Exergame Design to Improve Self-Regulation of Lifestyle Physical Activity: Lessons from Mobile Applications for Physical Activity
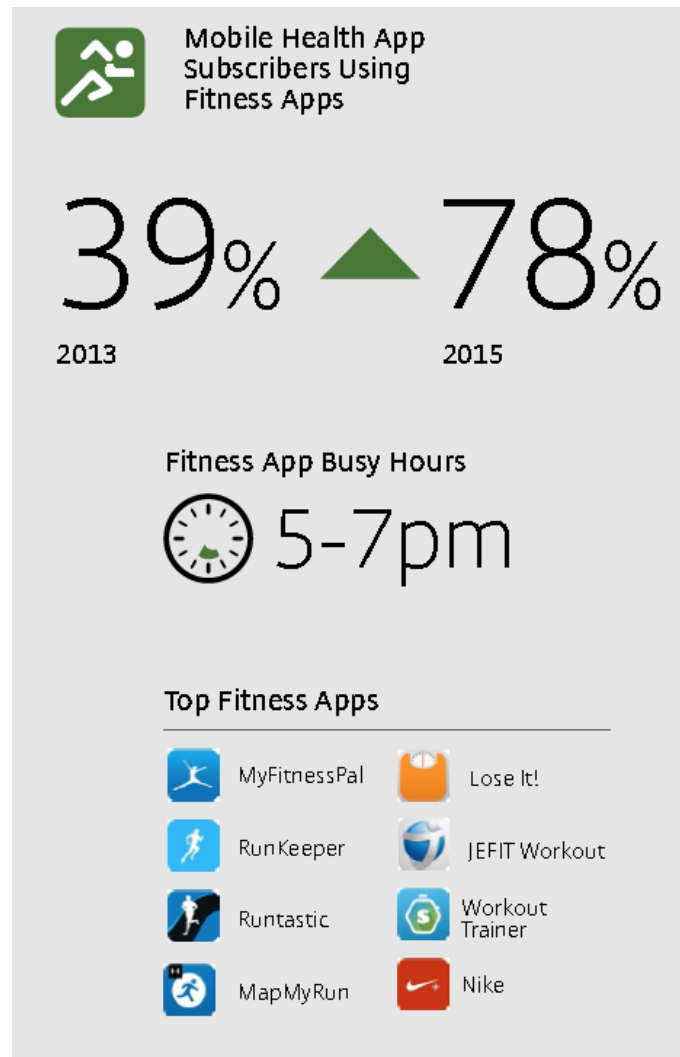
David E. Conroy, Ph.D.

agenda

- what we know about physical activity apps

- contrasting exergames and apps

- competence is the hook

- theory can help optimize competence-based comparisons

physical activity apps are increasingly popular

Citrix (2015)

From: Effectiveness of a Smartphone Application for Weight Loss Compared With Usual Care in Overweight Primary Care Patients: A Randomized, Controlled TrialSmartphone Application for Weight Loss in Overweight Primary Care Patients
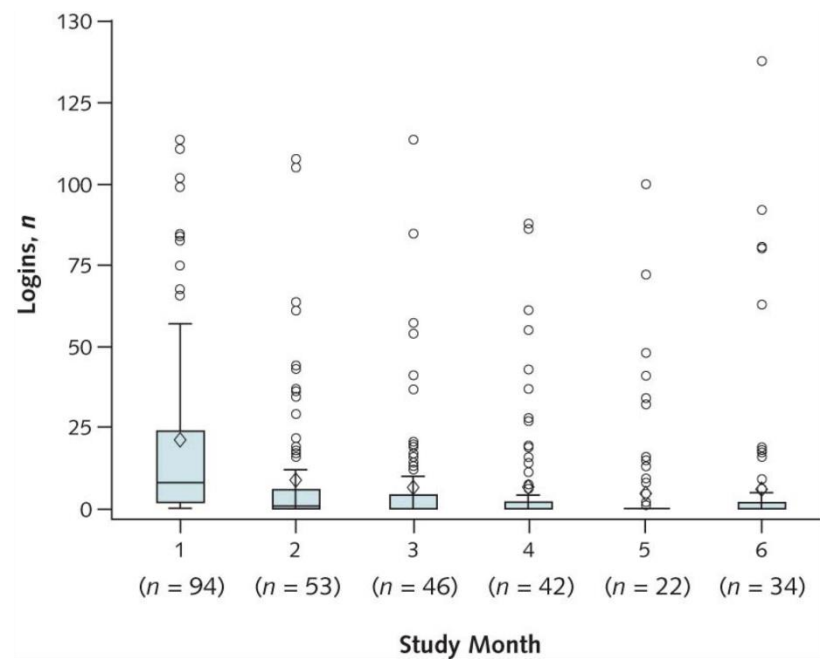
Table 4. Logins Among Intervention Group Participants, by Month

Characteristic	Month					
	1	2	3	4	5	6
Participants who logged in, n (%)	94 (97)	53 (55)	46 (47)	42 (43)	22 (23)	34 (35)
Mean logins, n	20.9	8.6	6.5	6.3	4.3	6.2
Median logins, n	8	1	0	0	0	0
Interquartile range	2–24	0–6	0–4	0–2	0–0	0–2
Range	0–114	0–108	0–114	0–88	0–100	0–138

Figure Legend:

Number of logins among MyFitnessPal users, by month.
Boxes represent the median number of logins and interquartile range.

engagement is a necessary condition for behavior change

Pellegrini et al (2015)
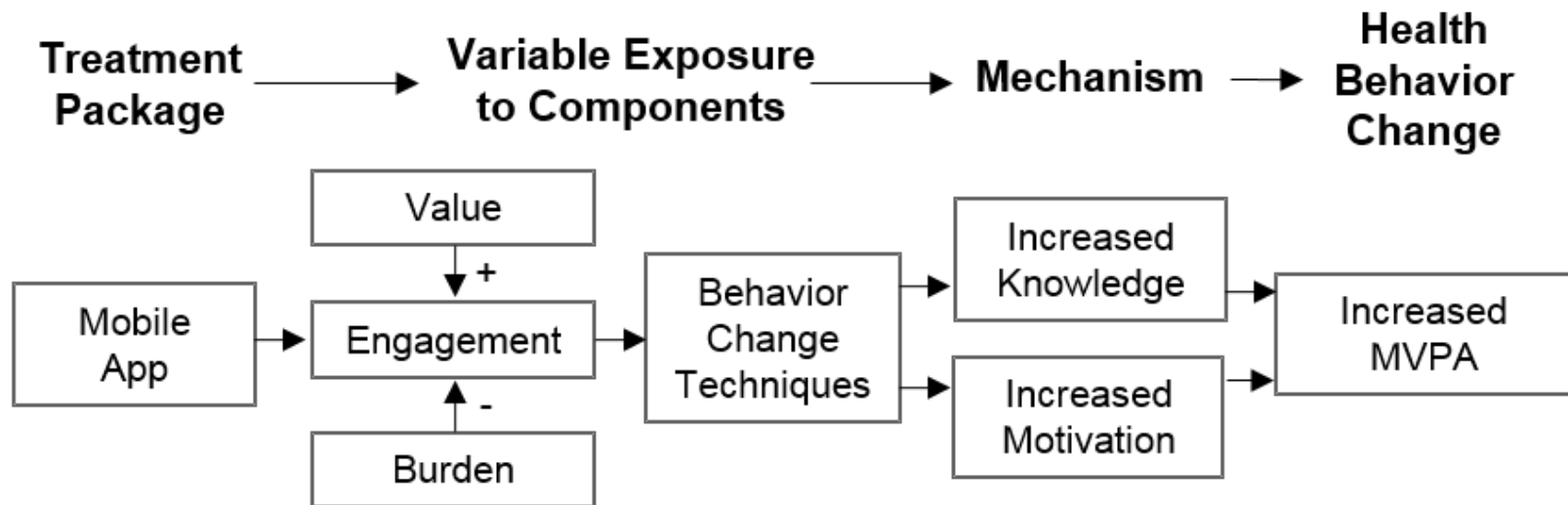
conventional research process limits potential for efficacy trials

Idea & Proposal

Design & Development

Average time = 17 years!

Only 14% of ideas make it

Dissemination & Implementation

Recruitment & Data Collection

Data Analysis

RAND Europe (2008)
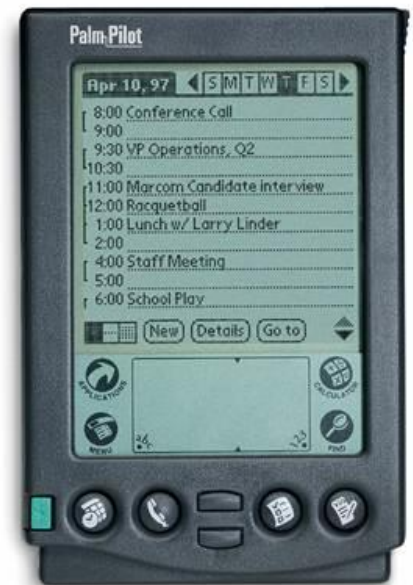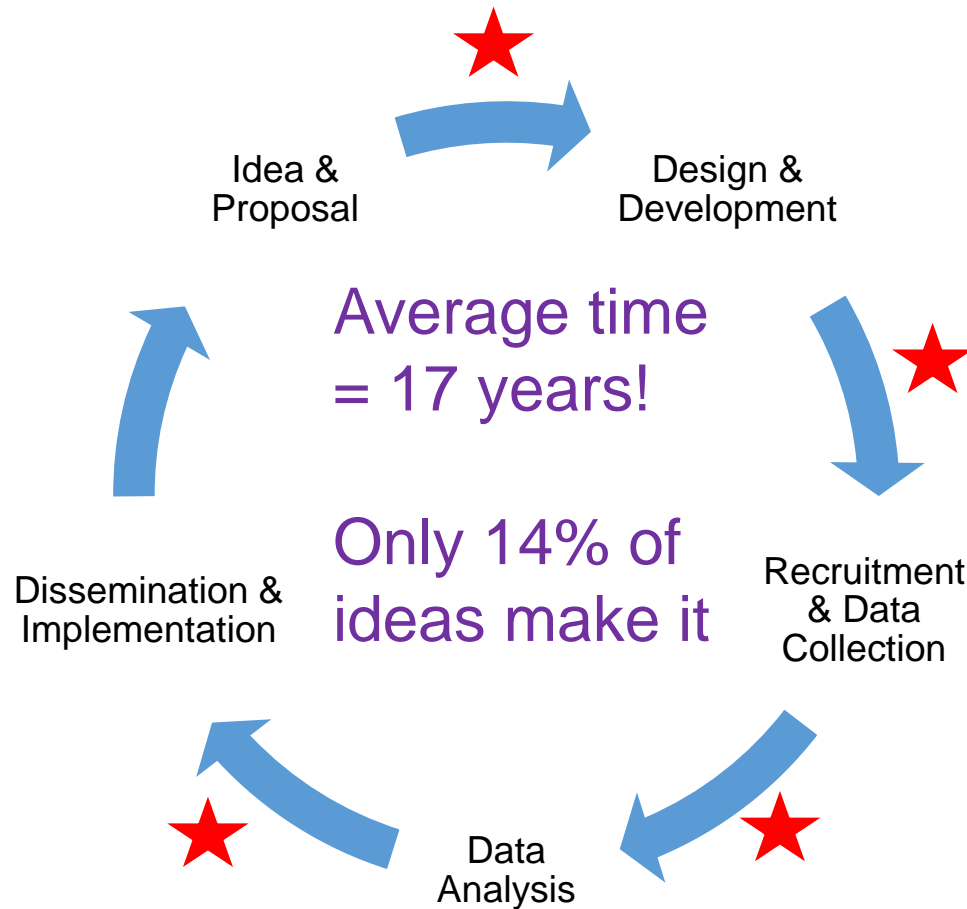
treatment packages can be deconstructed into components
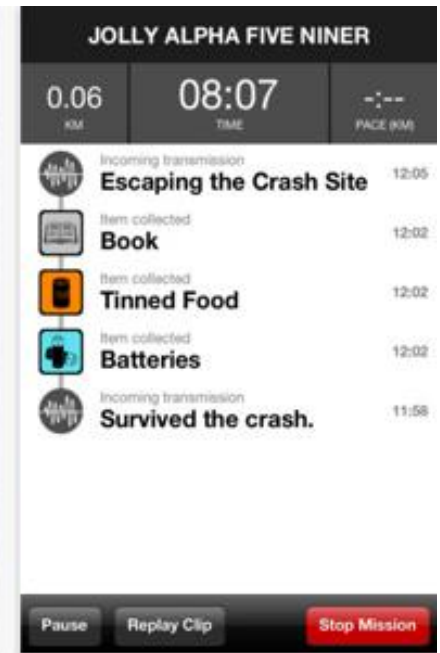

Collins et al. (2005)

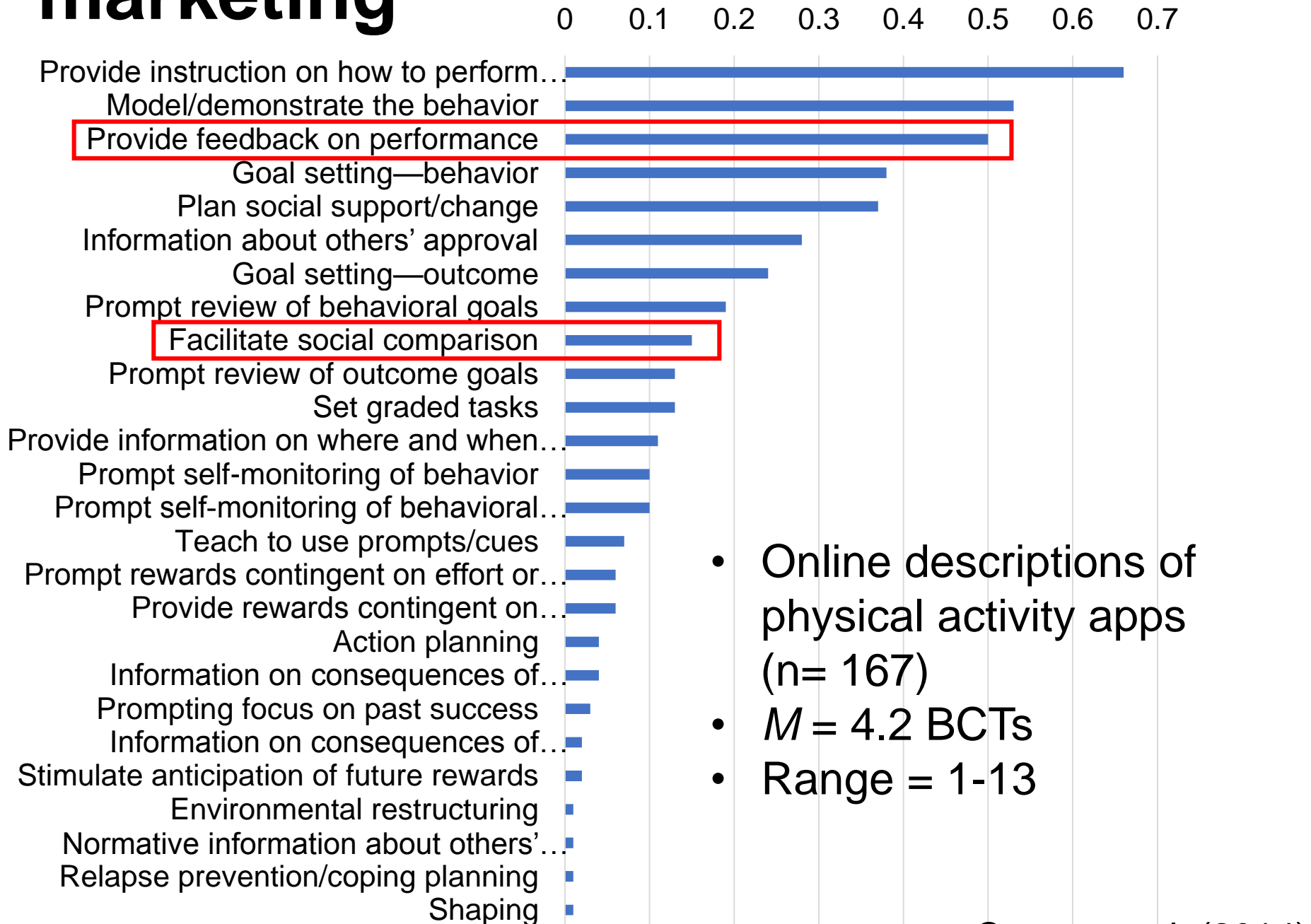# physical activity apps vary in their game-like features

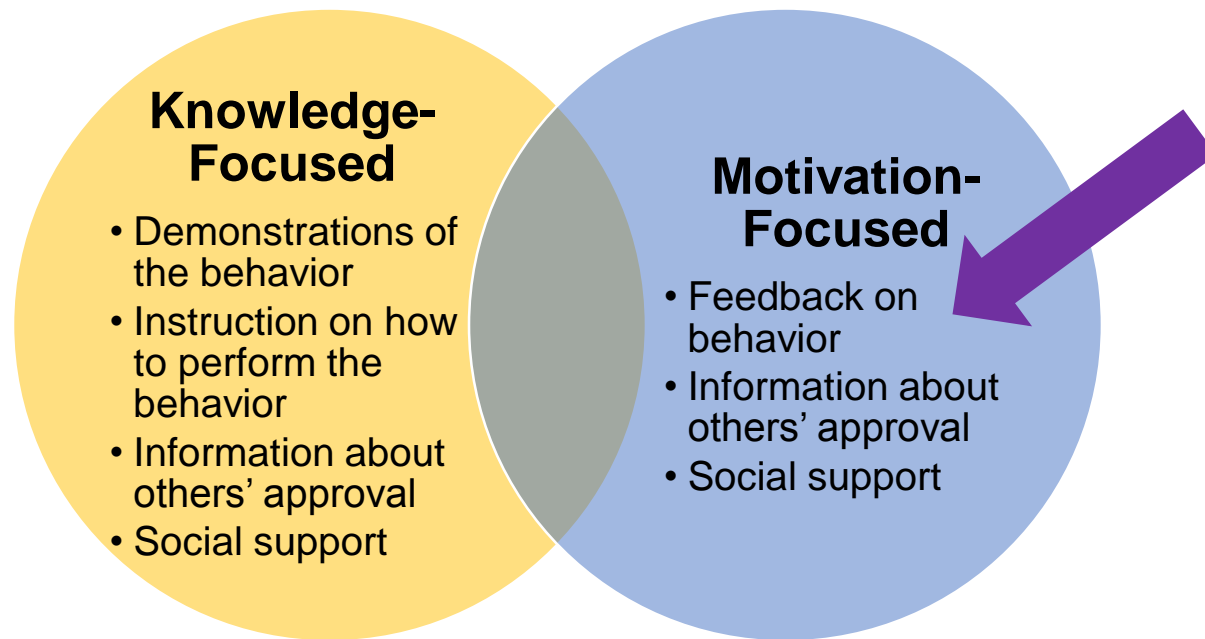**Daily Cardio Workout**
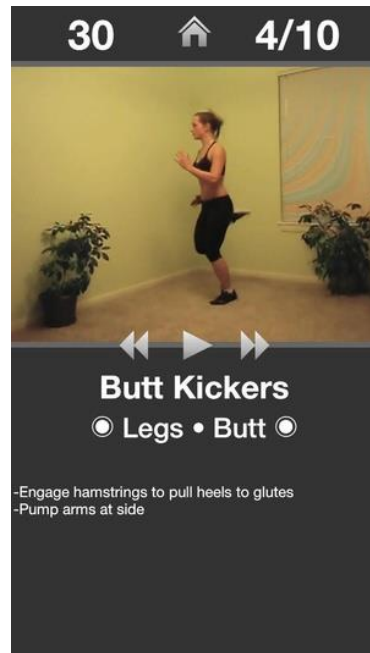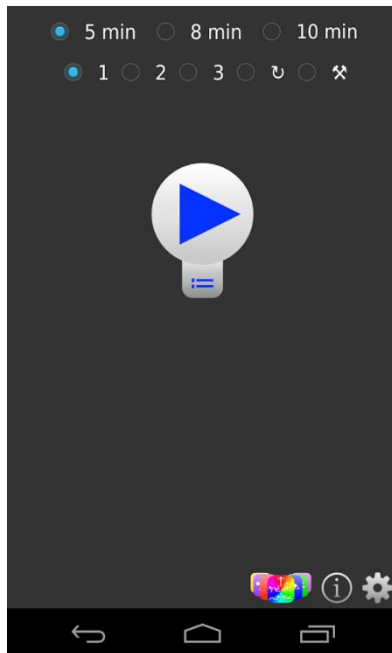
Zombies, Run!

marketing

- Online descriptions of physical activity apps (n= 167)
- M = 4.2 BCTs
- Range = 1-13

Conroy et al. (2014)

implementation

Figure showing BCT implementation proportions:

- Social support (unspecified) — ~0.79
- Information about others' approval — ~0.64
- Instruction on how to perform a behavior — ~0.49
- Demonstration of the behavior — ~0.47
- **Feedback on behavior** — ~0.42
- Goal setting (behavior) — ~0.36
- Prompts/cues — ~0.35
- Graded tasks — ~0.33
- Social reward — ~0.32
- Self-monitoring of behavior — ~0.29
- **Social comparison** — ~0.26
- Self-monitoring of outcome(s) of behavior — ~0.22
- Non-specific reward — ~0.22
- Goal setting (outcome) — ~0.18
- Review behavior goal(s) — ~0.18
- Action planning — ~0.15
- Material reward (behavior) — ~0.10
- Monitoring outcome(s) of behavior by… — ~0.09

- User inspection of physical activity apps (n=100)
- *M* = 6.6 BCTs
- Range = 1-21

Yang et al. (2015)

two types of physical activity apps exist based on BCT configurations

Knowledge-Focused

- Demonstrations of the behavior
- Instruction on how to perform the behavior
- Information about others' approval
- Social support

Motivation-Focused

- Feedback on behavior
- Information about others' approval
- Social support

Conroy et al. (2014); Yang et al. (2015)

leaderboards are a common gamification strategy

- performance feedback is used as a hook
- capitalizes on universal need for competence

users engage in tasks with different competence-related aims

- achievement goals: the dynamic aim, purpose or focus of competence-related behavior
- defining competence
  - absolute
    - did I perform perfectly?
  - self
    - did I perform better than before?
  - norm
    - did I perform better than my partner?

mastery goals
task goals
learning goals

performance goals
ego goals
ability goals

achievement goals vary in their definition of competence and the valence of the incentive

	Mastery	**Performance**
Approach Success		
Avoid Failure		

Elliot (1999)

performance-approach goals enhance pride after outperforming others

>50% increase

Rebar & Conroy (2011)
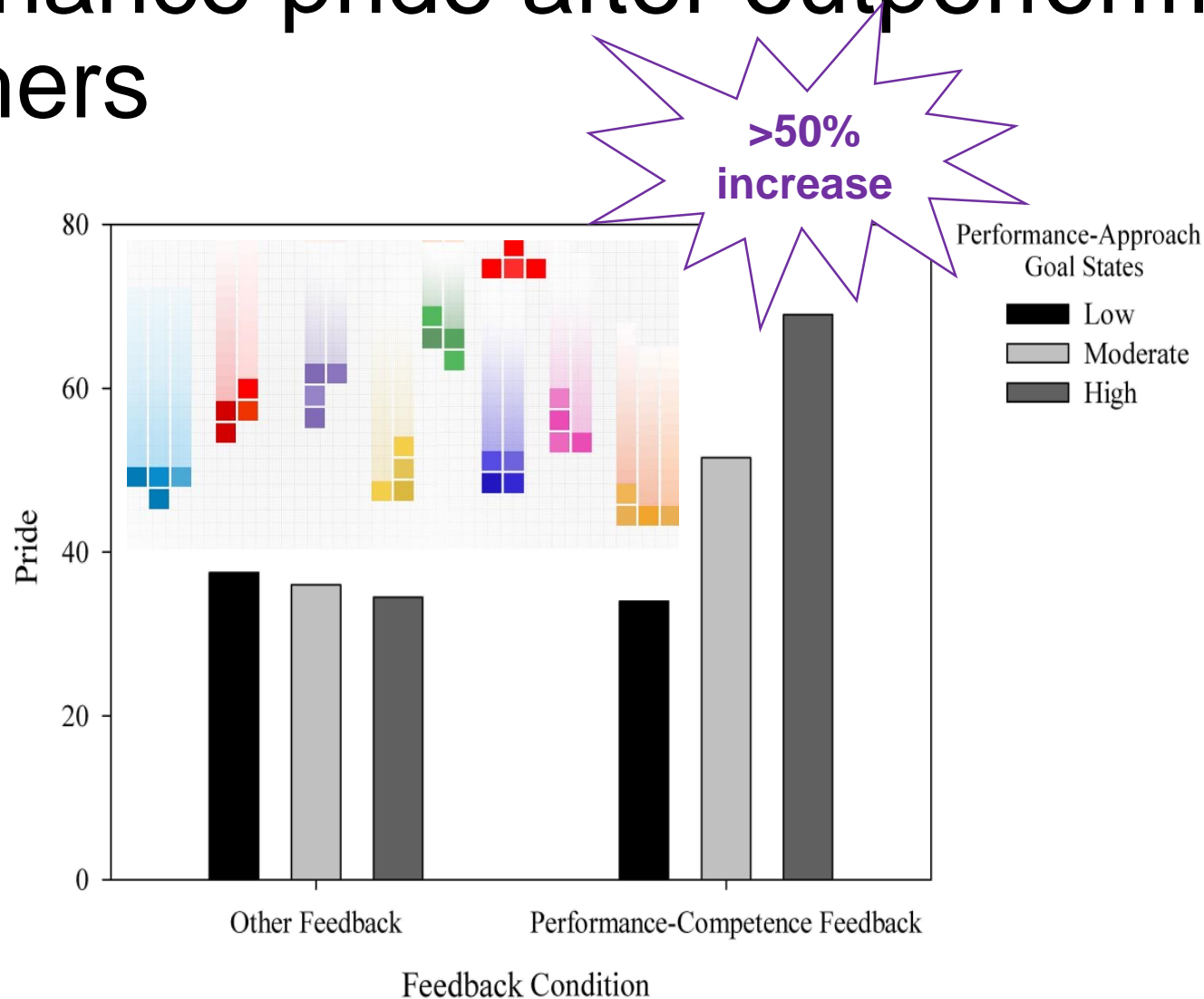
performance-avoidance goals evoke shame after being outperformed by others

~100% increase

Rebar & Conroy (2011)
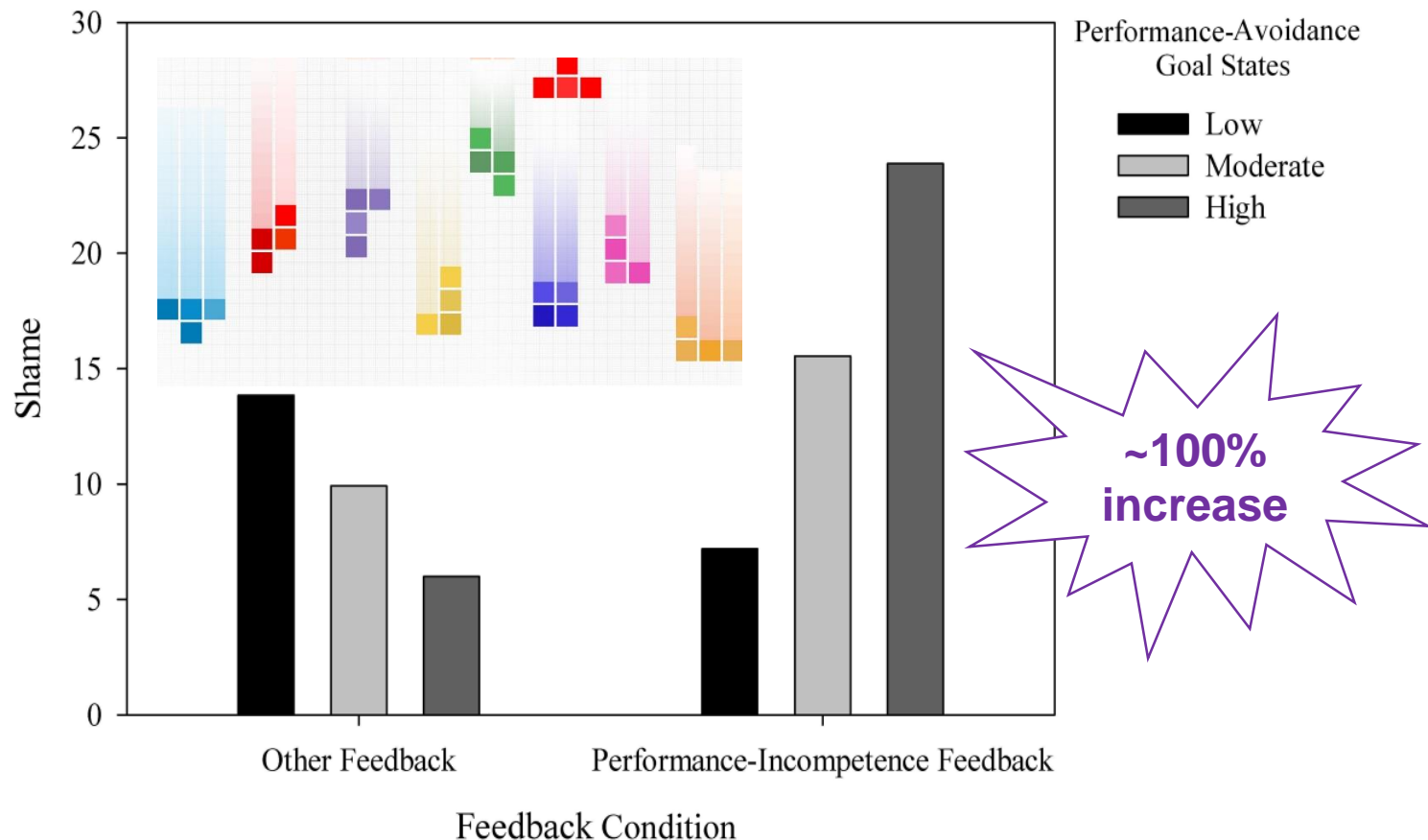
conclusions

- impact will be determined by ability of these technologies to (1) engage users, and (2) modify behavior

- more ≠ better when it comes to behavior change techniques
  - leaderboards can be a double-edged sword

- limited motivation theory guiding work
  - control theory infused in many apps but not well-matched for most contemporary exergames
  - greater emphasis needed on the affective processes that guide both engagement and behavior change

- questions? conroy@psu.edu

control theory underlies many apps and wearables

Goal Setting / Comparator

Planning

Feedback & Self-Monitoring

Physical Activity

states of goal involvement determined by a person X situation interaction

Person

- neurophysiology

- achievement motive dispositions

- self-concept

- task-related beliefs

Situation

- evaluative climate

- recognition

- ability groupings

- timing

- authority

- task

Elliot (1999)