degree to which team members see themselves as others see them according to levels of intellectuality, creativity, social skills – explains how some teams are more effective than others (Polzer, Milton, & Swann, 2002). Teams with high congruencies in areas related to tasks may enable them to quickly adapt to changes in their environment. For example, studies of military teams have posited that team member familiarity and knowledge of one another's skills is a key factor in successful team performance (Cannon-Bowers, Salas, & Converse, 1993). Theoretical modeling of such teams suggests that having redundant knowledge and skills present in a team enables teammates to engage in back-up behaviors, filling in when teammates are struggling and need help (Eduardo Salas, Burke, & Stagl, 2004). Furthermore, Weick (1993) theorizes that in stressful contexts, understanding each member's role enables a team to successfully improvise and survive in turbulent times. However questions remain unanswered, such as what congruent roles matter most? What redundancies in team roles, if any, effect team effectiveness? This study seeks to answer such questions by empirically investigating specific types of team congruencies and role redundancies that may predict team effectiveness in action teams.

What does it mean for a team to be effective? According to Hackman (2002), team effectiveness can be evaluated along three dimensions: the external results the team achieves, the degree to which the experience is satisfying to members, and the degree to which the team has a capability to grow and develop in future performances. These three outcomes collectively combine to suggest a holistic picture of a team's success. Like the legs on a stool, with just one diminished dimension a team can be unbalanced and its overall effectiveness can be compromised. For example, a team might create a satisfying solution or product, but if members are unhappy with their process and would not choose to work with one another again, then they have only achieved limited success. This holistic perspective is particularly salient in high-performance action teams (Sundstrom, McIntyre, Halfhill, & Richards, 2000). In such teams, successful performances may depend on the degree of member familiarity, or 'transactive memory' (Wegner, Erber, & Raymond, 1991), so members can flexibly adapt to changing conditions and task demands challenges (Cannon-Bowers et al., 1993; E. Salas, Merket, & Bergondy, 1999). Therefore, in this study, a picture of a team's effectiveness was constructed to reflect these three dimensions of success by gathering data on a team's final race ranking, team member's satisfaction levels with their performance, and the degree to which team members would choose to race with one another in the future.

With this conception of team effectiveness in mind, this study set out to answer the following research questions:

In the Primal Quest 2006 Adventure race,

1) What effect, if any, do team-level variables of team experience and team member familiarity have on team effectiveness?
2) What effect do team-level congruence measures of shared goals, perceptions of skill-levels, and perception of roles have on team effectiveness?
3) What effect does the presence of particular team roles have on team effectiveness?

Context & Population

The annual Primal Quest (PQ) Expeditionary Adventure Race (www.ecoprimalquest.com) is considered one of the longest and most difficult team endurance races in the world. In the summer of 2006 the PQ organization held its ten-day, non-stop format race in which 89 top, international athletic teams raced through 450 miles of demanding terrain in southeast Utah. Three hundred and fifty-six racers competed in the 2006 Primal Quest race, of which 28.7% were female, and the average age of 36.8 years ($\sigma = 6.24$) Of the ninety teams, twenty were from non-US countries, such as Australia, Brazil, Guatemala, Ireland, Japan, Mexico, New Zealand, South Africa, Spain and Sweden. The general location of the race was kept secret, disclosed to the participants only a few months before the race. Though this might seem like ample time to prepare, it is not since these races are held in such extreme contexts (such as the frozen glaciers of Alaska, tropics of Borneo or the hot deserts of Morocco) or ambiguous contexts that include the range of climates (such as Argentina or New Zealand).

In addition, only a few hours before the race began were teams given maps with the specific sequence of athletic stages of the race. The maps held 43 sequential check-points to which the co-ed teams of four members collectively navigated through deserts, canyons, white-water rivers and snow-peaked, high altitude mountains, all the while dealing with changes in weather and the inevitable task and relational conflicts that emerged (De Dreu & Weingart, 2003). Using a compass and altimeter, teams made their own judgments about the fastest and safest way to travel from checkpoint to checkpoint. Each team decided how fast to race, what equipment to pack, how and when to sleep, and when and what to eat during their race. Teams were not allowed any support personnel during the race. These factors guaranteed that no team could completely prepare for the exact terrain, route, and conditions. Teams find themselves operating with incomplete or ambiguous information as they perform in complex settings in which small mistakes could have large consequences.

These races are dangerous and exhausting. Data from previous years of Primal Quest races suggests that almost half of the field drops out due to physical injuries, such as broken bones, blisters, hypothermia, or dehydration. Fatalities, though rare, do occur during the race. After ten days, the race is over no matter where a team is on the course. The $250,000 total purse is the largest cash prize in the sport.

Methodology

Pre- and post-race surveys were administered to racers to gather quantitative and qualitative data. The pre-race survey was given to each racer (n=356) the day before the race via a brief 10-minute face-to-face meeting with each team. In the meeting the researcher gave the same verbal directions and each racer individually filled out a two page paper questionnaire. This data was gathered, analyzed and entered into an SPSS database in order to construct the following input variables:

Team Goal Congruence (TGC): Each racer circled one of six final ranking in which they hoped to finish (*Win, Top 5, Top 10, Top 20, Top 30, To Finish*). The researcher assigned each goal a number (Win=1, Top5=5, Top10=10, Top20= 20, Top30=30, Finish=45) that was entered into the database. Based on analysis of the previous three years of races, only half the entered field typically finishes so 45 was assigned for "finishing" state. TGC was created by summing the absolute values of the differences between individual goals and a team average goal. For example, for a team in which two members hoped to win ($X_1=1$, $X_2=1$) and two hoped finish in the top 20 ($X_3=20$, $X_4=20$), the team average goal was 10.25. TGC was then created as follows: $|1 - 10.25| + |1-10.25| + |20 - 10.25| + |20 - 10.25| = 39$. This approach yielded a numeric TGC indicator for each team that ranged from zero to 66 (on a possible scale of zero to 117). The scale was reversed so that higher scores represented higher levels of team goal congruence.

Team Experience (TE): Each racer circled the number (ranging from zero to 20) of expeditionary length races (races greater than four days) that they individually have entered. These were summed and TE became the average number of such races experienced per team.

Team Familiarity (TF): Each racer wrote down the name of each of their teammates in a blank space provided and circled the number of expeditionary length races (ranging from zero to 20) they had entered with each team mate. TF was calculated by averaging the twelve pair wise combination of races among the teammates.

Team Skill Perception Congruence (TSPC): This variable was constructed to measure the degree to which team members saw themselves as others saw them in

terms of their skill levels in different race disciplines. The race was designed to include nine disciplines: trekking, mountain biking, kayaking, horseback riding, ropes, swimming, mountaineering, navigation, and first aid. Using a scale that ranged from one to seven, each racer indicated their own level of expertise in each discipline relative to the field racers present at the race. Using the same scale, members then indicated their perception of each of their teammate's level of expertise in each discipline. An intermediary measure of individual skill congruence (ISC) was derived by summing the absolute values of the differences between an individual's self-assessment in each discipline and the average of their peer's assessment of their skill in each discipline. With this in hand, TSPC was generated by summing the ISCs in each team. This generated a team measure of TSPC that ranged from zero to 110 (on a possible scale of zero to 216). Scores were reversed so that higher scores represented higher level of team congruence.

Team Role Perception Congruence (TRPC): This variable was constructed to measure the degree to which team members saw themselves as others saw them in terms of the key roles they would play on their team during the race. Each racer was asked an open ended question in which they wrote the roles they expected to assume in their team during the race. Next they wrote the name each team mate and wrote what key roles they expected each one to fulfill during the race. Racers typically wrote several roles for themselves and for each teammate. This qualitative data was analyzed and the roles (n=3,349) were open-coded to generate seven emergent role categories that drew on the racer's own words (see Figure 1): Motivator (n=808), Work-horse (n=604), Logistics/coordinator (n=314), Decision-maker (n=332), Navigator (n=1032), Specialty Expert (n=177), and Other (n=188). An intermediary percent measure of individual role congruence (IRC) was calculated by coding which role an individual noted he/she would play and then finding the percent of their teammates who also noted that he/she would play that role. For example, if a racer indicated they would be the navigator and everyone else on the team also noted that that same individual would play that role, then the IRC was 1.0 (100%) since all three members agreed. If however only one of the three teammates mentioned that the individual would play that role, then the IRC would be just .33. If a teammate mentioned they would play more than one role, then an average IRC from the multiple roles was calculated to yield a single IRC for each member. TRPC was created for each team by averaging the individual IRCs in which the lower scores indicated lower levels of team congruence.

Figure 1. Team Role Categories Derived on the Roles Racers Indicated

Motivator	These were social and relational functions in which members suggested they would keep spirits up as well as bring the group closer together. Roles in this category included phrases such as "morale leader", "motivator", "leader of team cohesion", "driver of team spirit", "keep spirits up", and "cheerleader" (n=808).
Work horse	These included more operational responsibilities of carrying heavy loads and the weight of others. This category included phrases such as being the "work horse", "load carrier", "tower", and "strong man" (n=604).
Logistics/ Coordinator	This included process and coordination tasks such as organizing food, keeping track of time and monitoring water intake. This category included phrases such as "coordinator", "maintaining efficiency", "progress tracker", "time keeper", "mandatory gear checker", "reminder", and "feeder"(n=314).
Decision-maker	This included more strategic functions to direct the group in decision making and strategy. This category included phrases such as: "strategist", "lead decider", "problem solver", "team captain", and "pace setter" (n=332).
Navigator	This role was the most frequently cited and drew on the specific skill of orienteering. It included phrases such as "navigator", "co-navigator", "lead navigator", "main navigator", and "route finder" (n=1032).
Special Expert	This was a broad category of specialty skills that members brought to the team, such as being the "mechanic", "kayaker", "ropes specialist", "local knowledge", "canyon leader", "biker expert", "language translator", etc. (n=177)
Other	Finally, this title was reserved for roles that were difficult to decipher or assign to an existing category. Phrases included "fast", "female", "experienced", "consistent", "all around", "team player", "engine", "to keep up", "mental", "rock", etc. (n=188).

Figure 2. Means and Standard Deviations for Input and Output Variables

		Mean	SD
Team Level Measures	Age	36.92	6.24
	Team Experience (TE)	3.81	3.65
	Team Familiarity (TF)	1.02	1.30
Team Congruence Measures	Team Goal Congruence (TGC)	18.76	18.07
	Team Skill Congruence (TSC)	39.00	17.56
	Team Role Congruence (TRC)	.50	.18
Team Agreed-Roles (TAR)	Motivator (TAR-M)	.80	.77
	Workhorse (TAR-W)	.69	.73
	Logistics (TAR-L)	.19	.39
	Decision Maker (TAR-DM)	.18	.44
	Navigator (TAR-N)	1.47	.78
	Specialty Expertise (TAR-E)	.11	.32
	Other (TAR-O)	.02	.15
	Total # TAR per Team (TAR-TOT)	3.46	1.69
Team Role Redundancies (TRR)	Motivator (TRR-M)	.20	.43
	Workhorse (TRR-W)	.16	.37
	Logistics (TRR-L)	.00	.00
	Decision Maker (TRR-DW)	.02	.15
	Navigator (TRR-N)	.58	.62
	Specialty Expertise (TRR-E)	.00	.00
	Other (TRR-O)	.00	.00
	Total # TRR per Team (TRR-TOT)	.96	.87
Team Effectiveness Outcome Measures	Final Rank (FR)	45	25.73
	Individual Post-race Satisfaction (IS)	2.10	1.50
	Individual Inclination to Race with Team in the Future (IF)	2.32	1.36

Team-Agreed Roles (TAR): This variable was constructed to measure team-level agreement on the roles present in the group. A count was kept of the number of instances in which at least three team members agreed that a particular role (motivator, workhorse, navigator, etc) would be played by one of those three. For instance, if a racer in a team felt they would be the navigator and two other teammates agreed, then team had a team-agreed role of navigator (TAR-N = 1). If two racers on the team felt they would assume decision-making roles, and at least two other teammates agreed, then the team had two team-agreed roles for decision-makers (TAR-DM = 2). In contrast, if two racers felt they would play a motivational role on the team, but only one other teammate agreed with each, then no team-agreed roles were counted for motivation (TAR-M = 0). Counts were kept for all team roles, including Workhorse (TAR-W), Logistics/coordinator (TAR-L), Specialty Expert (TAR-E) and Other (TAR-O). In addition, the sum total of all agreed upon roles present in a team were calculated (TAR-TOT).

Team Role Redundancies (TRR): This variable measured the presence and prevalence of more than one team-agreed upon role. For example, if a team had three members with team-agreed roles as navigators (TAR-N = 3), one member as the workhorse (TAR-W = 1) and two members as motivators (TAR-M = 2), then the team had two team role redundancies in navigator, no role redundancies in workhorse, and one redundancy in motivator roles. These team role redundancies were

counted as TRR-N = 2, TRR-W=0, and TRR-M=1, respectively. A total sum of all the number of redundant roles present in each team was also kept (TRR-TOT).

At the conclusion of the race, the race organizers awarded teams a **final ranking (FR)** score based on when they finished or withdrew from the race. Of the 89 teams that entered, only 28 teams completed the full race course and were awarded ranks from 1st to 28th place based on the times they finished. Another 28 teams completed a shortened race course and were awarded ranks from 29th to 56th based on the times they finished. An additional 15 teams went unranked (meaning they lost a member but completed the short course) and were awarded ranks 57th through 71st. The final 18 withdrew entirely and were given a final ranking based on the times they withdrew from the field (for example the team in 89th place was the first team to withdraw).

Two weeks after the race the researcher emailed each racer a post-race survey, to which 60.7% of the population emailed a response directly to the researcher (n=216). The survey asked racers to indicate on a scale their **individual level of satisfaction (IS)** with their team performance and their **inclination to race with their team again in the future (IF).** In addition racers were invited to explain their responses in the email in an open-ended format, which the researcher open-coded for themes.

Analysis

This section presents the correlational findings which show that team role congruency, and specifically the congruent roles of the workhorse, was one of the most significantly positively correlated input variables to all three output measures of team effectiveness. The correalational data is followed by two phases of regression analysis, both of which illustrate the predictive power of team role congruence on measures of team final ranking, individual satisfaction and inclination to race with the team in the future.

Bivariate correlations were calculated to identify patterns of association among the input and outcome variables (see Figure 3). Since no teams were found to have team redundant roles (TRR) in Logistics/Coordinator, Specialty Expert, or Other, analysis could not be computed since the input variable was constant.

Among the input variables team experience showed no significant correlations to team goal congruence, team skill perception congruence or team role perception congruence. Team familiarity was significantly correlated to team goal congruency ($r = .18$, $p < .01$) and to team role congruency ($r = .14$, $p < .05$). In contrast, the strong correlation observed between team experience and team familiarity suggests their tight and overlapping positive relationship ($r = .53$, $p < .01$).

As expected, significant correlations were found among final ranking and team familiarity ($r = .35$, $p < .01$) and team experience ($r = .22$, $p < .01$). Equally significant correlations with final rankings were observed when teams had agreed upon and redundant roles of navigator ($r = .28$, $p < .01$) and redundant workhorse roles ($r = .22$, $p < .01$). Team role perception congruence ($r = .21$, $p < .01$) and skill perception congruence ($r = .16$, $p < .01$) were also significantly correlated with final rankings. Interestingly, teams that had agreed upon roles in the Other category (which were roles named other than the six key roles coded) showed significant negative correlations to final ranking ($r = -.22$, $p < .01$). This suggests that the presence of these agreed upon roles in teams were significantly associated with teams finishing in worse places. Also noteworthy is that team goal congruency was not correlated to final rank, which was unexpected.

With respect to individual post-race satisfaction (IS), team skill and role congruencies were most significantly correlated, with values of $r = .22$ ($p < .01$) and $r = .21$ ($p < .01$) respectively. Team familiarity was significantly associated with individual satisfaction ($r = .17$, $p < .05$) which is not surprising since one would think that teams that have raced with one another more will likely be more satisfied than teams that have not raced with one another before. And interestingly, having agreed upon team roles of workhorse ($r = .15$, , $p < .05$) and redundant roles of team motivator ($r = .17$, $p < .05$) also were significantly associated with higher levels of individual satisfaction.

The inclination of members to race again with their team (IF) was most significantly correlated with familiarity ($r = .28$, $p < .01$), team role congruence ($r = .25$, $p < .01$) and the presence of the agreed role of workhorse ($r = .25$, $p < .01$). Teams that had redundancies the role of workhorse roles also were significantly correlated with IF ($r = .20$, $p < .01$). Having agreed and redundant roles of navigator were also significantly correlated with IS ($r = .15$, , $p < .05$). Neither team goal congruence nor team experience showed significant correlations to post-race satisfaction. In sum, team role perception congruency (TRPC), team agreed roles of workhorse (TAR-W), team familiarity (TF), and the number of agreed upon roles in teams (TAR-TOT) proved to be the only input variables to be significantly correlated with all three outcome variables of team effectiveness.

Scatter plots suggested linear relationships between each independent variable and each of the three outcome variables: Final rank (FR), individual post-race satisfaction (IS), and individual inclination to race with the team again (IF). An initial set of predictive linear regression models were constructed for each of the three outcome variables with respect to the main families of

Figure 3. Correlational Coefficients for Variables

	AGE	TF	TE	TGC	TSPC	TRPC	TAR -M	TAR -W	TAR -L	TAR -DM	TAR -N	TAR-E	TAR -O	TAR-TOT	TRR -M	TRR -W	TRR -DM	TRR -N	TRR -TOT	FR	IS
TF	.01																				
TE	.00	.53**																			
TGC	.16**	.18**	.04																		
TSPC	.08	.09	.01	.32**																	
TRPC	.01	.14*	.01	.27**	-.02																
TAR-M	.12*	.16**	-.04	.20**	-.04	.50**															
TAR-W	-.02	.16**	.10	.05	.04	.40**	.21**														
TAR-L	-.02	.15**	.03	.11*	.07	.27**	.02	.29**													
TAR-DM	-.03	.09	.15**	.19**	.06	.10	-.09	.00	.19**												
TAR-N	-.02	-.08	-.02	.16**	.04	.32**	.01	.10	.04	.18**											
TAR-E	.12*	-.18**	-.12*	-.06	-.05	.11*	.09	-.09	.10	-.07	-.08										
TAR-O	-.12*	.032	.09	-.01	.08	-.04	-.06	-.04	.12*	.28**	-.19**	-.05									
TAR-TOT	.04	.14**	.05	.26**	.05	.66**	.54**	.62**	.46**	.36**	.54**	.16**	.05								
TRR-M	.12*	.05	-.05	.01	-.02	.29**	.81**	.17**	-.09	-.07	-.05	.16**	-.07	.40**							
TRR-W	.02	.31**	.23**	.01	.11*	.34**	.15**	.78**	.26**	.03	.10	-.06	-.07	.51**	.08						
TRR-DM	-.06	-.04	.07	.10	.06	-.04	-.06	-.04	.12*	.63**	.01	-.05	.49**	.18**	-.07	-.07					
TRR-N	-.01	-.12*	-.01	.11*	.09	.25**	-.04	.11*	.05	.15**	.93**	-.05	-.14**	.49**	-.02	.09	-.02				
TRR-TOT	.05	.04	.05	.09	.09	.45**	.44**	.49**	.12*	.17**	.66**	.02	-.08	.79**	.51**	.52**	.10	.72**			
FR	-.11	.35**	.22**	.06	.16**	.21**	.03	.18**	.13*	.10	.28**	-.03	-.22**	.25**	.09	.22**	-.02	.28**	.32**		
IS	0	.17*	-.01	.10	.22**	.21**	.12	.15*	.03	-.05	.02	.07	-.05	.15*	.17*	.11	-.11	.03	.13	.39**	
IF	-.12	.28**	.04	.00	.03	.25**	.12	.25**	.09	.05	.15*	-.05	.03	.26**	.12	.20**	.09	.15*	.25**	.44**	.47**

* $p < 0.05$ level (two-tailed) ** $p < 0.01$ level (two-tailed)

Figure 4. Initial Model ofStandardized Coefficients Predicting Effects of Input Variables on Outcomes Variables of Team Final Rank, Individual Satisfaction and Individual Inclination to Race Again with Team.

	Final Rank (FR)	Individual Satisfaction with Team (IS)	Inclination to Race Again with Team (IF)
TF	.239~	.289**	.291**
TE	.114	-.213*	-.044
TGC	-.107	-.009	-.095
TSPC	.202~	.212**	.037
TRPC	.210*	.185**	.227***
Overall Model F	3.758**	6.467***	6.178***
R^2	.190	.137	.133
Adjusted R^2	.140	.116	.111
N	89	216	216

~ p < .10 * p < .05 **p < .01 ***p < .001

input and congruent variables (see Figure 4). Each of the models revealed modest levels of explanation of variance, with R^2 values ranging from .133 to .190. This reinforces earlier discussion of the nature of the performances as being inherently unpredictable. It is worth pointing out that other variables, such as physical conditioning of athletes, which were not measured in this study. Although the R^2 for each model are modest it is noteworthy still given the emergent complexity of the performances.

Team familiarity (TF) and role congruence (TRPC) were the only input variables to have significant predictive power across all three outcomes, while team goal congruence (TGC) showed no significant effects With regards to final ranking, team familiarity had the strongest significant effect (β = .239, $p < .10$) followed by team role congruency (β = .210, $p < .05$) and team skill congruence (β = .202, $p < .10$). Team familiarity also had the most significant effect on individual satisfaction (β = .289, $p < .01$) followed by team skill congruency (β = .212, $p < .01$) and role congruency (β = .185, $p < .01$). Interestingly, team experience also had a strong negative effect (β = -.213, $p < .05$) on individual satisfaction. When predicting IF, team familiarity (β = .291, $p < .01$) and team role congruence (β = .227, $p < .001$) displayed the only significant effects.

Though team goal congruence (TGC) did not hold any significant predictive coefficients in the regression models, interaction effects were tested and a significant interaction was observed among TE x TGC with respect to FR (β = .373, $p < .05$). A split mean analysis revealed TCG had a positive effect in low experience groups, while it had essentially no effect in high experienced teams on final ranking (β = .17 vs. -.04). This suggested that the less experienced the team the greater positive effect shared goals had on predicting final rank.

With a baseline model established, additional sub-variables of team role congruency were introduced to establish which, if any, roles would have significant effects on all three outcome measures (see Figure 5). Variables TAR-M, TAR-N and TRR-TOT were excluded for colinearity concerns and TRR-L, TRR-E, and TRR-O were not included in the modeling since no team had redundant roles of Logistics, Specialty Expert or Other.

Across all three models, team familiarity was the only input variable to have significant effects on all three team effectiveness outcome measures, which was expected. However, team experience nor team goal congruence showed significant effects on team effectiveness. When predicting final rank, aside from TF (β = .295, $p < .10$), team role redundancies in navigation (TRR-N) had a strong significant effect (β = .212, $p < .10$). Interestingly, having agreed upon roles other than those of the seven roles (TAR-O) had strong negative effects on team final ranking (β = -.287, $p < .05$).

Figure 5. Fuller Model of Standardized Coefficients Predicting Effects of Input Variables on Outcomes Variables of Team Final Rank, Individual Satisfaction and Individual Inclination to Race Again with Team.

	Final Rank (FR)	Individual Satisfaction with Team (IS)	Inclination to Race Again with Team (IF)
TF	.295~	.342***	.415***
TE	.107	-.186	-.123
TGC	-.133	.052	-.067
TSPC	.176	.236***	.014
TRPC	.107	.072	.107
TAR-W	-.007	.239*	.247*
TAR-L	.054	-.015	.020
TAR-DM	-.009	-.009	-.085
TAR-E	.002	.138~	.041
TAR-O	-.287*	-.041	-.058
TAR-TOT	.084	-.142	-.080
TRR-M	.033	.172	.074
TRR-W	-.018	-.146	-.112
TRR-DM	.119	-.014	.237*
TRR-N	.212~	.101	.229**
Overall Model F	2.266**	3.085***	3.395***
R^2	.327	.194	.210
Adjusted R^2	.183	.131	.148
N	89	216	216

~ p < .10 * p < .05 **p < .01 ***p < .001

When predicting individual satisfaction, TF displayed the strongest significant effect ($\beta = .342$, $p < .001$), followed by team skill perception congruency ($\beta = .236$, $p < .001$), having agreed upon roles of workhorse ($\beta = .239$, $p < .05$) and special expertise ($\beta = .138$, $p < .10$). Finally, in predicting inclination of team mates to race with the team in the future (IF), team familiarity showed the strongest and most significant effects ($\beta = .415$, $p < .001$) followed by having redundant navigational roles ($\beta = .229$, $p < .01$). The presence of redundant roles in decision making ($\beta = .237$, $p < .05$) and agreed upon roles of workhorse ($\beta = .247$, $p < .05$) also had significant effects on IF.

Discussion & Implications

Adventure racing is a highly dangerous, unpredictable and complex context of study. In this race, small navigational errors put some teams dozens of miles off course and out of the race. Freak desert electrical storms forced a number of teams to take shelter for hours, loosing valuable final rankings. And small decisions of when to rest, drink water, and clean shoes of debris had large unforeseen repercussions for many of the teams Finding potent and predictive models to explain team performance in such seemingly random contexts is by any means a challenge. So the conclusions discussed in this section should be viewed as suggestive and warrant further study and observations.

The analysis suggests that team familiarity was indeed a powerful predictor of team effectiveness. For example, teams that finished in the top 20 had raced with each teammate in an average of 2.13 races expeditionary races, which put them almost six times more familiar with their teammates than racers who finished in the bottom 20 places. This resonates with the hypothesis that teams who have raced together more will tend to do better, be more satisfied and choose to race again with the team in the future.

However, team familiarity was not significantly correlated to team perception of skills and only slightly

correlated with team perception of roles. This is a surprising finding that contradicts previous theoretical work that posited a strong positive relationship between team member familiarity and knowledge of one another's skills and abilities (Cannon-Bowers & Salas, 2001). Perhaps this finding emerged in the adventure racing population because many team members, no matter how many years they raced with one another, struggled to accurately assess skill levels of their teammates in unfamiliar tasks (such as horseback riding or white water swimming). In addition, perhaps highly unfamiliar teammates came together on a team and still knew one another's skill level through reputation and word of mouth. In any event, this finding suggests further research into the various dimensions of team familiarity, or transactive memory, that explain team performance (Wegner et al., 1991).

The predictive power of team role congruence (TRPC) –specifically the roles of workhorse, motivator, navigator and decision-maker –with team effectiveness was an important insight. In baseline models TRPC proved generally more significant and had a more powerful effect than even a team's level of experience. This suggests that the shared and explicit knowledge of one's team responsibilities may well be a key factor in how teams are able to adapt and succeed in such complex and fatiguing environments. Specifically, having agreed upon responsibilities and redundancies on aspects of team motivation, navigation, and decision making could explain how teams are able to succeed or fail in the midst of ambiguous information and fatigue. For example, sixteen of the top twenty teams (80%) had redundant team navigational roles in comparison to only five of the bottom twenty teams (25%). In some ways this empirical finding supports Weick's theoretical claim that, in time of stress, team members need to hold a "virtual role system" in mind so members can continue to interpret data and act (Weick, 1993). However, the predictive power of specific redundant roles –such as motivators, navigators, and decision makers – suggests that teams put themselves in positions to perform more effectively by equipping themselves with "back-up" capabilities (Eduardo Salas, Burke, & Samman, 2001). Given this finding a question that remains unanswered is how teams created role congruence. For example, did they discuss their roles in advance? Do they have such history with one another that they "just know?" Or perhaps they recruited one another based on their perceptions of the roles they could play. Moreover, having more than one team member occupying a role could create friction or disagreement, particularly in leadership roles such as the navigator. How do teams negotiate the presence of duplicate roles in ways that support team effectiveness? These could questions for further study that might reveal insights into the dynamics and mechanisms of establishing and maintaining team role congruency and redundancies.

In contrast, team goal congruence proved surprisingly weak in its relationship to team effectiveness. Based on previous research, it was hypothesized that performance goal congruence would have a positive effect on team effectiveness, particularly on team level satisfaction (Kristof-Brown & Stevens, 2001). However, the only significant power of team goal congruence was in how it effected higher vs. lesser experienced teams in their final ranking. In less experienced teams, higher goal congruence led to slightly better final rankings. However, in more experienced teams higher goal congruence had no effect. The lack of predictive power of team goal congruence is particularly interesting since many of the of the post race comments stated explicitly that incongruent goals were a main reason for dissatisfaction or decision not to race with the team again. The diminished role of team goal congruence could be explained if racers held a different perspective of team goals beyond a final rank or finishing. It is also possible that final placement goals that each racer declared beforehand may simply be unfounded, particularly in less experienced teams. That is, saying you want to finish in the top 20 teams is one thing, but racers may not understand what that physically and mentally requires. What might be more important, particularly in post race satisfaction and in making the decision to race with a team again, is how well the team reconciles and adjusts its goals as members become fatigued, stressed, and derailed during the race itself. This would suggest further study into the processes of how the members surface and recalibrate goals throughout the race.

In conclusion, this study suggests a new concept of team role congruency, which is a team-level measure of the degree to which members see themselves as others see them in terms of the key team responsibilities and functions they assume. The findings suggest that team role congruency is a strong predictor of action team effectiveness in complex and adaptive settings. Redundancies in key leadership roles (e.g decision making, navigation) and the presence of agreed upon pro-social roles (e.g. workhorse, motivator) had strong effects on team final ranking, individual satisfaction, and inclination of members to race with the team again. The study confirms the predictive power of team familiarity and offers empirical evidence that casts doubt assumed positive effect that team experience or goal congruency has on team effectiveness in complex contexts.

References

Cannon-Bowers, J. A., & Salas, E. (2001). Reflections on shared cognition. *Journal of Organizational Behavior, 22*(2), 195-202.

Cannon-Bowers, J. A., Salas, E., & Converse, S. A. (1993). Shared mental models in expert team decision making. In N. Castellan (Ed.), *Individual and group decision making: current issues* (pp. 221-246). Hillsdale, NJ: Lawrence Erlbaum.

De Dreu, C., & Weingart, L. R. (2003). Task versus relationship conflict, team performance, and team member satisfaction: A meta-analysis. *Journal of Applied Psychology, 88*(4), 741–749.

Hackman, J. R. (2002). *Leading teams: Setting the stage for great performances*. Boston, MA: Harvard Business School Press.

Kristof-Brown, A. L., & Stevens, C. K. (2001). Goal congruence in project teams: Does the fit between members' personal mastery goals and performance goals matter? *Journal of Applied Psychology, 86*(6), 1083-1095.

Polzer, J. T., Milton, L. P., & Swann, W. B. (2002). Capitalizing on diversity: Interpersonal congruence in small work groups. *Administrative Science Quarterly, 47*(2), 296-324.

Roberto, M. (2002). Lessons from Everest: The interaction of cognitive bias, psychological safety, and system complexity. *California Management Review, 45*(1), 136-156.

Salas, E., Burke, C. S., & Stagl, K. C. (2004). Developing teams and team leadership: Strategies and principles. In D. V. Day, S. Zaccaro, J. & S. M. Halpin (Eds.), *Leader development for transforming organizations: Growing leaders for tomorrow* (pp. 325-355). Mahwah, NJ: Lawrence Erlbaum Associates.

Salas, E., Burke, S., & Samman, S. (2001). Understanding command and control teams operating in complex environments. *Information Knowledge Systems Management, 2*, 311-323.

Salas, E., Merket, D., & Bergondy, M. (1999). Making sense out of team performance errors in military aviation environments. *Transportation Human Factors, 1*(2), 231-242.

Sundstrom, E., De Muese, K. P., & Futrell, D. (1990). Work teams: Applications and effectiveness. *American Psychologist, February*, 120-133.

Sundstrom, E., McIntyre, M., Halfhill, T., & Richards, H. (2000). Work groups: From the Hawthorne studies to work teams of the 1990s and beyond. *Group Dynamics, 4*(1), 44-67.

Wegner, D., Erber, R., & Raymond, P. (1991). Transactive memory in close relationships. *Journal of Personality and Social Psychology, 61*(6), 923-929.

Weick, K. E. (1993). The collapse of sensemaking in organizations: The Mann Gulch disaster. *Administrative Science Quarterly, 38*(4), 628-652.