



"Challenge"! The Psycho- Neurophysiology of "Flow"

(or how we mapped motivational states onto the heart, literally)

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“Threat"! The Psycho- Neurophysiology of Stress

(or how we mapped motivational states onto the heart, literally)

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- Raise your hands if you believe your heart rate increases when you are performing a non-physical but stressful task.
- Raise your hands if you believe your heart rate does not increase when you are performing a non-physical/non-stressful task.







Heart Rate and Competitive Decision Making

Jim Blascovich¹, Richard F. Nash
Marquette University

Gerald P. Ginsburg
University of Nevada, Reno

Volunteers?

		Column Player			
		1	2	3	4
Row Player	1	5 / -5	5 / -5	15 / -15	15 / -15
	2	5 / -5	5 / -5	15 / -15	15 / -15
	3	15 / -15	15 / -15	25 / -25	25 / -25
	4	15 / -15	15 / -15	25 / -25	25 / -25

Zero-sum Game

Heart Rate and Competitive Decision Making

Jim Blascovich¹, Richard F. Nash
Marquette University

Gerald P. Ginsburg
University of Nevada, Reno

Table 1
Cell Means
(Heart Rate in Beats per Min)

	Males
Winners	82.08
Losers	73.86

Were these increases in heart rate pathophysiological?

THE CARDIOLOGISTS WHO HAVE IDENTIFIED
THE #1 CAUSE OF HEART ATTACK
GIVE YOU THE LIFE-SAVING FACTS

Type A

BEHAVIOR AND YOUR HEART

- ▄ HOW TO RECOGNIZE THE TYPE A PATTERN IN YOUR OWN PERSONALITY AND BEHAVIOR
- ▄ HOW AND WHY TYPE A BEHAVIOR LEADS TO HEART DISEASE
- ▄ WHAT YOU CAN DO IF YOU ARE TYPE A

By Meyer Friedman, M.D. & Ray H. Rosenman, M.D.

Type A Behavior Pattern

- Intense Drive; Ambition; Need for Achievement
- Time urgent; competitive; need to control
- Aggressive, Hostile
- Multitasker
- Talks fast, walks fast, finish other's sentences
- Rarely sees doctor; never sees psychiatrist
- Seldom out sick
- Values respect, not liking
- Hates vacations
- Accepts and sticks to difficult goals

How was Type A personality pattern assessed?

- Structured Interview
 - One-on-one
 - Videotaped
 - Scored
- Jenkins Activity Survey
- Physiologically

Reactivity Hypothesis

- Increased cardiovascular reactivity (i.e., changes from baseline) during non-metabolically demanding tasks is pathophysiological.
- Heart rate was the measure of choice
- “Hot reactors” and “Cold reactors”

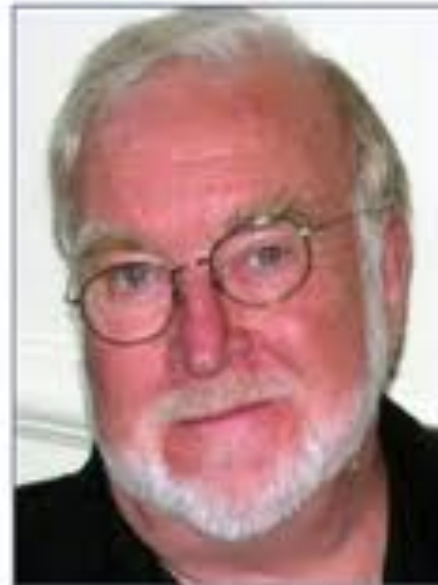
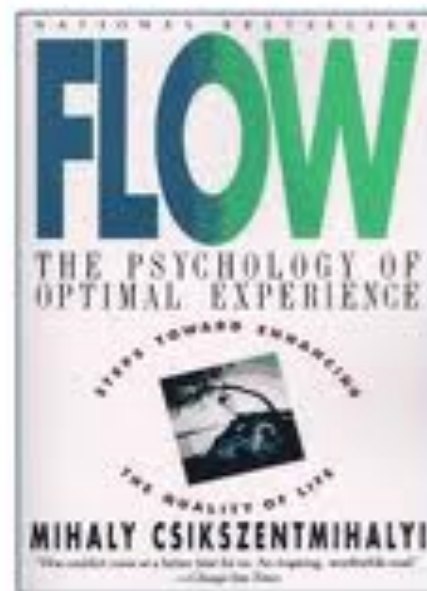
Logical Problem: “Affirmation of the Consequent”

- If A causes B, then B is equivalent to A

–IS A LOGICAL FALLACY!

- There may be other causes of B

Mihaly Csikszentmihalyi



Flow is the mental state of operation in which a person in an activity is fully immersed in a feeling of energized focus, full involvement, and success in the process of the activity.

According to Csíkszentmihályi, flow is completely focused motivation.

“Flow” is to be on the ball, in the moment, present, in the zone, wired in, in the groove, or keeping your head in the game.

Flow

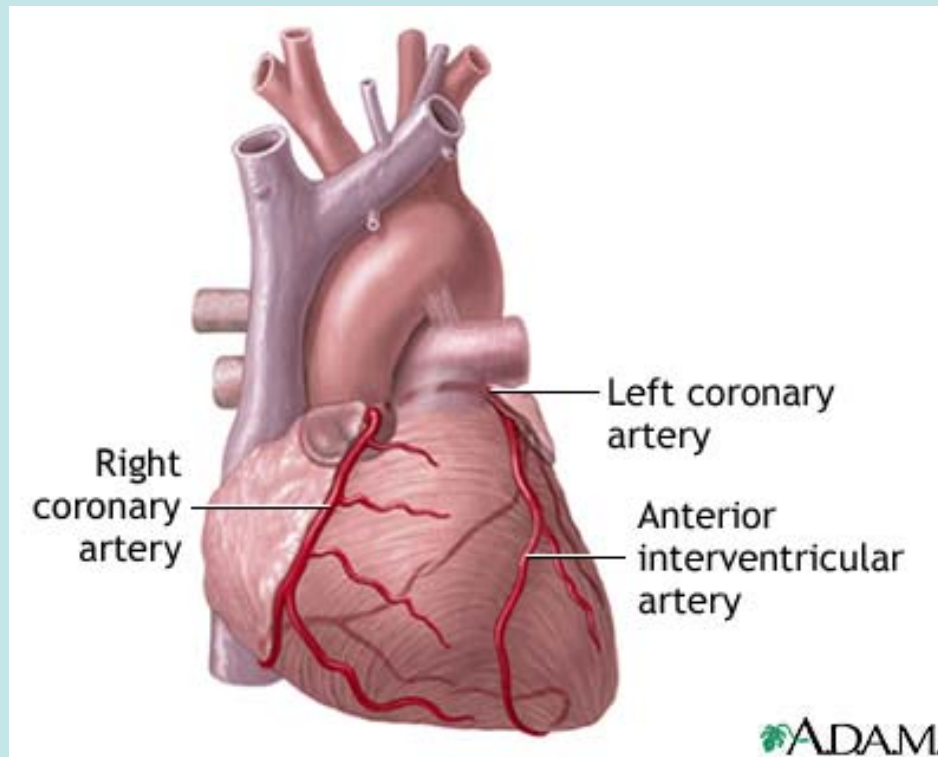
- Clear goals
- Skills/Demands Balance
- Concentration/Limited Field of Concentration; Focus on the Activity Itself
- Loss of Self-consciousness
- Distorted Sense of Time
- Personal Control



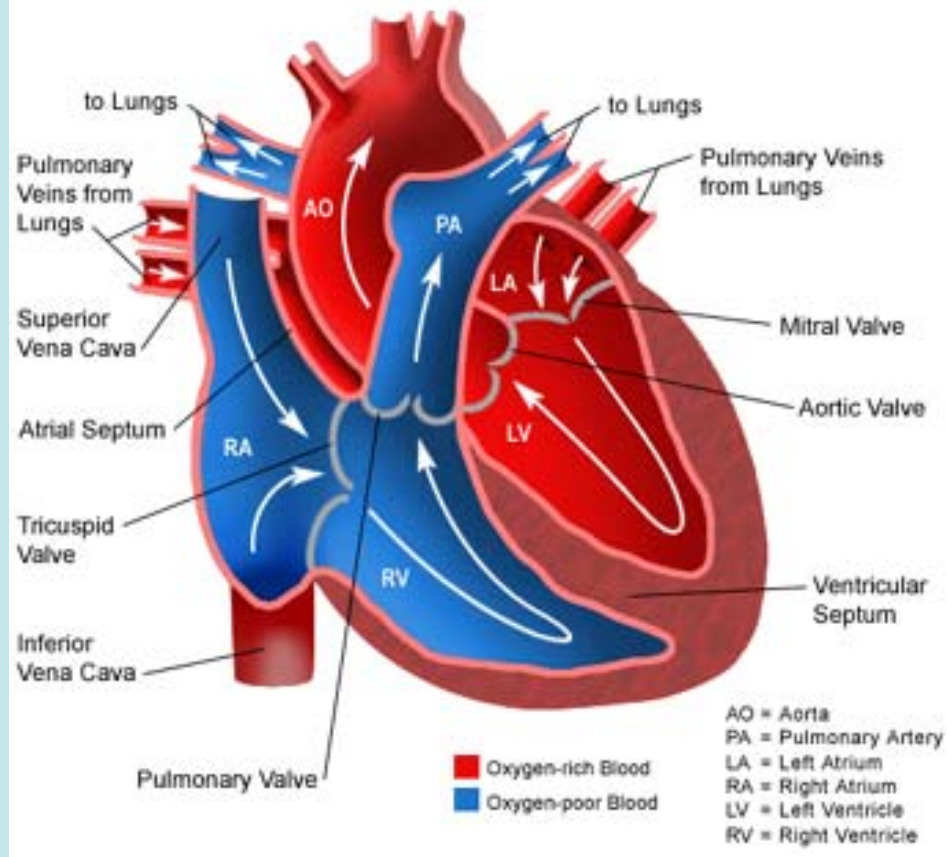
Are “flow” and “Type A” two sides of the same coin physiologically?



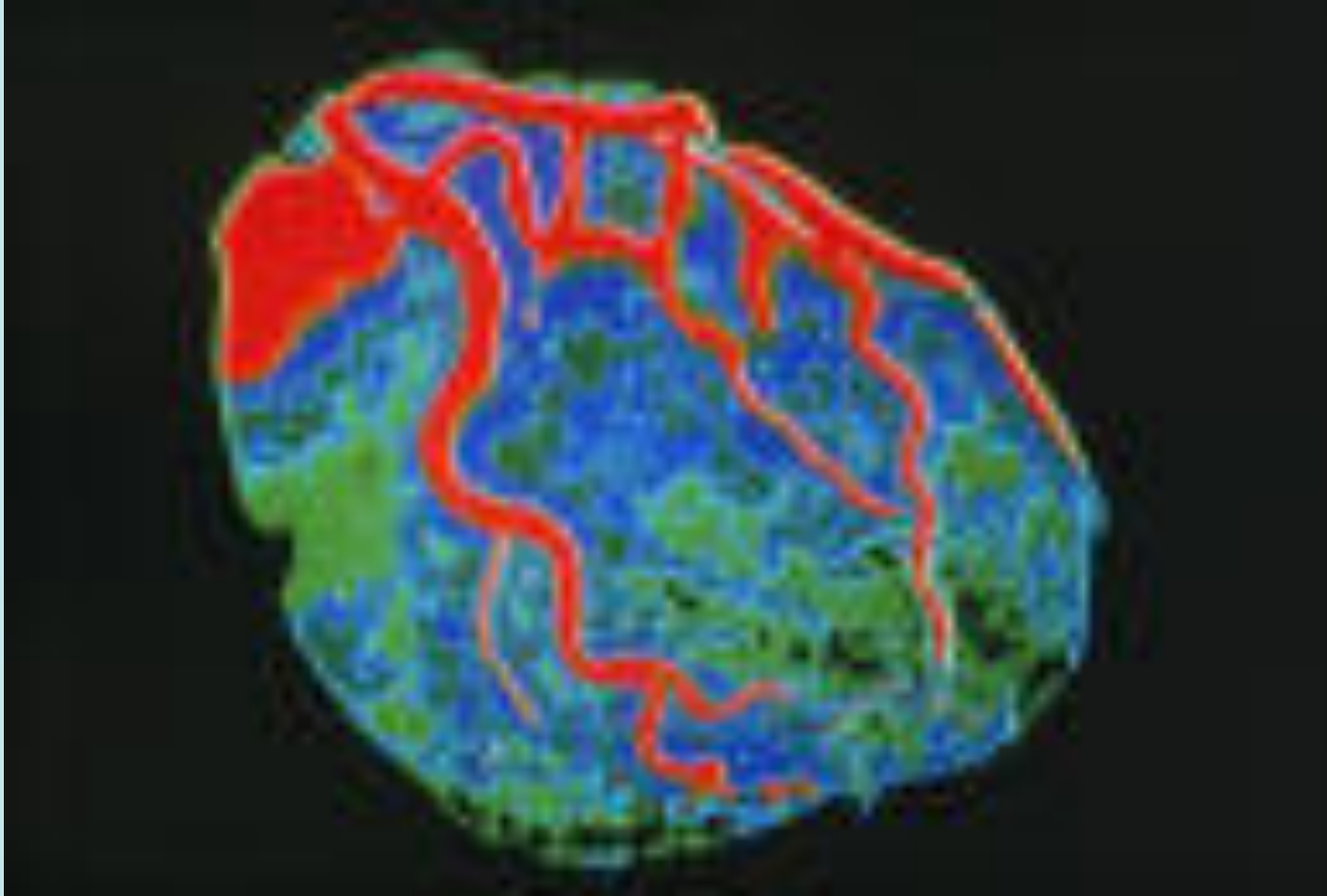
The Cardiovascular System



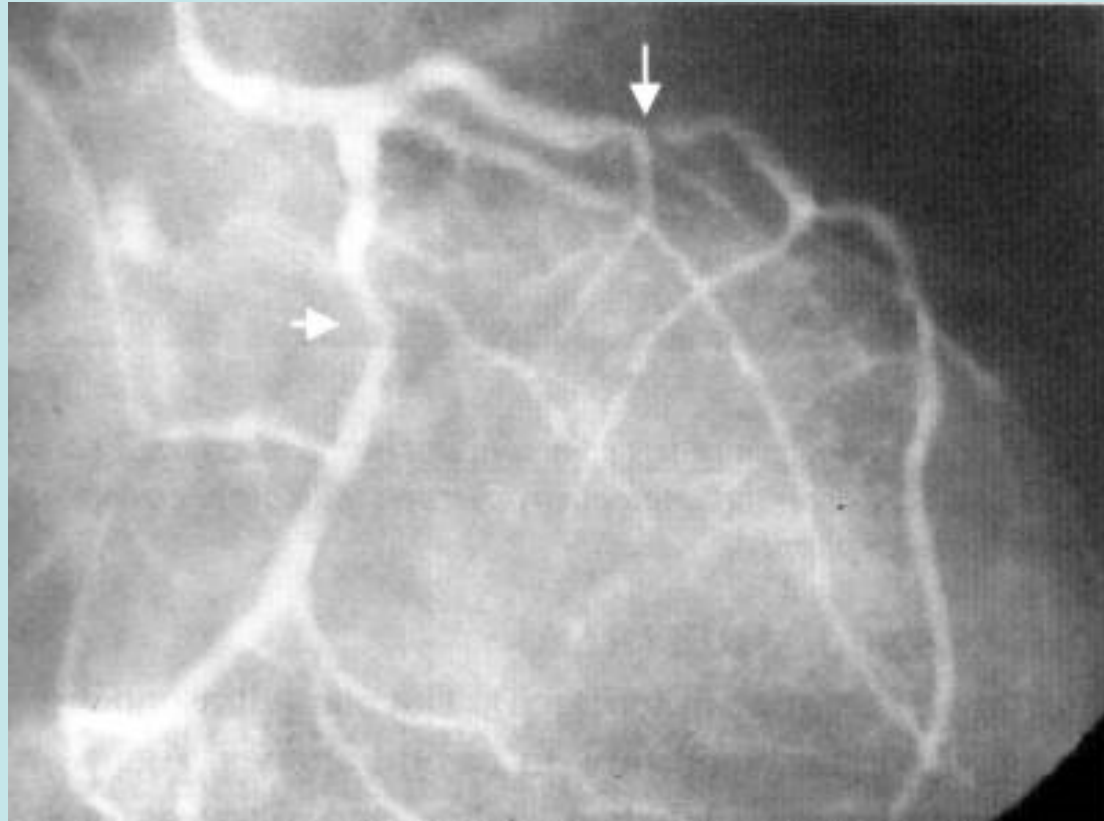
Normal Heart



Coronary Arteries



Coronary Occlusion



What do HR changes tell us about pathophysiology?

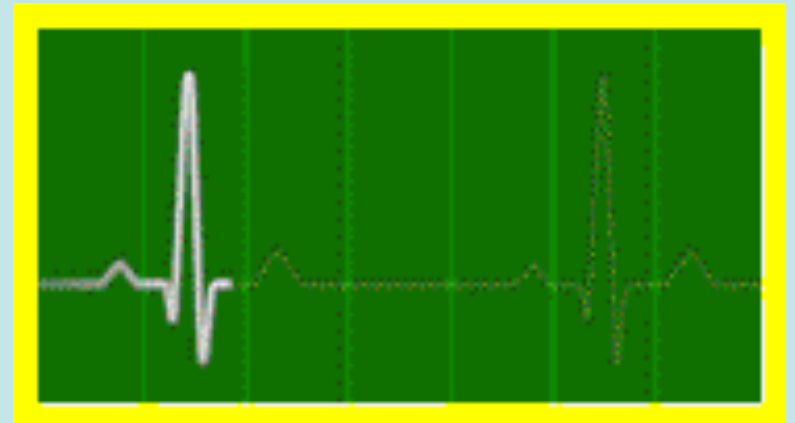
Is there more to the story?

Cardiovascular Measurement

- **Chronotropic**
- **Inotropic**
- **Hemodynamic**

Cardiovascular Measures: Chronotropic

- **Interbeat Interval**
 - (usually expressed in msec)
- **Heart Rate**
 - $60,000/IBI$
- **Systolic Time Intervals**
 - systole vs diastole
 - pre-ejection period (PEP)
 - left ventricular ejection time (LVET)
 - electromechanical systole = (PEP+LVET)

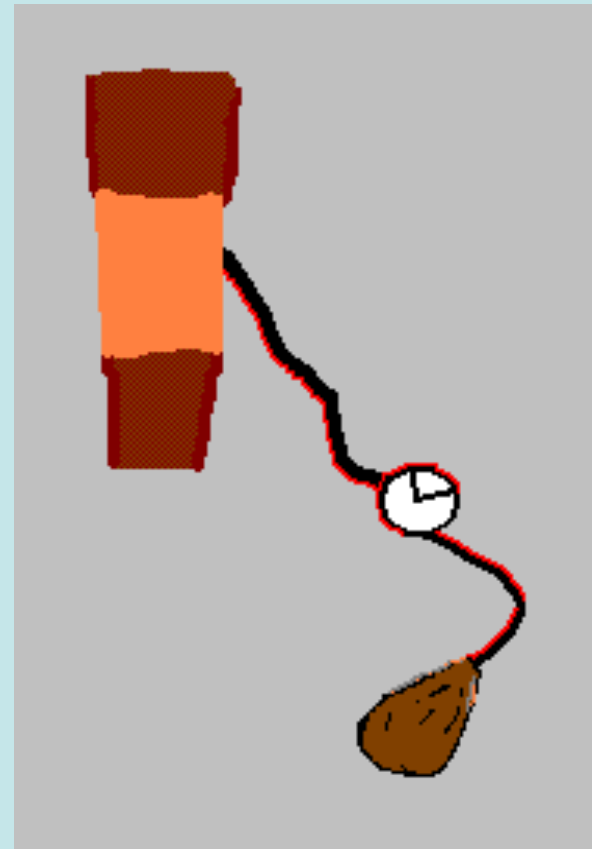


Cardiovascular Measures: Inotropic

- **Contractility**
 - **PEP** ($VC = PEP * (-1)$)
- **Stroke Volume**
 - **SV**
 - **amount of blood ejected by the heart on a beat**
- **Cardiac Output**
 - **HR x SV**

Cardiovascular Measures: Hemodynamic

- **Blood Pressure**
 - systolic (SBP)
 - diastolic (DBP)
 - mean arterial (MAP)
- **Viscosity**
- **Flow (CO) = HR x SV**
- **Resistance TPR = (COxMAP)**



Cardiovascular Measurement: Chronotropic & Inotropic

- **Electrocardiography (ECG or EKG)**
- **Impedance Cardiography (IKG OR ZKG)**

(Dienstbier, 1989)

Physiological Toughness

- neuro-endocrine system
 - sympathetic adrenal medullary (SAM) axis
 - pituitary adrenal cortical (PAC) axis
- states
 - physiological toughness
 - physiological (weakness)

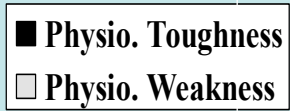
Physiological Toughness

SAM Axis

- Neural Response
 - sympathetic neural stimulation of the myocardium enhancing cardiac performance particularly contractility
- Endocrine Response
 - adrenal medullary release of epinephrine causing vasodilation resulting in a systemic decline in vascular resistance

Physiological Weakness (H)PAC Axis

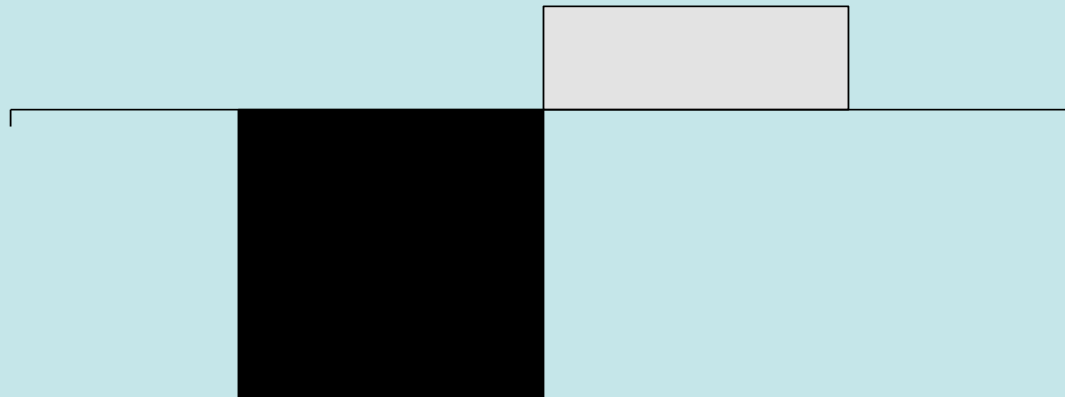
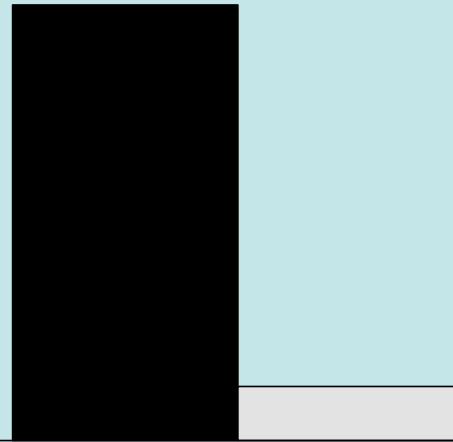
- Neural
 - sympathetic neural stimulation of the myocardium enhancing cardiac performance
- Endocrine
 - pituitary adrenal cortical inhibition of adrenal medullary release of epinephrine and norepinephrine resulting in little change or even increases in systemic vascular resistance



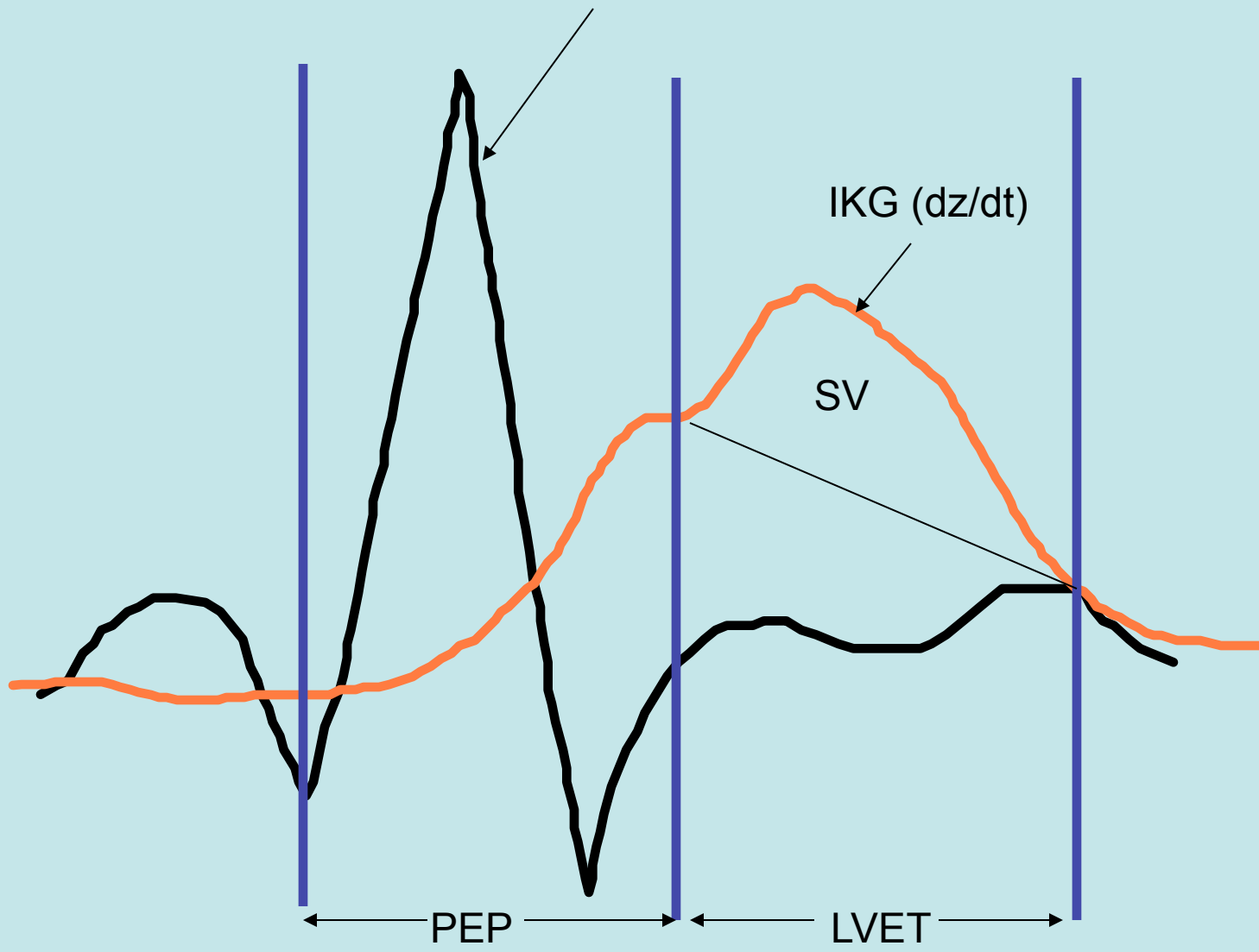
Ventricular Contractility (PEP x -1)

CO

TPR

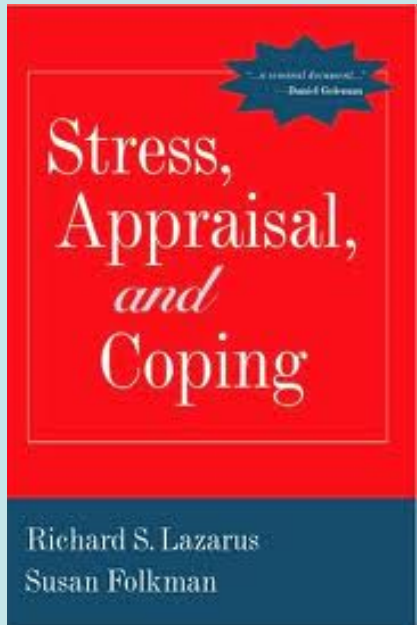


EKG & IKG



Do Dienstbier's patterns map on to any psychological constructs?



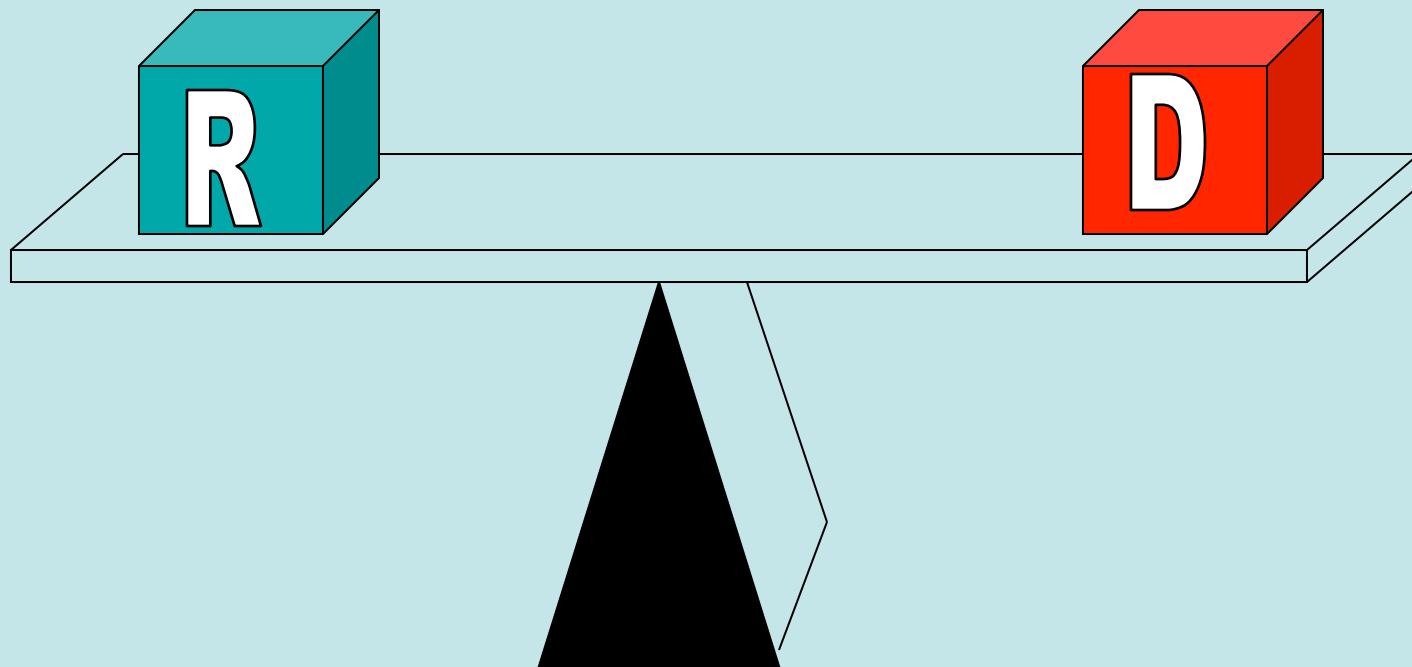


Resource/Demand Appraisals

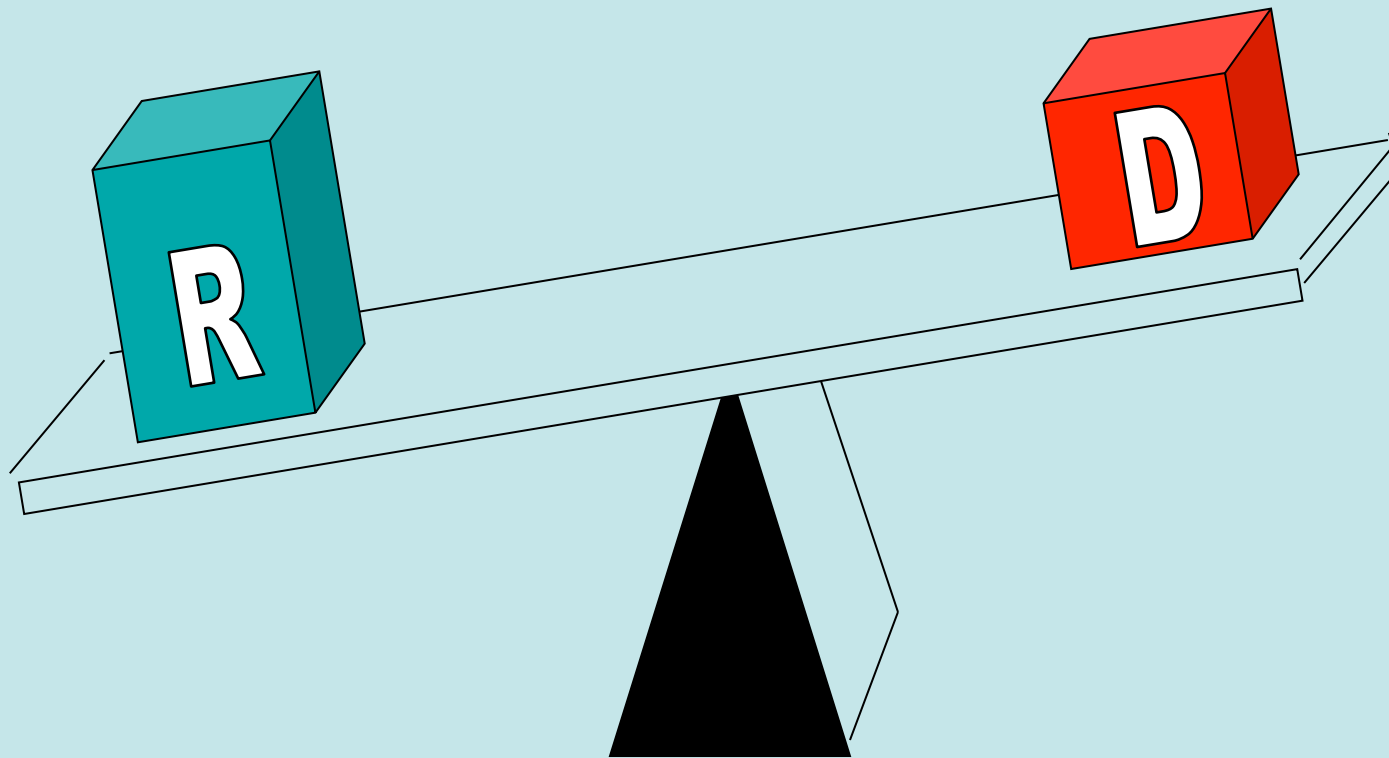
Key Motivational States

- **Challenge**--when resources roughly equal or outweigh demands
- **Threat**--when demands outweigh resources.

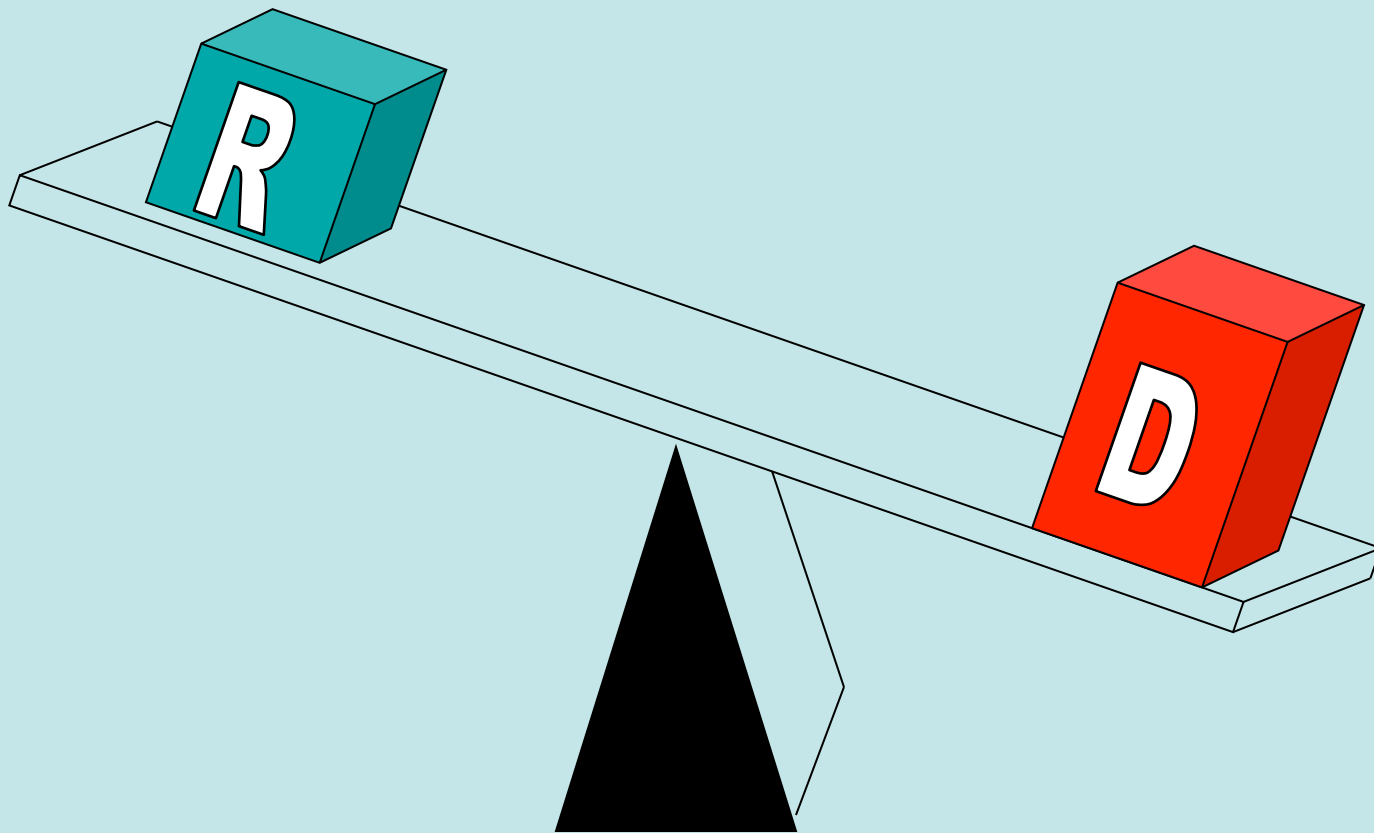
Challenge



Challenge



Threat



Resources and Demands

- Danger
- Uncertainty
- Required Effort
- Skills, Knowledge & Abilities
- Dispositions
- Social Support

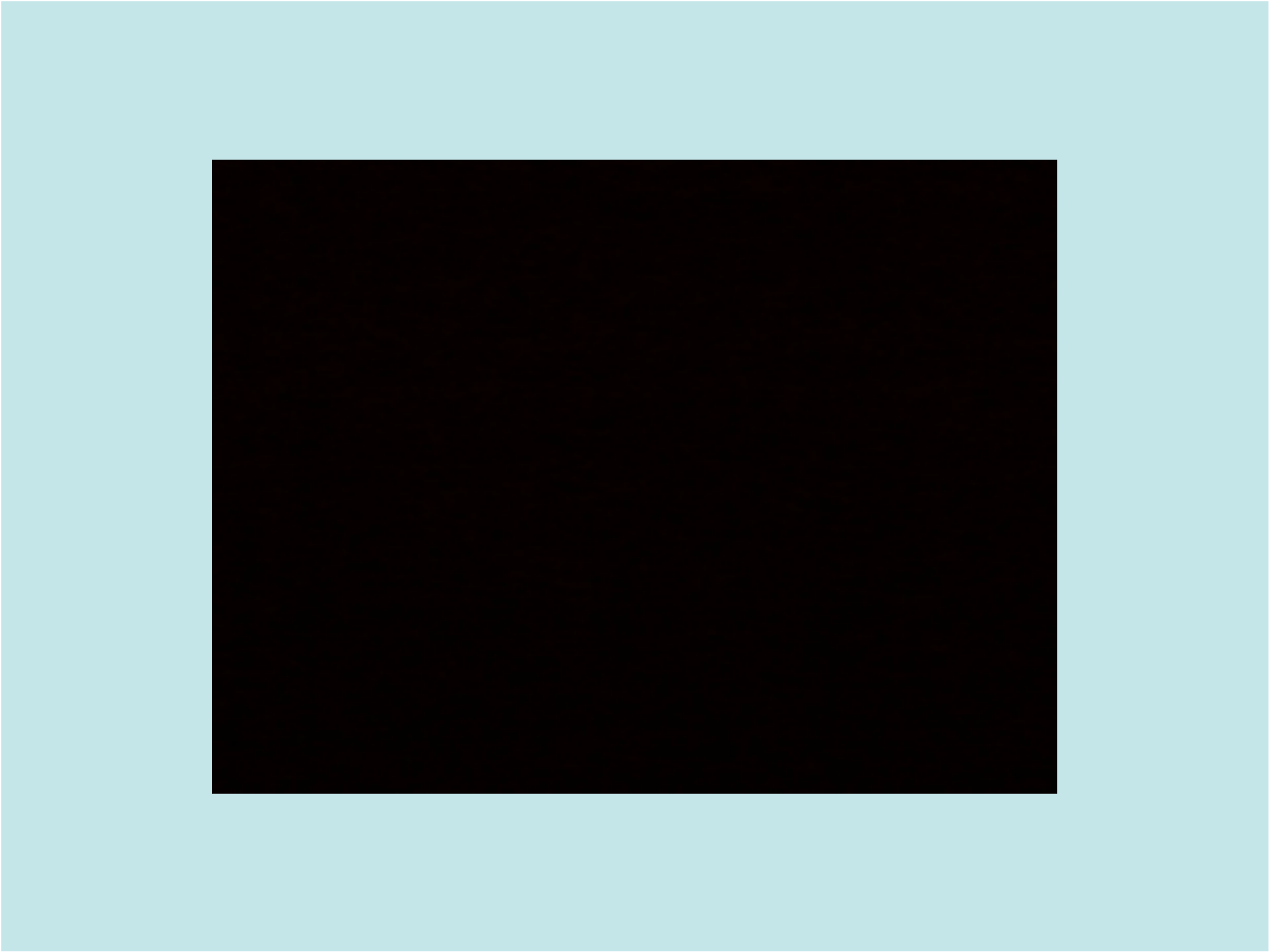
Resources and Demands

- may not be rationally related to any particular task
- but related in a way to multiple tasks

Affective Cues

- Visual
- Embodiments





Thesis

If differences in physiological toughness patterns map on to challenge and threat in performance situations, these patterns could be used to index these psychological states.

Key Motivational States

- **Challenge**--when resources roughly equal or outweigh demands
 - indexed by Dienstbier's pattern of physiological toughness
- **Threat**--when demands outweigh resources.
 - indexed by Dienstbier's pattern of physiological weakness

Validation Studies

- correlational



Motivated Performance Situations

- goal relevant
- require instrumental cognitive responses to “active coping” tasks
- *minimally metabolically demanding*

Examples of Motivated Performance Situations

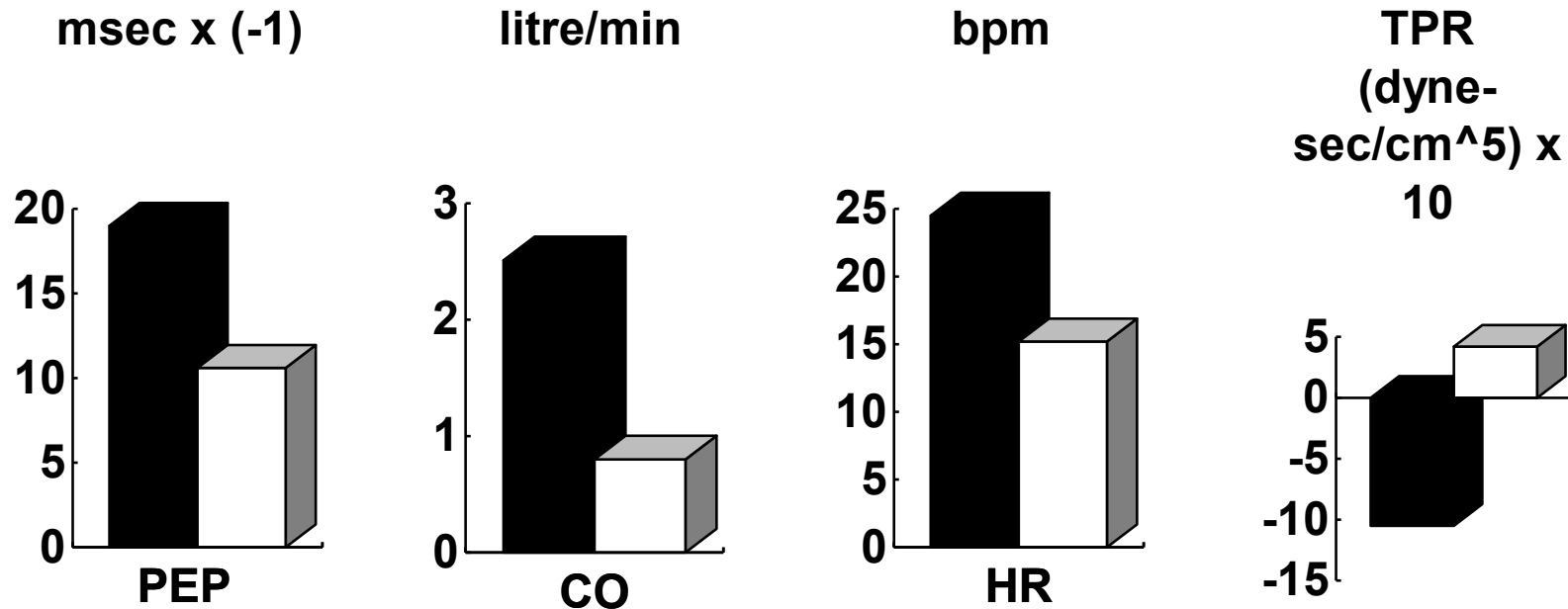
- Taking Exams
- Decision Making
- Giving Speeches
- Playing Games
- Interviews
- Many Social Exchanges
- Problem Solving

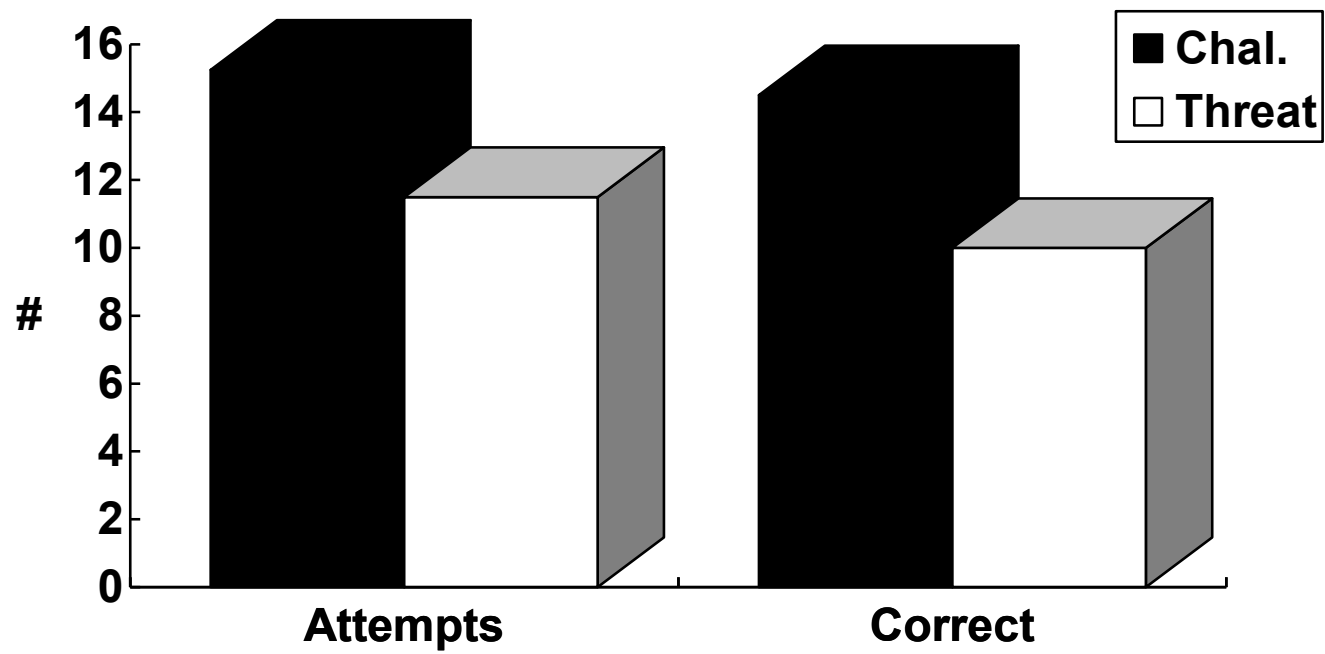
Procedures

- Baseline
- Task Instructions
- Demand and Resource Appraisals
- Task 1 (Serial Subtraction)
- Rest/Baseline
- Demand and Resource Appraisals
- Task 2 (Serial Subtraction)

Subjective, Physiological, and Behavioral Effects of Threat and Challenge Appraisal

Joe Tomaka, Jim Blascovich, Robert M. Kelsey, and Christopher L. Leitten





Attempts

Correct

Validational Studies

- correlational
- experimental

Procedures

- Informed consent
- Sensors applied
- Baseline
- Manipulation
- Vigilance Task

U.S. National Anthem



U.S. National Anthem

THE
STAR SPANGLED BANNER
A PATRIOTIC SONG.

Baltimore. Printed and Sold at CARRS Music Store 36 Baltimore Street.
Air, Anacreon in Heaven.

Con Spirito

O! say can you see by the dawn's early light, What so
proudly we hail'd at the twilight's last gleaming, Whose broad stripes & bright stars thro' the
perilous fight, O'er the ramparts we watch'd, were so gallantly streaming. And the
Rockets' red glare, the Bombs bursting in air, Gave proof through the night that our

(Adap^d & Arr^d by T.C.) (21)

2^d time Chorus.

Flag was still there, O! say does that star spangled Banner yet wave, O'er the
Land of the free, and the home of the brave.

L.H.

On the shore dimly seen through the deep, And where is that land who so vauntingly swore
Where the foe's haughty host in dread silence reposed, That the havoc of war and the battle's confusion,
What is that which the breeze, o'er the towering steep, As it fitfully blows, half conceals, half discloses,
As it fitfully blows, half conceals, half discloses, Now it catches the gleam of the morning's first beam,
Now it catches the gleam of the morning's first beam, No refuge could save the hireling and slave,
In full glory reflected new shines in the stream, 'Tis the star-spangled banner, O! long may it
'Tis the star-spangled banner, O! long may it wave, And the star spangled banner, in triumph doth
O'er the land of the free, and the home of the brave. O'er the Land &c.

(3)

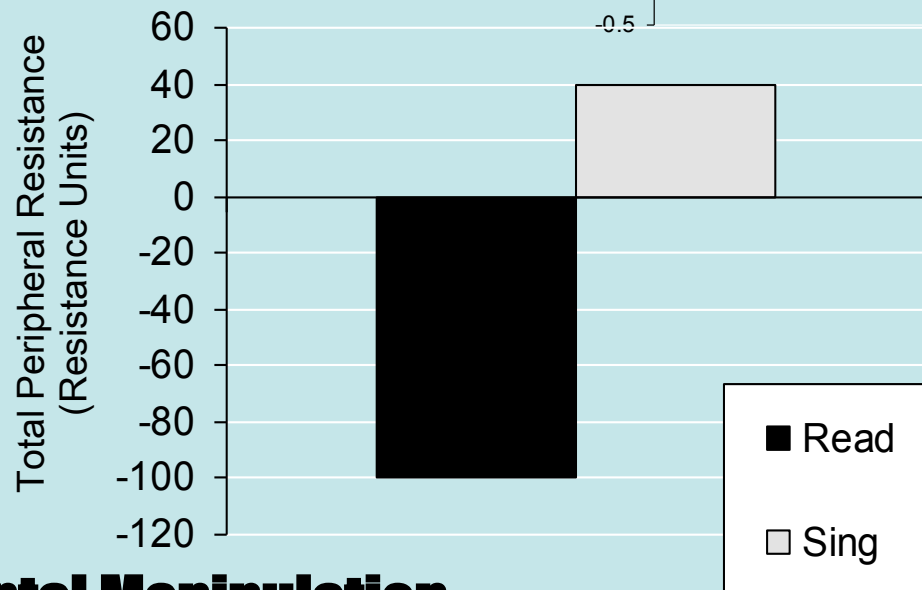
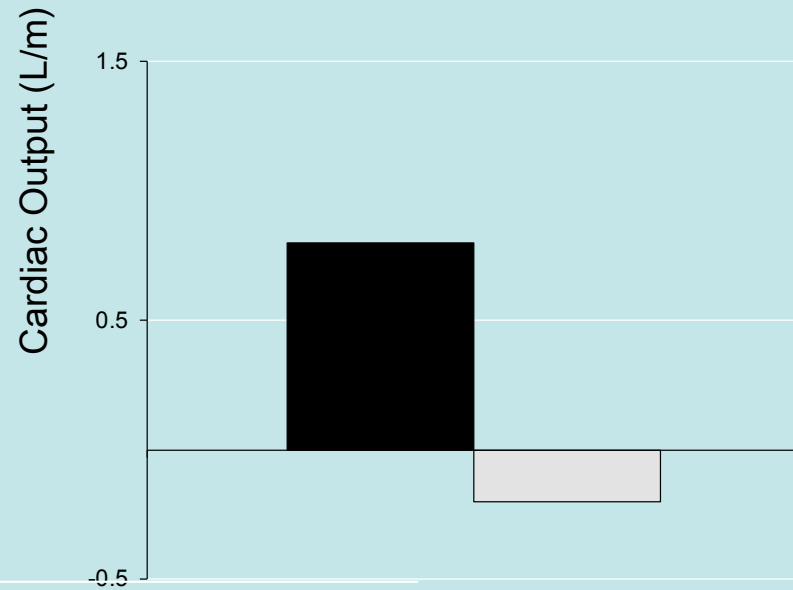
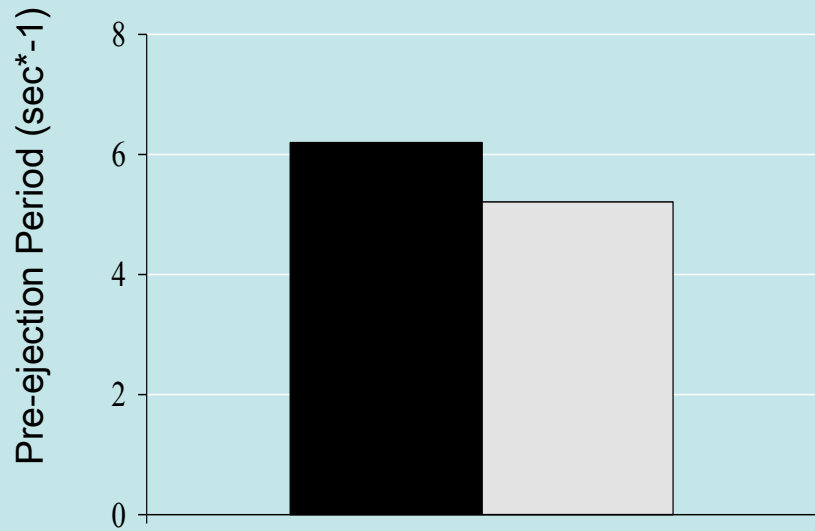
(4)

O! thus be it ever when freemen shall stand,
Between their lov'd home, and the war's desolation,
Blest with vict'ry and peace, may the heav'n rescued land,
Praise the Pow'r that hath made and preserv'd us a nation!
Then conquer we must, when our cause it is just,
And this be our motto—'In God is our Trust';
And the star spangled banner, in triumph shall wave,
O'er the Land &c.

For the Flute.

Con Spirito
Song.

(Adap^d & Arr^d by T. C.) (Pl. 2.)



Experimental Manipulation (Sarah Hunter, 2000)

Validation Studies

- correlational
- experimental
- manipulated physiology

NO EFFECTS

Validational Studies

- correlational
- experimental
- manipulated physiology
- predictive



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Journal of Experimental Social Psychology 40 (2004) 683–688

Journal of
Experimental
Social Psychology

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Predicting athletic performance from cardiovascular indexes of challenge and threat[☆]

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Received 6 June 2003; revised 14 October 2003

Available online 26 February 2004



Predictive Validation Study

- Topic: Performance
- Background
 - Challenge/threat theory
 - baseball
- Method
 - independent variable: Task relevant speech
 - Mediating variable: cardiovascular indexes
 - dependent variable: performance

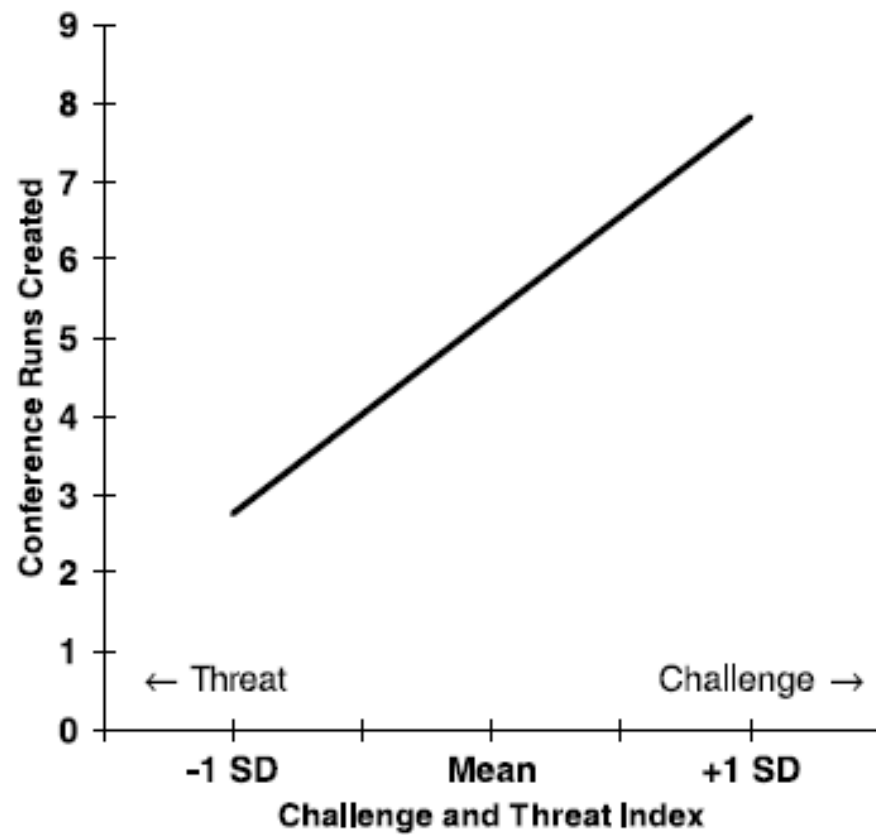


Fig. 1. Challenge and threat reactivity during the sports-related speech as a predictor of subsequent athletic performance, where a higher index value indicates greater relative challenge. One standard deviation represents 1.88 index units.

Validational Studies

- correlational
- experimental
- manipulated physiology
- predictive
- convergent

Motivational Processes Underlying Social Psychological Processes

- Attitudes
- Consciousness
- Dispositions
- Emotional Suppression
- Social Support
- Social Facilitation
- Social Comparison
- Stigma

Dispositions

- Defensive Pessimism



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The effects of negative reflection for defensive pessimists: Dissipation or harnessing of threat?

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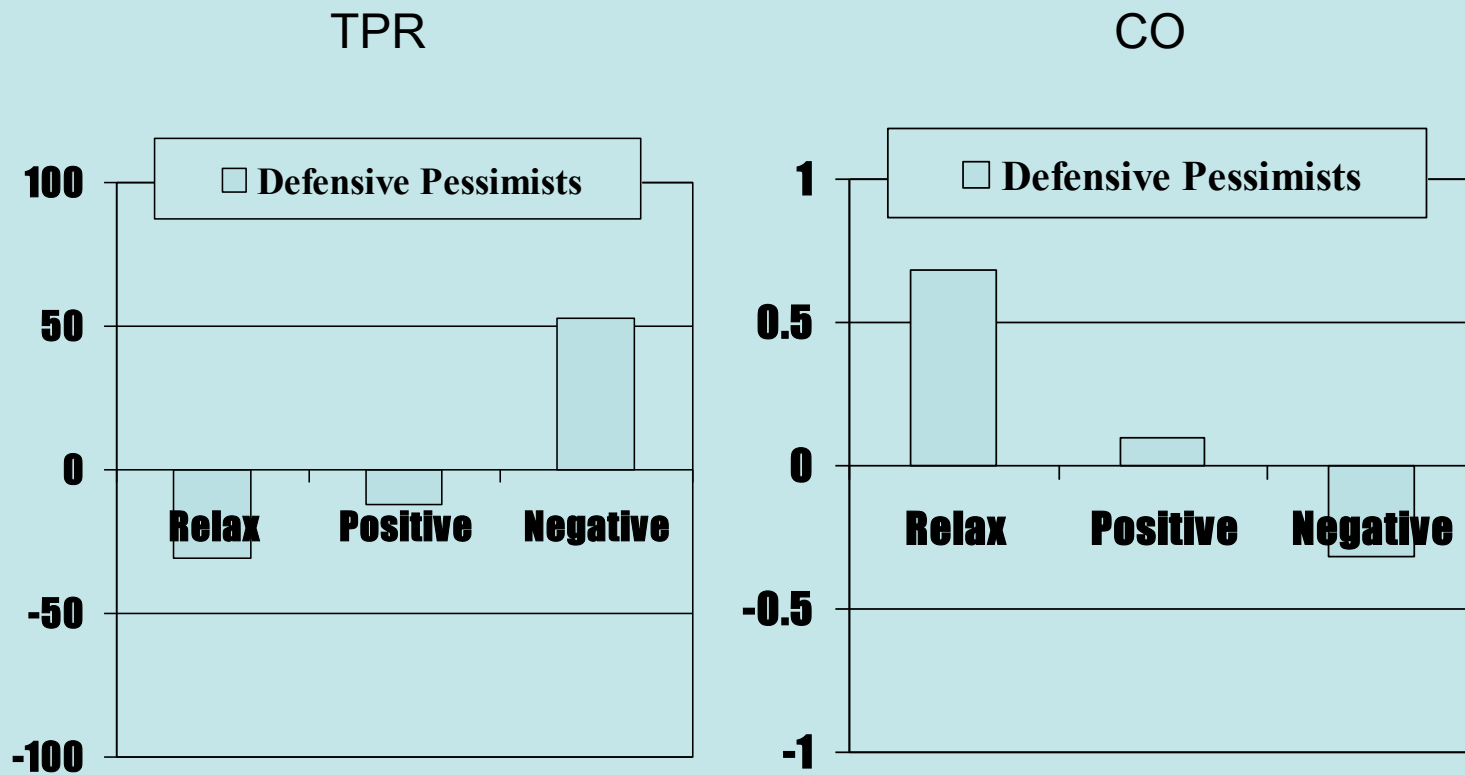
^dUniversity of California, Santa Barbara, United States

Defensive Pessimism

- Academic Defensive Pessimism (Norem & Spencer, 1996)
- Imagery Manipulation
 - negative
 - neutral
 - positive
- RAT Task

Results

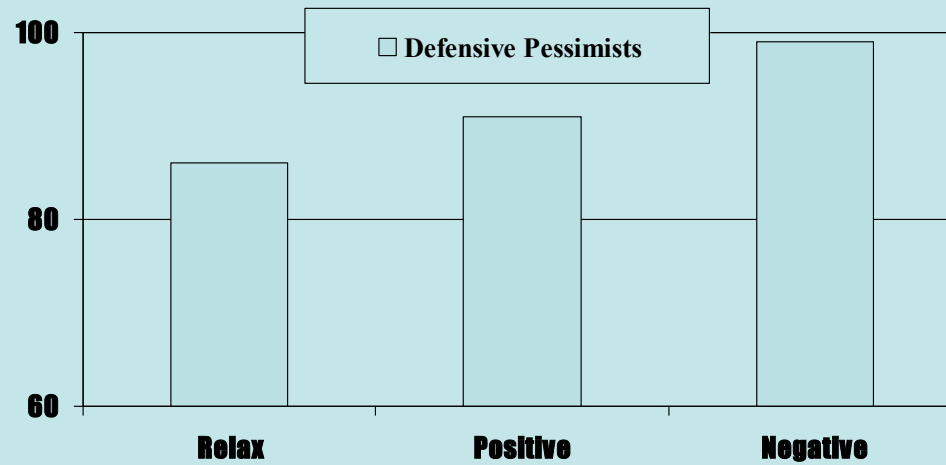
(Seery et al., 2008)



Results

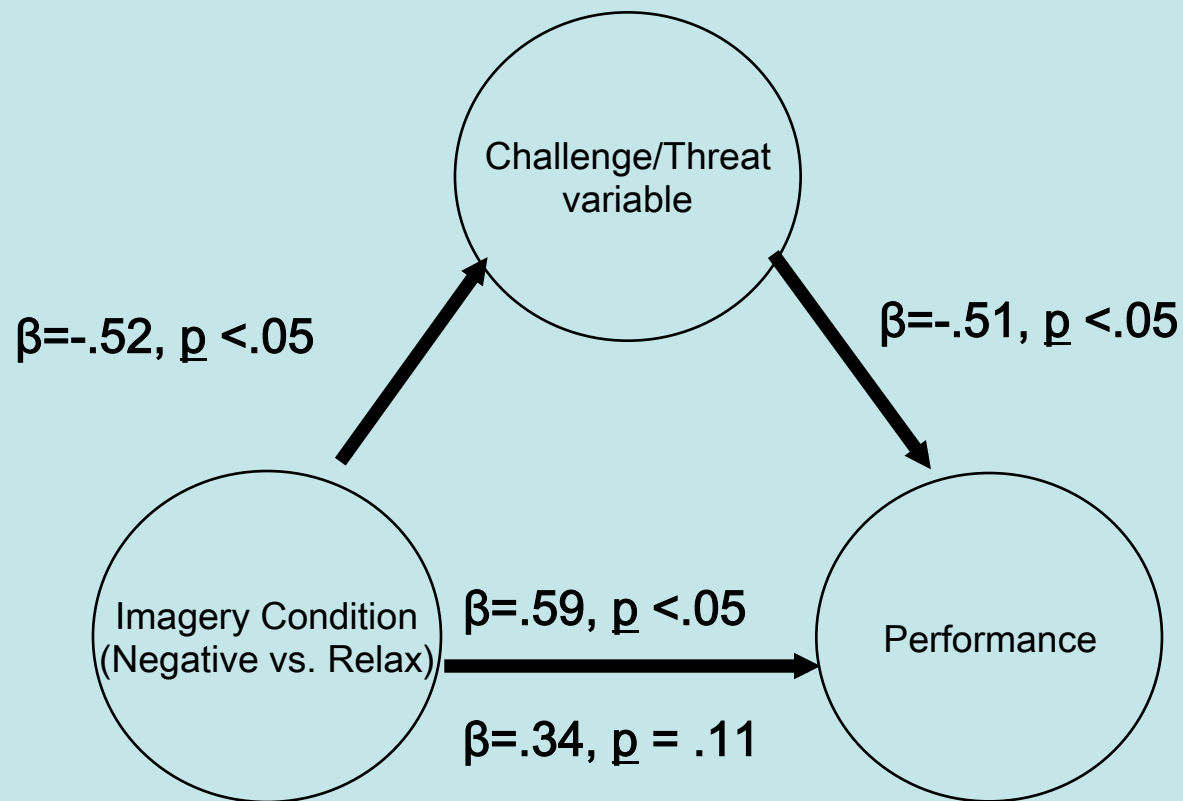
(Seery et al., 2008)

Performance



Results

(Seery et al., 2008)



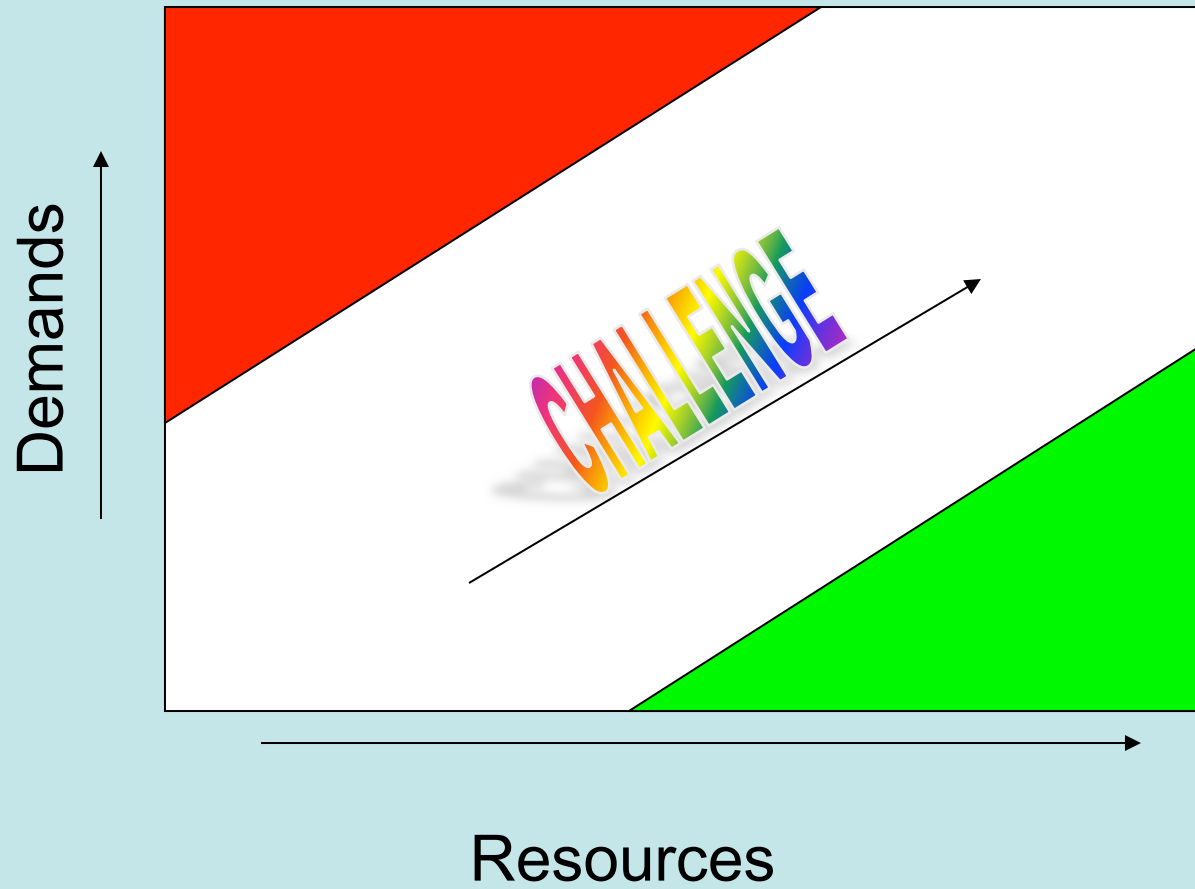
Conclusions

Type A Pattern by definition is a high demand > resource ratio.

- Intense Drive; Ambition; Need for Achievement
- Time urgent; competitive; need to control
- Aggressive, Hostile
- Multitasker
- Talks fast, walks fast, finish other's sentences
- Rarely sees doctor; never sees psychiatrist
- Seldom out sick
- Values respect, not liking
- Hates vacations
- Accepts and sticks to difficult goals

Flow is by definition a positive resource/demand ratio.

- Clear goals
- Skills/Demands Balance
- Concentration/Limited Field of Concentration; Focus on the Activity Itself
- Loss of Self-consciousness
- Distorted Sense of Time
- Personal Control



Thank you!