Finding the Adaptive Sweet Spot: Balancing Compliance and Achievement in Automated Stress Reduction

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BACKGROUND

Chronic stress profoundly affects individual and societal health (Rosch, 1991).
Automated approaches to stress (such as exercise and meditation apps) are affordable and private, but suffer from huge compliance issues from a lack of personalization (Waller & Gilbody, 2009):
• If goals are too easy, people lose motivation (Goal-Setting Theory).
• If goals are too difficult, people lose self-confidence (Self-Efficacy Theory).
To address this, we built **DStress** (Design for Stress), a theoretically grounded system that sets adaptive goals in three coaching dimensions: **Exercise, Meditation,** and **Accessibility**.

WHAT IS DSTRESS?

Web-based mobile system that modifies goal difficulty depending on participants' immediately previous performance.
Users report their progress with each activity daily.
• Completion ➔ Difficulty is increased
• Incompletion ➔ Difficulty is decreased
Adapts to the individual in three coaching dimensions to provide multiple strategies for success.

STUDY CONDITIONS

DStress system was compared to two **non-adaptive** versions:

• An **Easy** version presenting straightforwardly achievable activities.

• A **Difficult** version presenting challenging activities.

• DStress was designed to balance ease and challenge. Our goal was to determine which of the three systems most reduced stress.
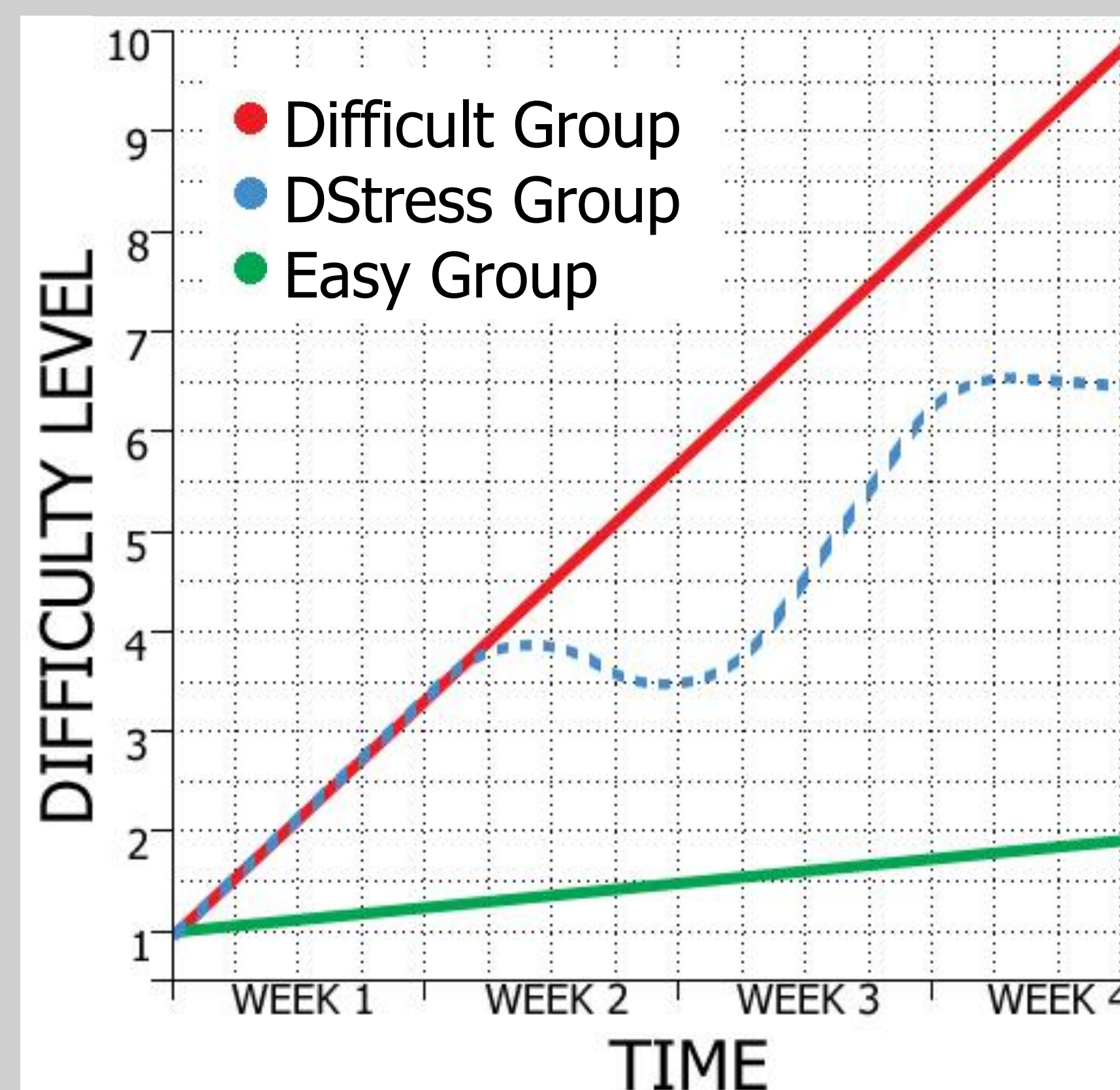
COACHING DIMENSIONS

DStress provides adaptive coaching in three different areas:

1. EXERCISE

• 46 exercises.
• Each rated for difficulty by two trainers.
• 3 exercises per day.
• Exercise on Mondays, Wednesdays, Fridays.
• DStress adjusts the difficulty of the exercises based on prior performance.
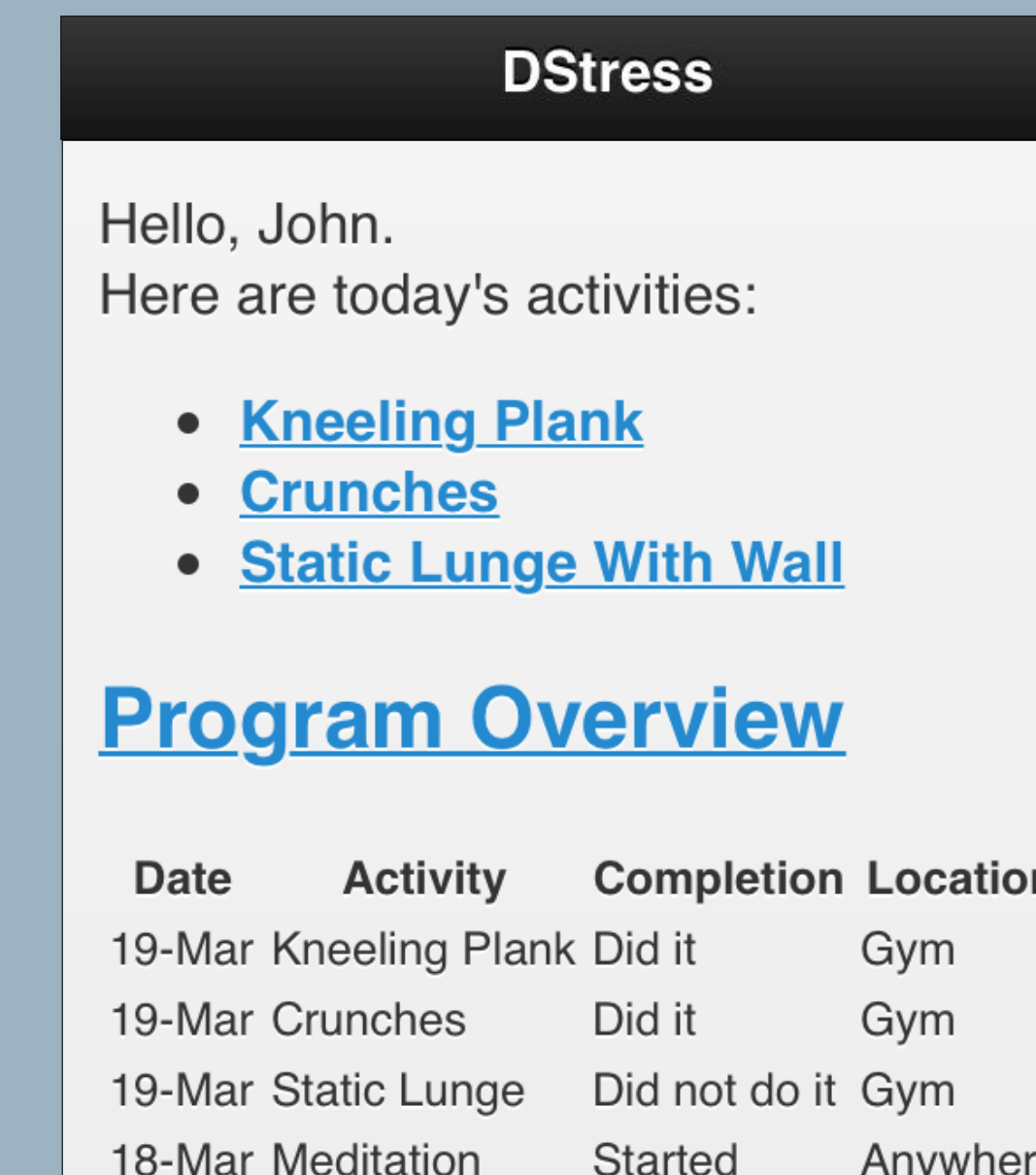
Elevated Lunge in Place
One Set : 8 - 12 lunges on each side (8-12 left, then 8-12 right per set)
Recommended Sets : 2

INSTRUCTIONS
Standing on one leg, reach back with one foot as far as you can, maintaining full contact of the front foot with an object such

2. MEDITATION

• Mindfulness Meditation on Tuesdays, Thursdays, Saturdays.
• Starts with 5 minutes and increases.
• Sunday is a rest day with no meditation or exercise.
• DStress adjusts the meditation length based on prior performance.

DStress

Hello, John.
Here are today's activities:
• Kneeling Plank
• Crunches
• Static Lunge With Wall

Program Overview

Date	Activity	Completion	Location
19-Mar	Kneeling Plank	Did it	Gym
19-Mar	Crunches	Did it	Gym
19-Mar	Static Lunge	Did not do it	Gym
18-Mar	Meditation	Started	Anywhere

3. ACCESSIBILITY

• Accessibility significantly affects compliance (Kaplan & McGuckin, 1986).
• DStress adjusts the proposed location for each workout based on prior performance.
• If a user doesn't make it to the gym, DStress will provide a **home workout** the following exercise day.

FIELD TRIAL METHOD

PARTICIPANTS

• $N = 65$ (42 female), Aged 19-59 ($M = 31.12$; $SD = 9.29$).
• Randomly assigned to one of the 3 conditions.

MATERIALS

• Group comparisons between Pre-Test and Post-Test.
• 4 week active testing period.
Pre and Post surveys of 3 stress measures:
1. Perceived Stress Scale (PSS)
2. Cohen-Hoberman Inventory of Physical Symptoms (CHIPS)
3. Depression Anxiety Stress Scale (DASS)

RESULTS

• **Stress**: DStress reduced stress more than the other conditions:

	Pre Stress	Post Stress	Difference
Easy	17.33	15.08	-2.25
Difficult	17.64	15.00	-2.64
DStress	21.79	12.32	-9.47***

Mean DASS Stress scale scores and difference scores before and after working with the three system versions. Highest possible score is 42, and lower scores indicate less stress (***$p<.001$).
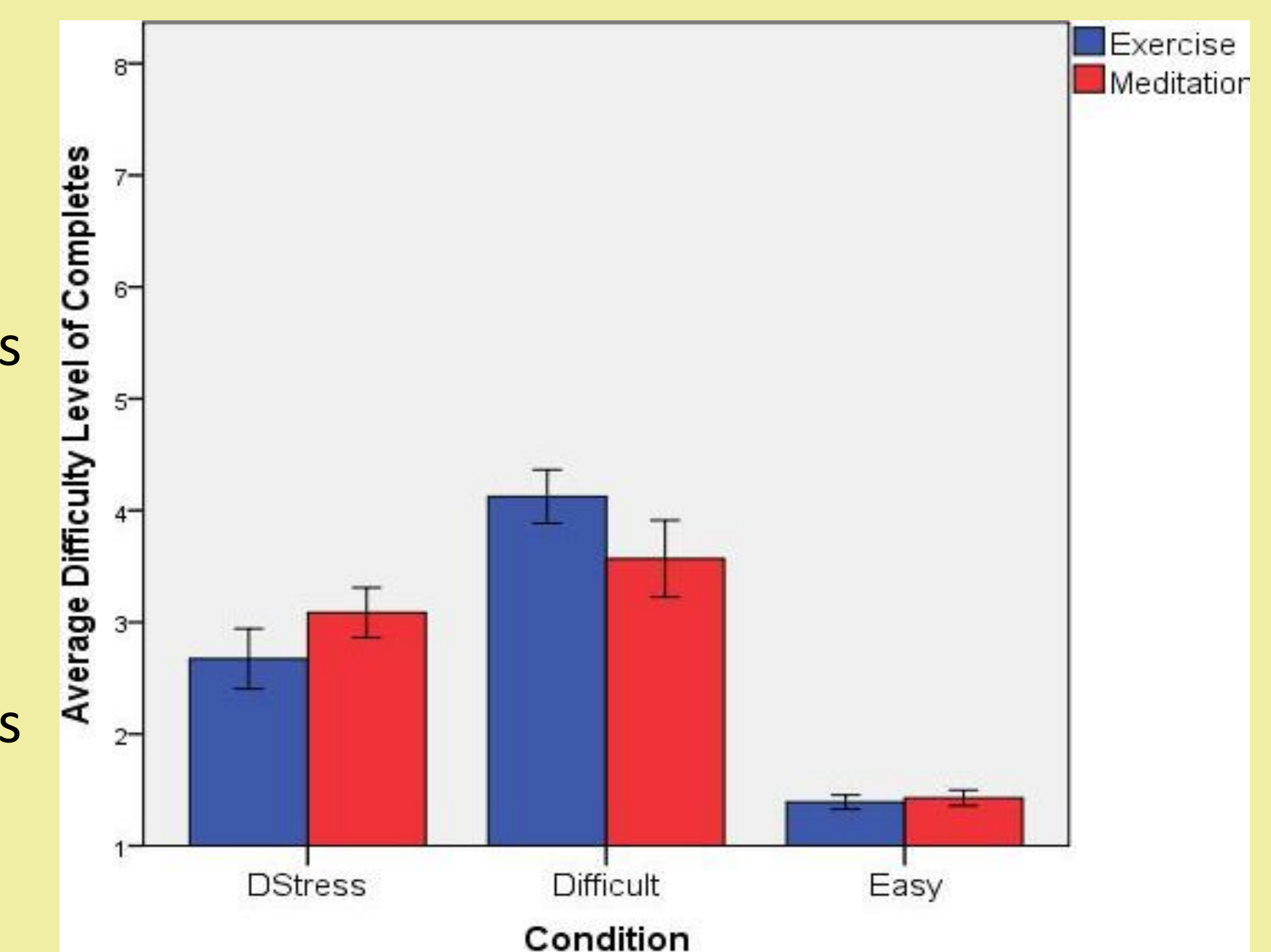
• **Compliance**:
For *exercise*, the DStress group was more compliant than the Difficult ($p=.03$) but not the Easy group ($p=.82$). For *meditation*, the DStress group was more compliant than the Difficult ($p=.01$) but not the Easy group ($p=.63$).
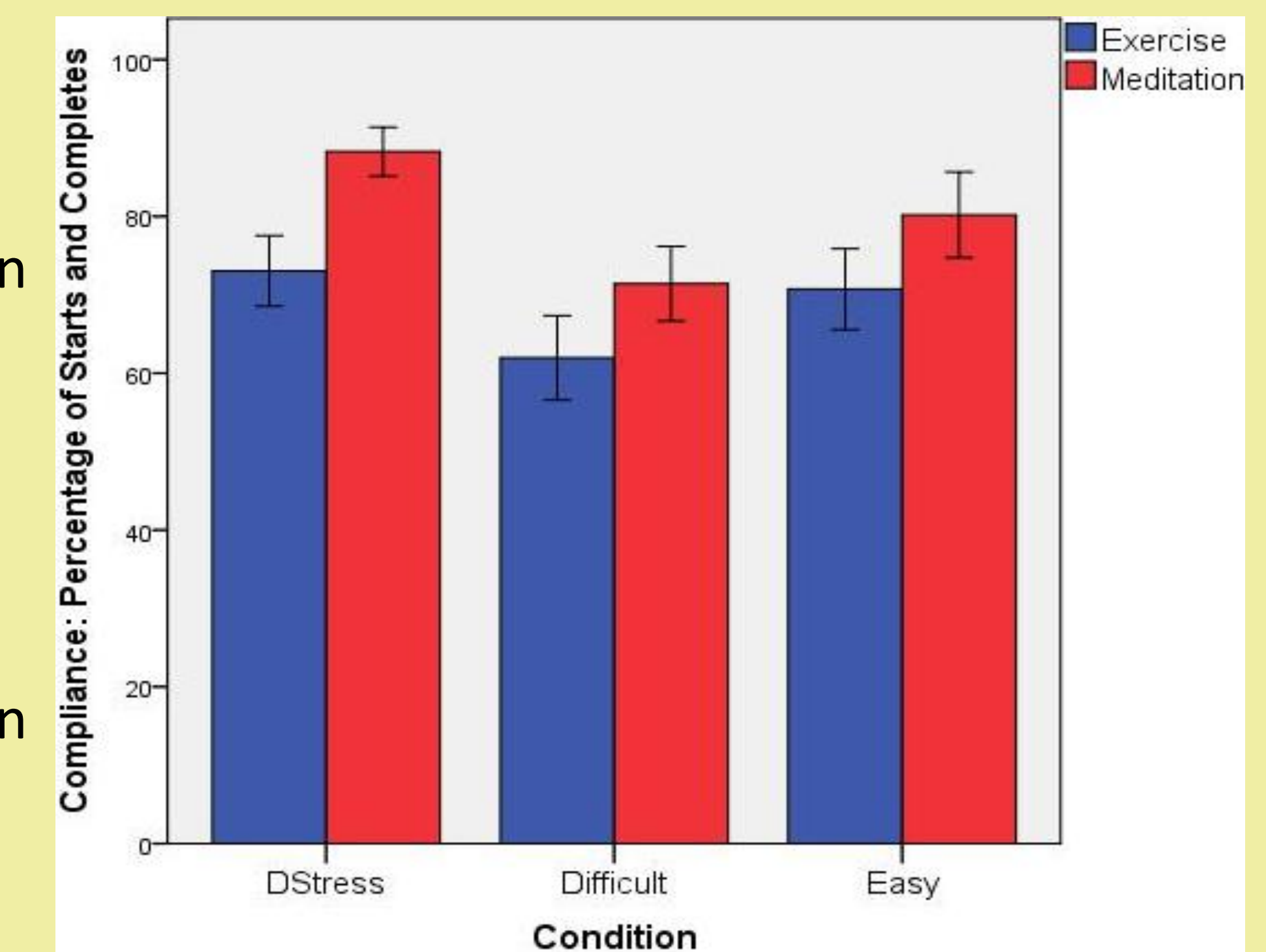
• **Achievement**:
The Difficult group succeeded in more challenging activities than the DStress group ($p<.001$). The DStress group succeeded in more challenging activities than the Easy group ($p<.001$).

Easy tasks and adaptivity led to better compliance than difficult tasks. But compliance alone does not guarantee stress reduction, as only the adaptive DStress group showed reduced stress. Stress reduction with DStress seemed to result from adaptively balancing compliance *and* achievement.