Teams & Stress:
A Meta-Analysis & Process Analysis

Dissertation Defense
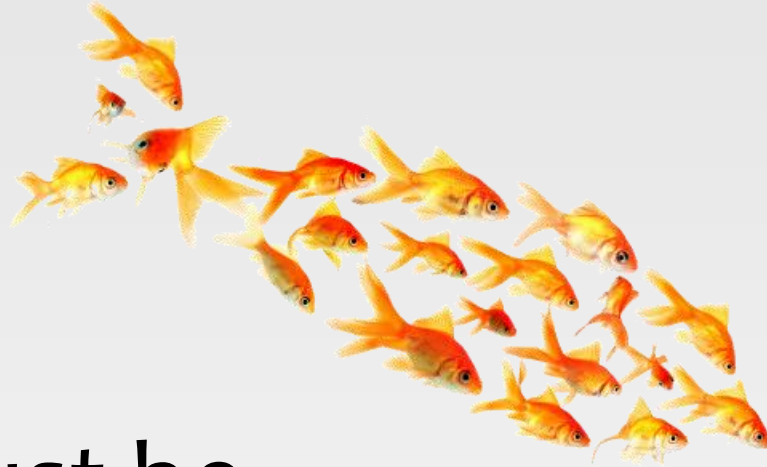Brandy A. Brown
April 21st, 2011 @ 2pm in Brackett 419

Overview: Team Stress & Performance

- Literature Review

- Meta-Analysis: Methods & Results
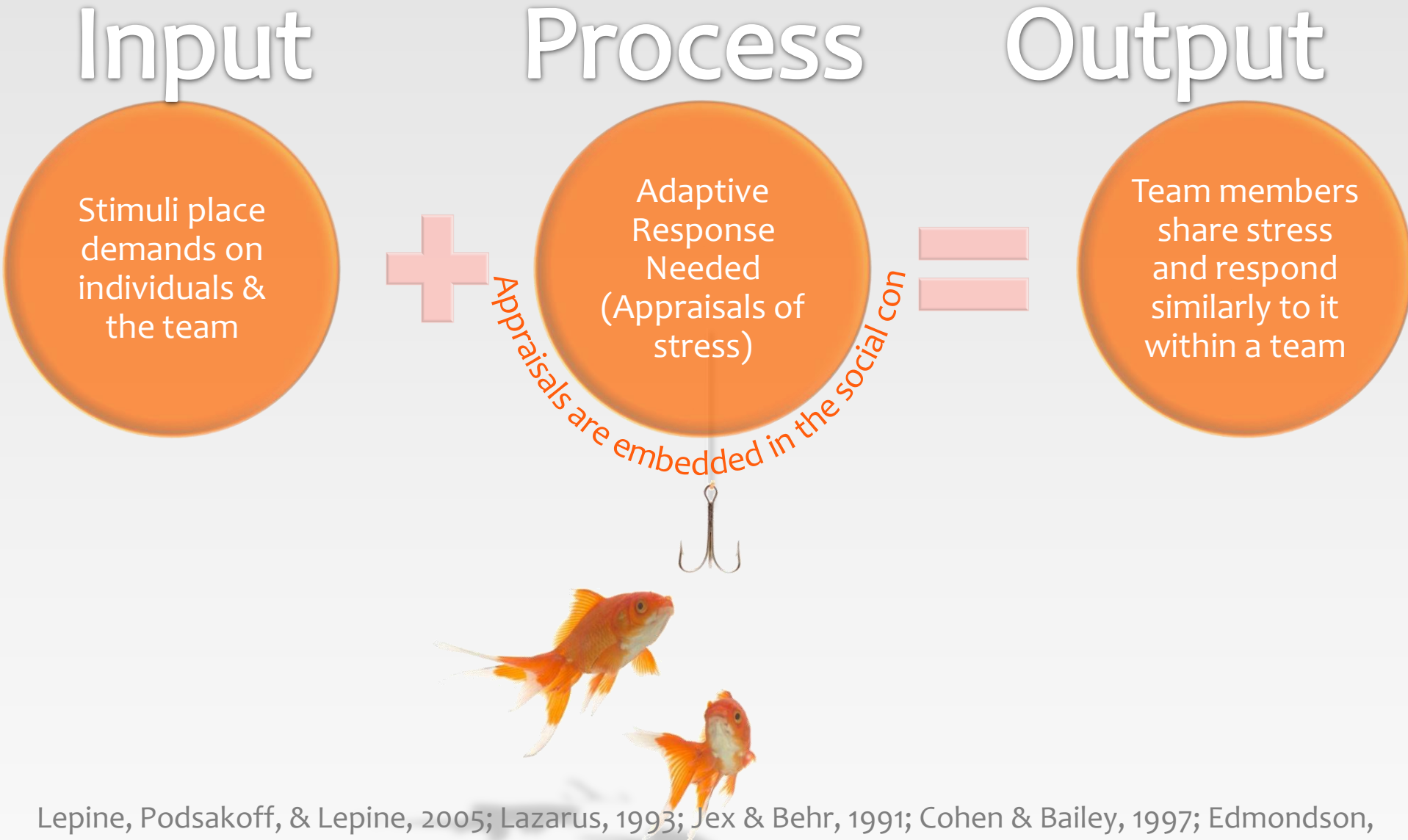
- Team Process Analysis: Methods & Results

- Discussion

Organizations are using teams to cope with stress, but:

Teams must be **effective** to produce superior results in the workplace

Boone, Van Olffen, Witteloostuijn, & De Brabander, 2004; Moon et al., 2004; Denison, Hart, & Kahn, 2006

Theoretical Basis: Team Stress

Input

Stimuli place demands on individuals & the team

+

Process

Adaptive Response Needed (Appraisals of stress)

=

Output

Team members share stress and respond similarly to it within a team

Appraisals are embedded in the social con

Lepine, Podsakoff, & Lepine, 2005; Lazarus, 1993; Jex & Behr, 1991; Cohen & Bailey, 1997; Edmondson, 2002; Kerr & Tindale, 2004; West, 2002
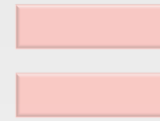
Current Literature: Team Stress

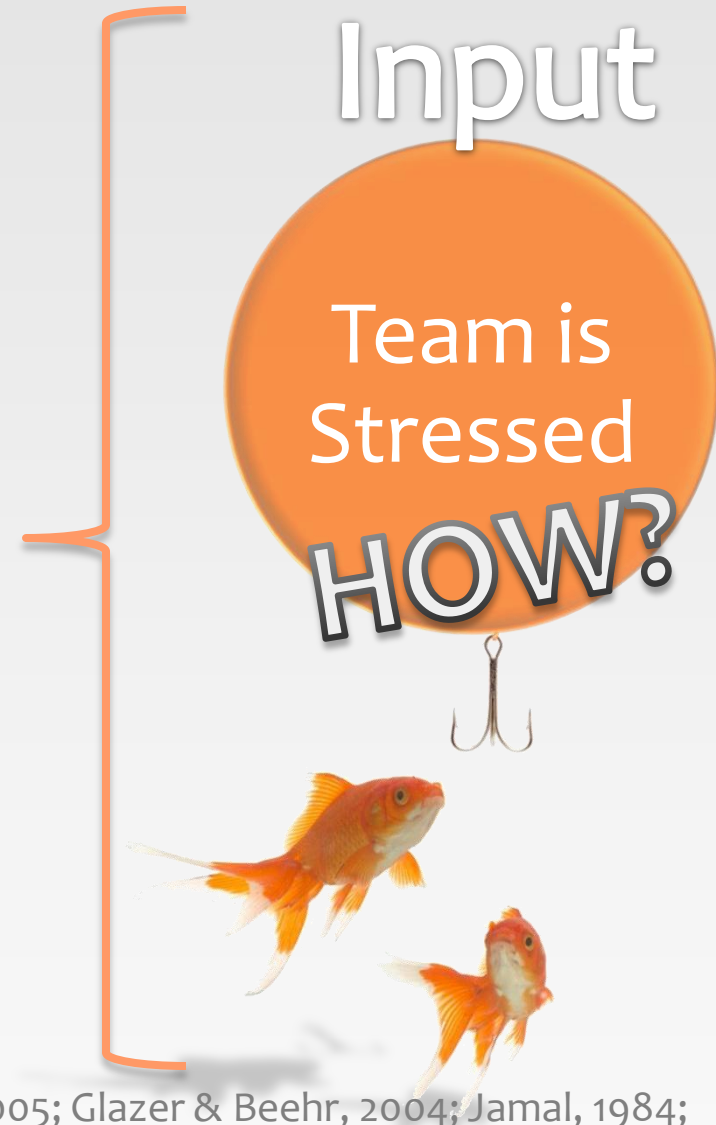## Input

Team is Stressed

+

Process

Teamwork Process Effects

=

Output

Enhances *OR* Limits Teams???

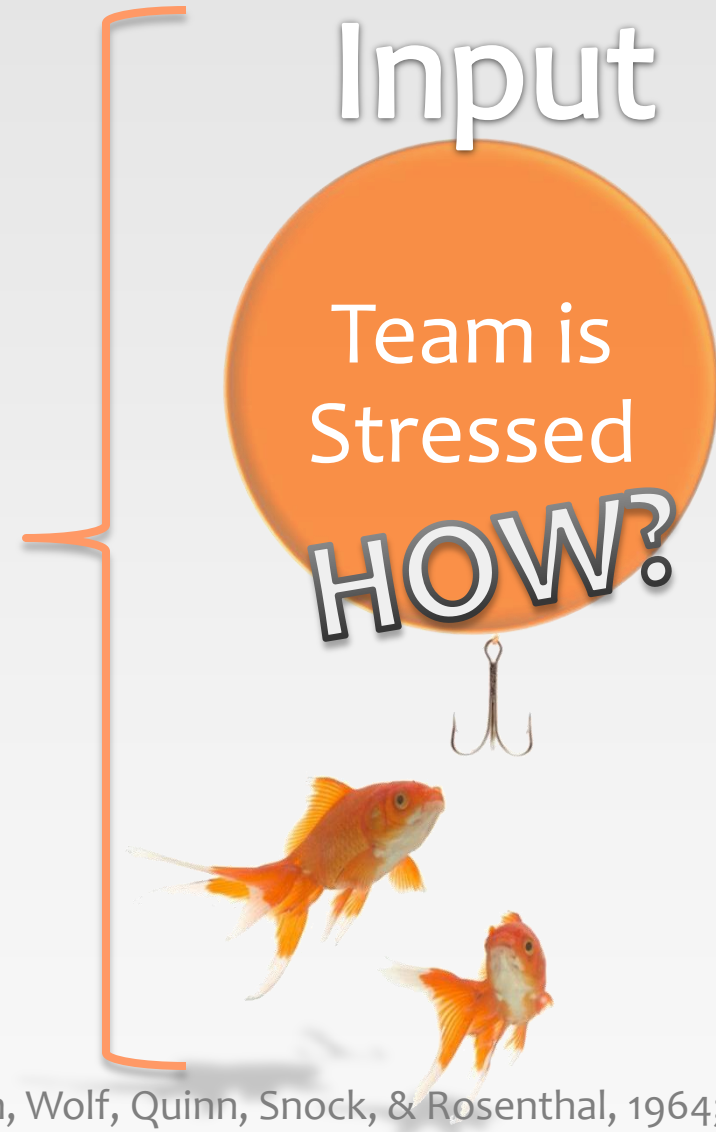Hobfoll, 2001; Gump & Kulik, 1997; Drach-Zahavy & Fruend, 2007

Past Literature: Individual Stress

- Early INDIVIDUAL stress studies & models distinguished between two types of stress (qualitative & quantitative) but found no meaningful differences

- Categorization of stressors may be the missing piece in teams research

Input

Team is Stressed

HOW?

Matteson & Ivancevich, 1990; Siegrist, 1996; Glazer & Behr, 2005; Glazer & Beehr, 2004; Jamal, 1984; Jordan, 1990

# Definition: Qualitative Stress

- Conditions that consist of highly complex tasks, non-routine jobs, or performance standards which are too high

- Role Episode Model: Role Ambiguity

- Pooled resources allow the team to meet these demands

Input

Team is Stressed

HOW?

Caplan et al., 1975; Siegrist, 1996; Newton & Keenan, 1996; Kahn, Wolf, Quinn, Snock, & Rosenthal, 1964; Drach-Zahavy et al., 2004; Boone et al., 2004
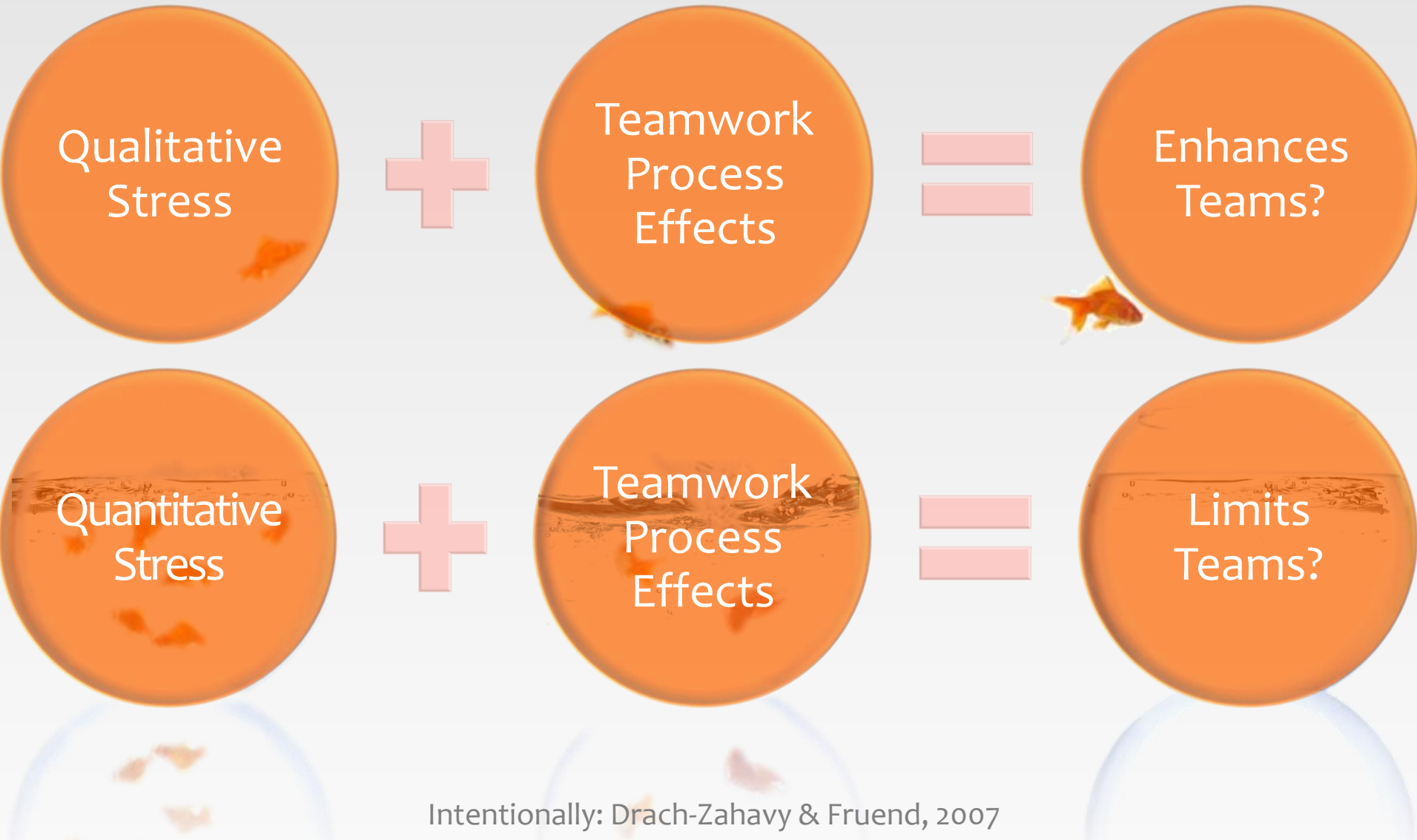
Definition: Quantitative Stress

- Conditions that consist of accumulating demands, time pressures, and overload

- Role Episode Model: Role Overload

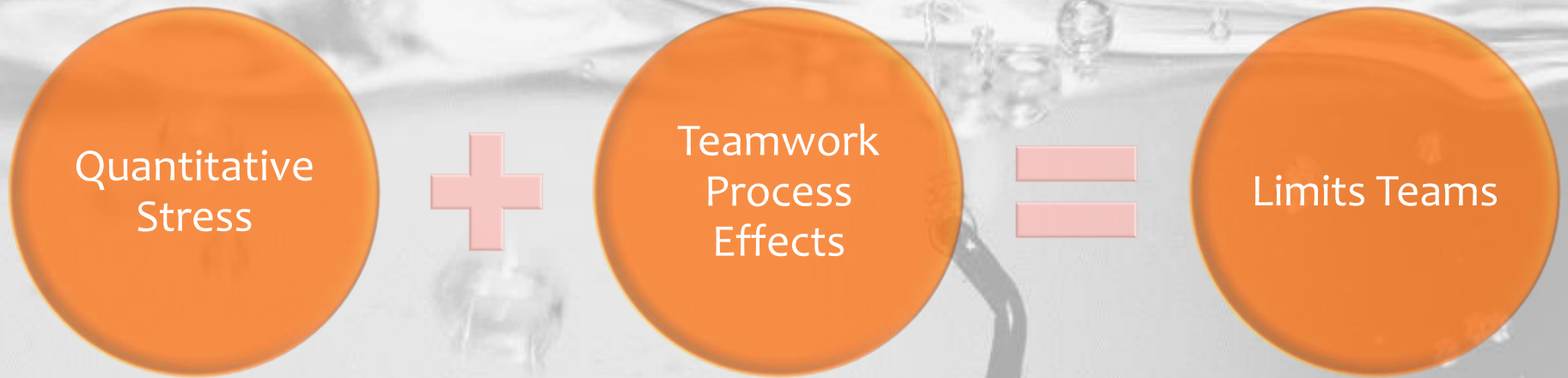- Attentional Focus Model: Stressed teams restrict attention
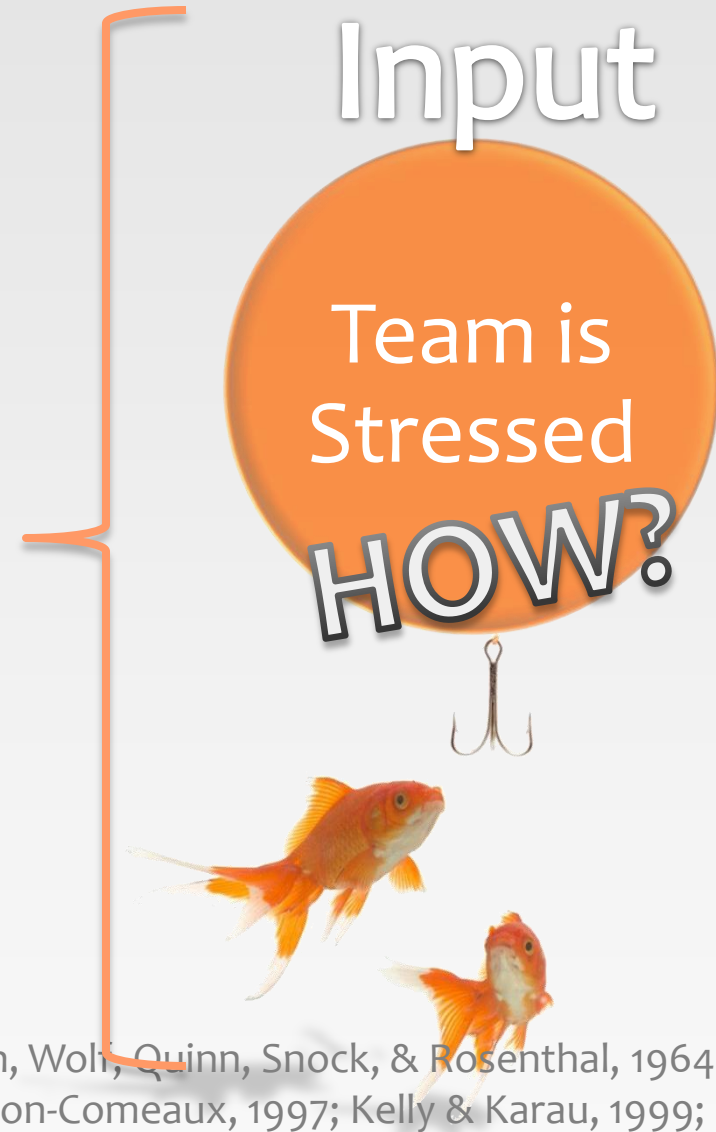
Input

Team is Stressed

HOW?

Caplan et al., 1975; Siegrist, 1996; Newton & Keenan, 1996; Kahn, Wolf, Quinn, Snock, & Rosenthal, 1964; Karau & Kelly, 1992; Karau & Kelly, 1992; Kelly, Jackson, & Hutson-Comeaux, 1997; Kelly & Karau, 1999; Parks & Cowlin, 1995

Team Stress Type Effects?

Qualitative Stress **+** Teamwork Process Effects **=** Enhances Teams?

Quantitative Stress **+** Teamwork Process Effects **=** Limits Teams?

Intentionally: Drach-Zahavy & Fruend, 2007

Study Overview

Quantitative Stress + Teamwork Process Effects = Limits Teams

Meta-Analysis

- Is there really a quantitative stress effect on team performance?

Process Analysis

- Which team processes are disrupted by quantitative stress?
  (leading to lower performance)

Team Effectiveness & Quantitative Stress
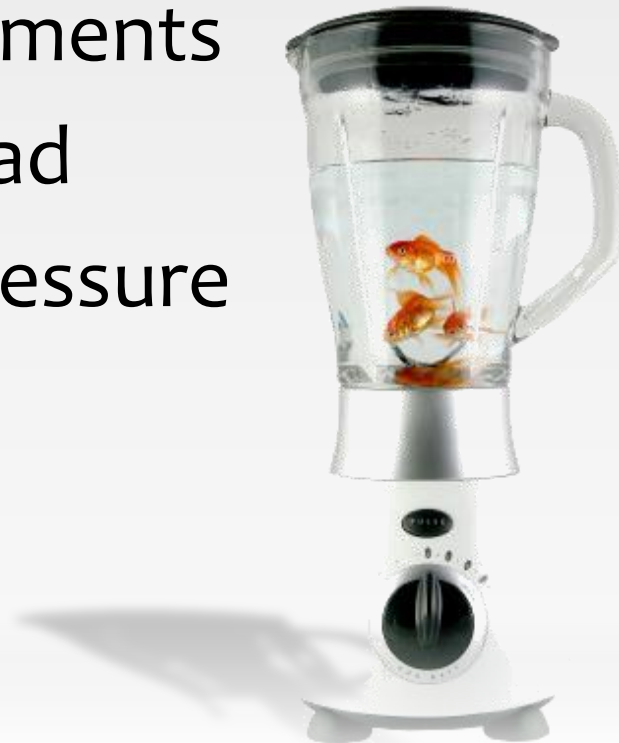# Study 1: Meta-Analysis

Method: Independent Variable Measures

Extensive search process has identified that most studies on teams and stress used quantitative stress

- Acute stress
- Low and high stress environments
- Workload
- Time Pressure
- Threat

- Battle Stress
- Strain (Acute Cognitive, Emotional, & Physical)
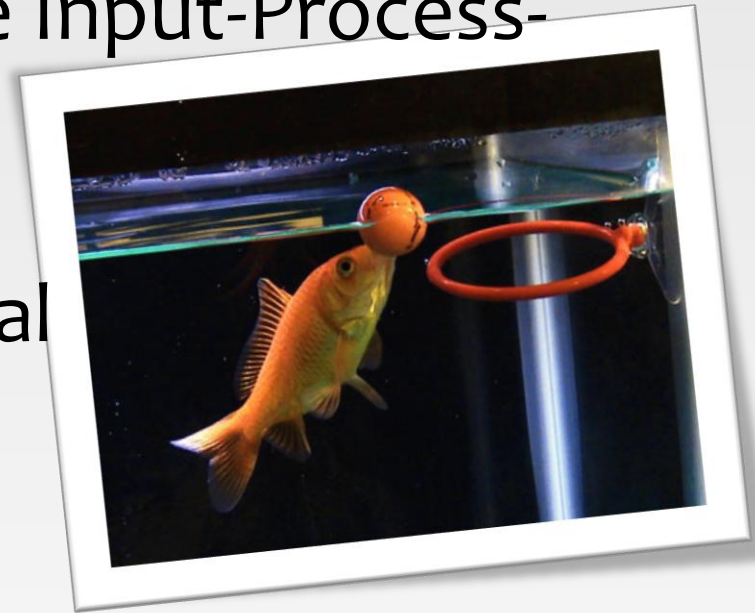- Perceived Stress & Stress Appraisals

Method: Dependent Variable

Team Performance or Effectiveness

- Performance = results of the Input-Process-Output model

- Effectiveness adds situational

  components into I-P-O

- Guzzo & Dickson (1996) –review of team literature use the term 'performance effectiveness' due to definitional issues

Method: Meta-Analysis Procedures

- Random effects model
  - assumes possibility of moderators
- Hunter & Schmidt v.1.1 (Schmidt & Le, 2005)

- Corrections:
  - Sampling error
  - Insufficient information available for study-level corrections
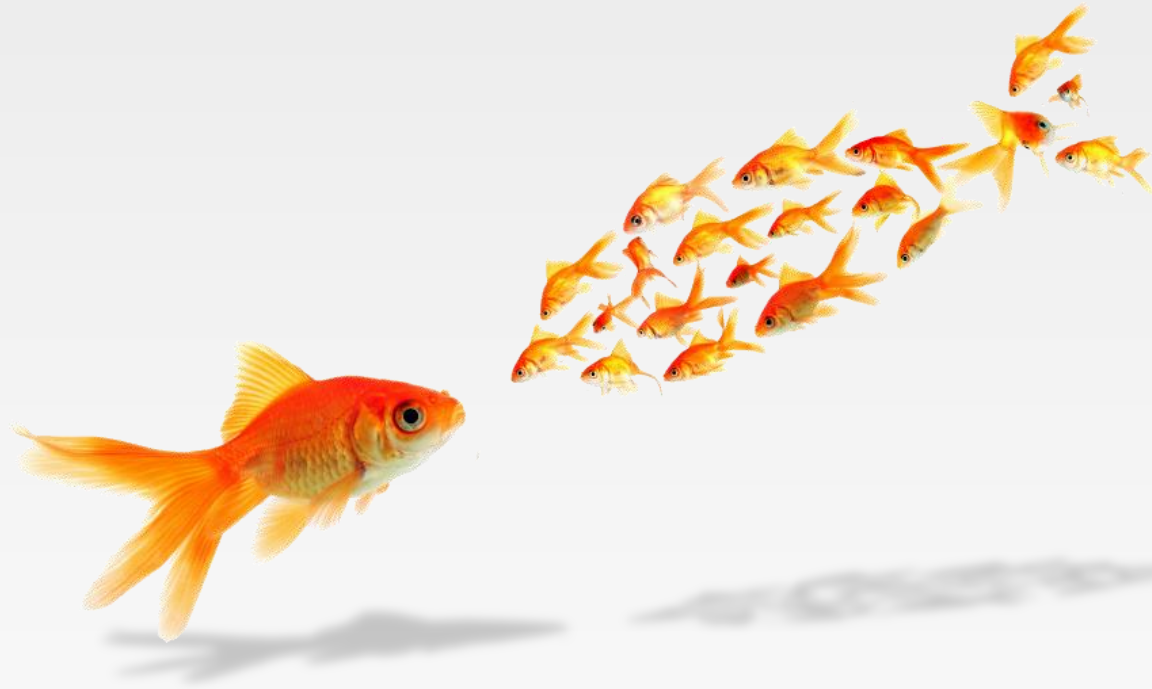 - Some reliability information available

Results: Quantitative Stress & Performance

Question 1: True effect size?

mean r_{obs} = -.366

$\hat{\rho}$ = -.438

N	1914
k	10
r_{obs}	-.366
SD_{obs}	.136
$\hat{\rho}$	-.438
$SD\rho$	.076
80% credibility interval	-.547 to -.329

Results: Quantitative Stress & Performance

Question 2: Any moderators?

% of observed variance due to artifacts

with Minionis (1995) **= 47%**
w/o Minionis (1995) **= 100%**

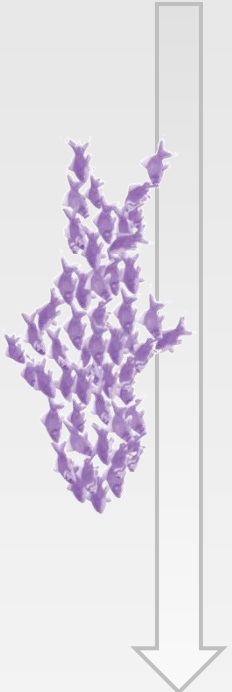|	
N	1794
k	9
r_{obs}	-.343
SD_{obs}	.096
$\hat{\rho}$	-.410
$SD\rho$	.000
80% credibility interval	-.410 to -.410

Stressed Teams: Processes & Performance
Study 2: Process Analysis

Effective Team Processes
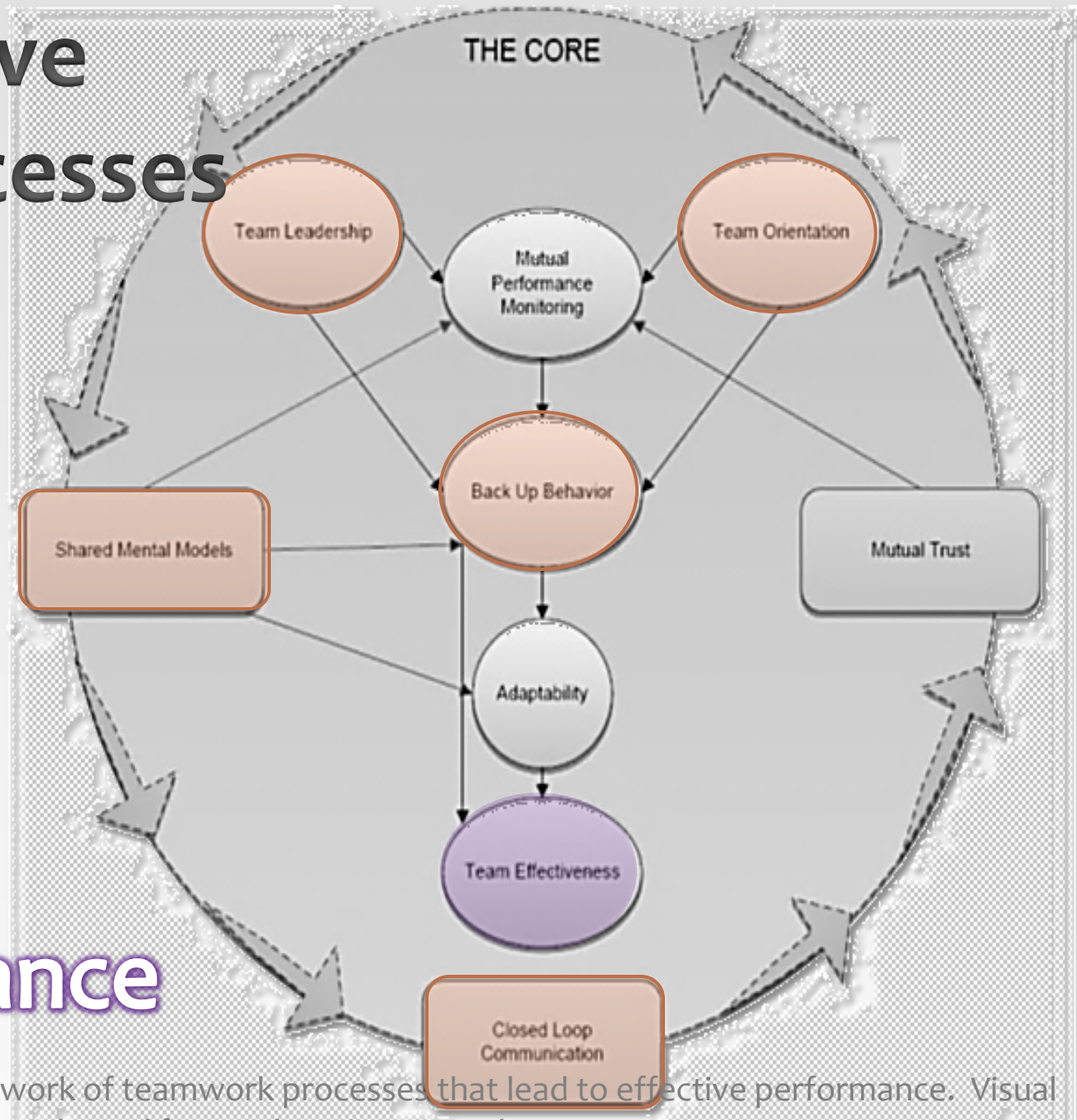
High Performance

Figure 1: Theoretical framework of teamwork processes that lead to effective performance. Visual adapted from Salas, Sims, & Burke, 2005.

Method: Participants

- 26 Undergraduate Teams
   - N = 52
    - Teams of 2
    - English-speaking

- Based on Power Analysis (22 team min.)

Method: Design

- Teamwork Process Variables: (Questionnaire)
  - Team Orientation
  - Team Leadership
  - Backup Behaviors (←Mutual Performance Monitoring ←Mutual Trust)
  - Shared Mental Models
  - Closed-Loop Communication

- Process Control Simulator
  - Stress Manipulation (High vs. Low)
    - Check: NASA TL-X Questionnaire
  - Performance (Error)
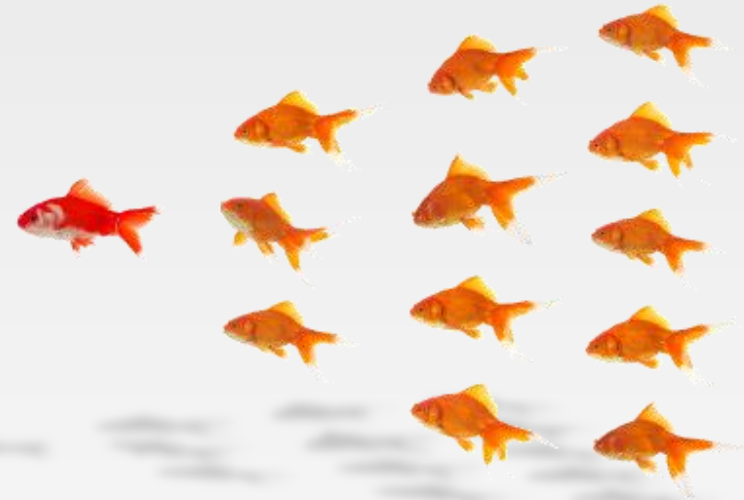
Method: Procedure

- Team arrives, fills out informed consent
- Team Orientation measure (<5 min)
- Brief orientation (1 min), tutorial (5 min), and practice session (5 min)
- Team undergoes one trial: low or high stress (10 min)
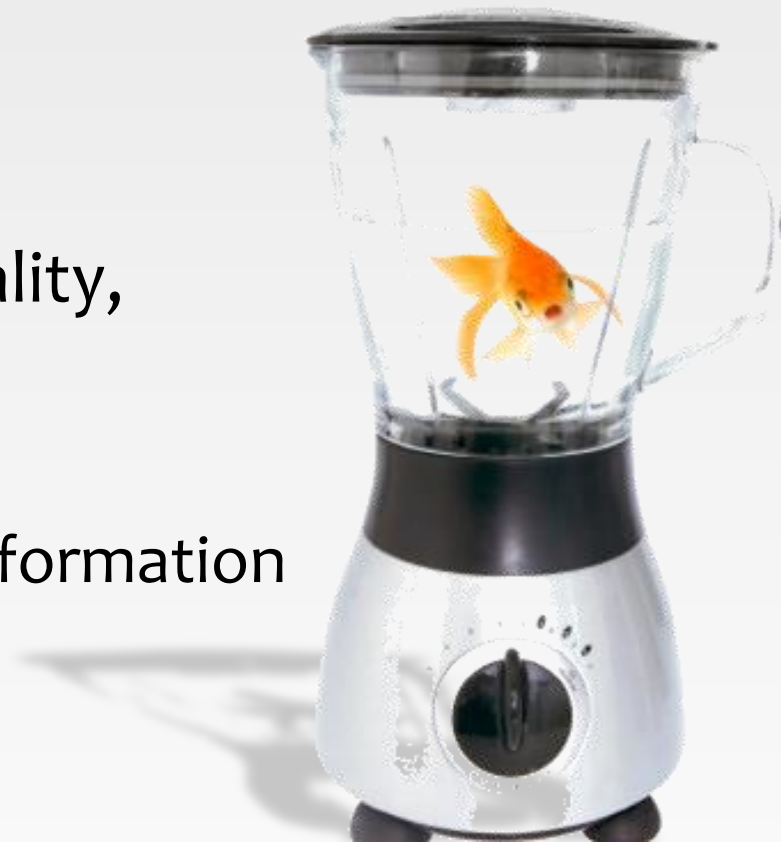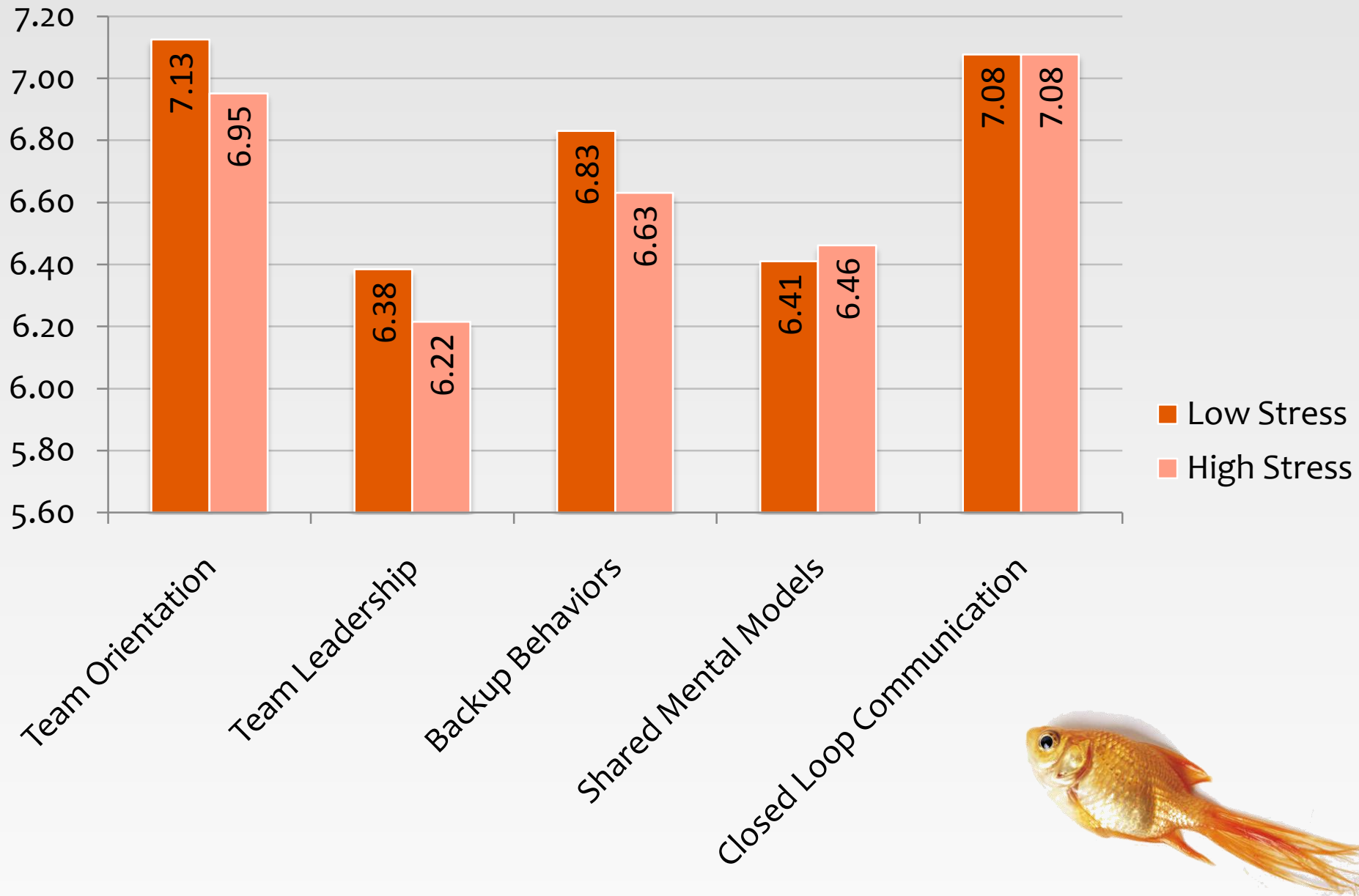- NASA-TLX and MTFQ (<15 min)
- Debrief
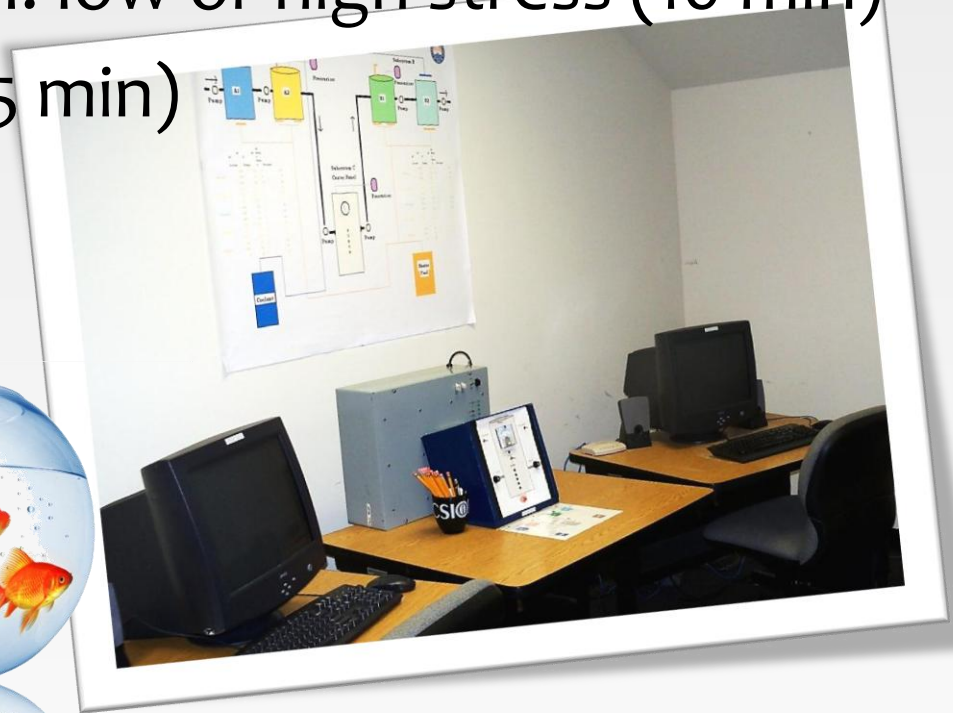
Data Preparation

- Error scores from simulation → z-scores
  → Performance Composites
  - Team Performance: All z-scores of Operator A, B, & Center averaged

- Regression Preparation: Normality, Linearity, Homoscedasticity, & Multicollinearity
  - Met assumptions without transformation

Initial Analyses: Means

Initial Analyses: Means

High Error = Low Performance

Bar chart. Y-axis ranges from -4 to 4. "Low Stress" bar = -3.62. "High Stress" bar = 2.95. Legend: Team Performance (Error).

Initial Analyses: Regression (w/o stress)

$$R^2 = .09$$

Variable	β
Team Orientation	-.11
Team Leadership	-.18
Backup Behaviors	.05
Shared Mental Model	.17
Closed Loop Communication	-.31

Initial Analyses: Regression (w/ stress)

$$R^2 = .75$$

Variable	β
Stress Condition	.839
Team Orientation	-.03
Team Leadership	-.06
Backup Behaviors	.20
Shared Mental Model	-.04
Closed Loop Communication	-.25

Study Results: Summary

- Meta-Analysis: Quantitative Stress negatively affects team performance

- Lab Study: No specific evidence of disruptions to the team processes we measured

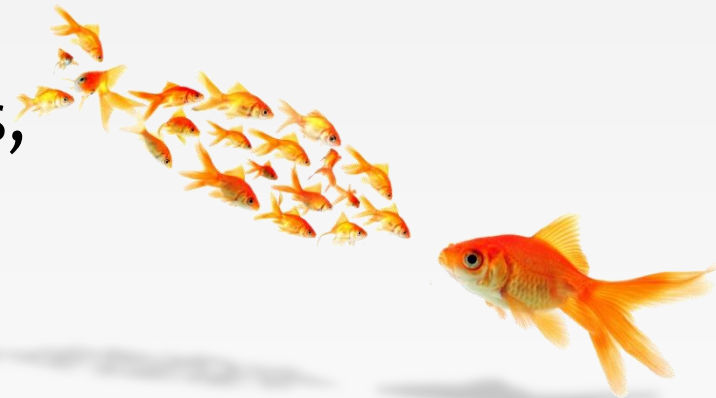before we focus on that, let's explore the data

Exploratory Analysis: Team Composition

Condition	Shared Mental Models					Mutual Trust				
	M	SD	t	df	Sig.	M	SD	t	df	Sig.
Prior Relationship (N = 17)	6.96	.84	-2.25	24	.032	8.81	1.07	-2.71	24	.012
Just Met (N = 9)	6.16	1.30	-2.34	16.16		7.59	1.12	-2.74	16.16	

- Consistent with Team Process Model
  (Salas, Sims, & Burke, 2005)
- Did not have performance effects, $t(24) = .119, p = .399$

Exploratory Analyses: Team Processes, Performance and Coordination.

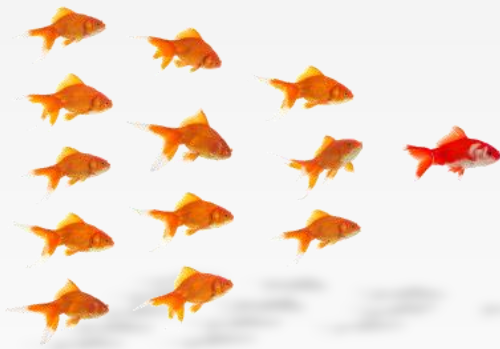| Team Orientation | $r = .59$ | Observed Team Coordination |

| Closed Loop Communication | $r = .59$ | Center Panel Error |

| Mutual Trust | $r = -.56$ | Team Performance |

Low Stress

Exploratory Analyses: Individual Perceptions of Performance & Contributions.

Low Stress

Observed Team Coordination $r = -.80$ B: Other Responsible

High Stress

Team Performance $r = -.59$ A: Other Responsible

Observed Team Coordination $r = -.61$ B: Other Responsible

Full Results: Summary

- Meta-Analysis: Quantitative Stress negatively affects team performance

- Lab Study: No specific evidence of disruptions to the team processes we measured, but more support for negative quantitative stress effects
  - Task required teamwork and stress was manipulated
  - Operator A more aware of team processes
  - Operator B more aware of team performance
  - In high stress – responsibility became a factor

Let's discuss…

Discussion

- Meta-Analysis: When categorized, quantitative stress has consistent effects

- Process Analysis:

  - Supports Meta-Analysis

  - When teams are quantitatively stressed, self-report measures do not capture team processes

  - Team members are aware of their workload but unaware of the effects on their teamwork

Discussion: Attentional Focus Model

- Team stress acts through team cognition so when teams experience quantitative stress…

  - Less Interpersonal Communication & Less Team Coordination
  - Team focus shifts to individual focus
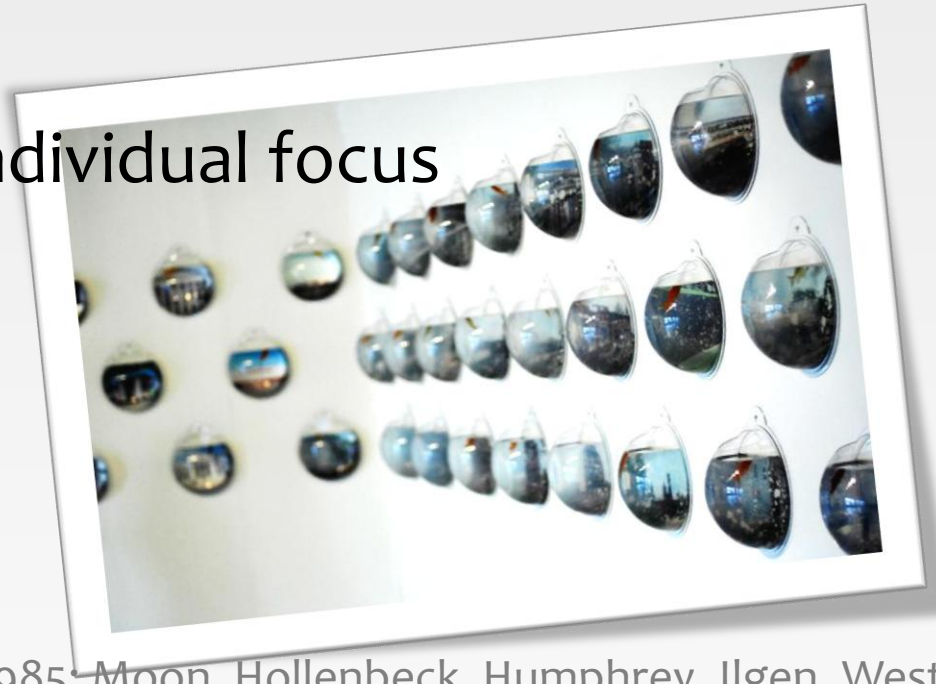
(Cogen & Bailey, 1997; E.G. Kelly & Mcgrath, 1985; Moon, Hollenbeck, Humphrey, Ilgen, West, Ellis, Et Al., 2004; Driskell, Salas, & Johnston, 1999)

Discussion: Attentional Focus Model

- Team stress acts through team cognition so when teams experience quantitative stress...

    - Study 2: Team members may be so unaware of this shift they cannot report on their teamwork processes accurately

(Cogen & Bailey, 1997; E.G. Kelly & Mcgrath, 1985; Moon, Hollenbeck, Humphrey, Ilgen, West, Ellis, Et Al., 2004; Driskell, Salas, & Johnston, 1999)

Discussion: Limitations

- Study 1: Limited Meta-Analysis

- Study 2:
    - Lab Study
    - Real-time Task
    - Dyads
    - Homogenous Sample
    - Self-report Team Processes

Discussion: Future Research

- Categorization of team stress needs to be standard

  - Requalification of past team stress work would allow further meta-analysis

Qualitative

Quantitative

Discussion: Future Research

- Team process measurement should move past self-report

  - Especially where cognitive load is a potential factor

  - E.g. physiological measures, communication count or coding, etc.

Questions?

Comments?

Feedback?

Discussion: Job Demands-Resources Model