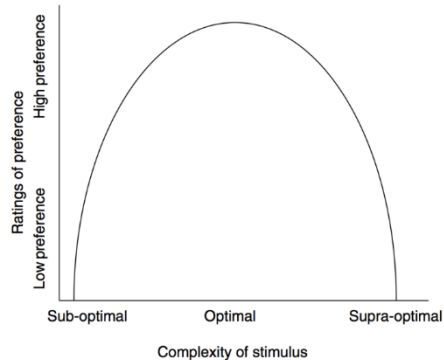


Affective responses to exercise

Dr Emmanouil (Manos) Georgiadis

Affect in our lives

- “Exercise makes you feel good”
(Fox, 1999, p.413)
- Why don't we exercise adequately to gain its numerous positive effects?
- People generally choose to do what makes them feel good and avoid what makes them feel bad!
(Ekkekakis & Acevedo, 2006, p.104)



The inverted U Model

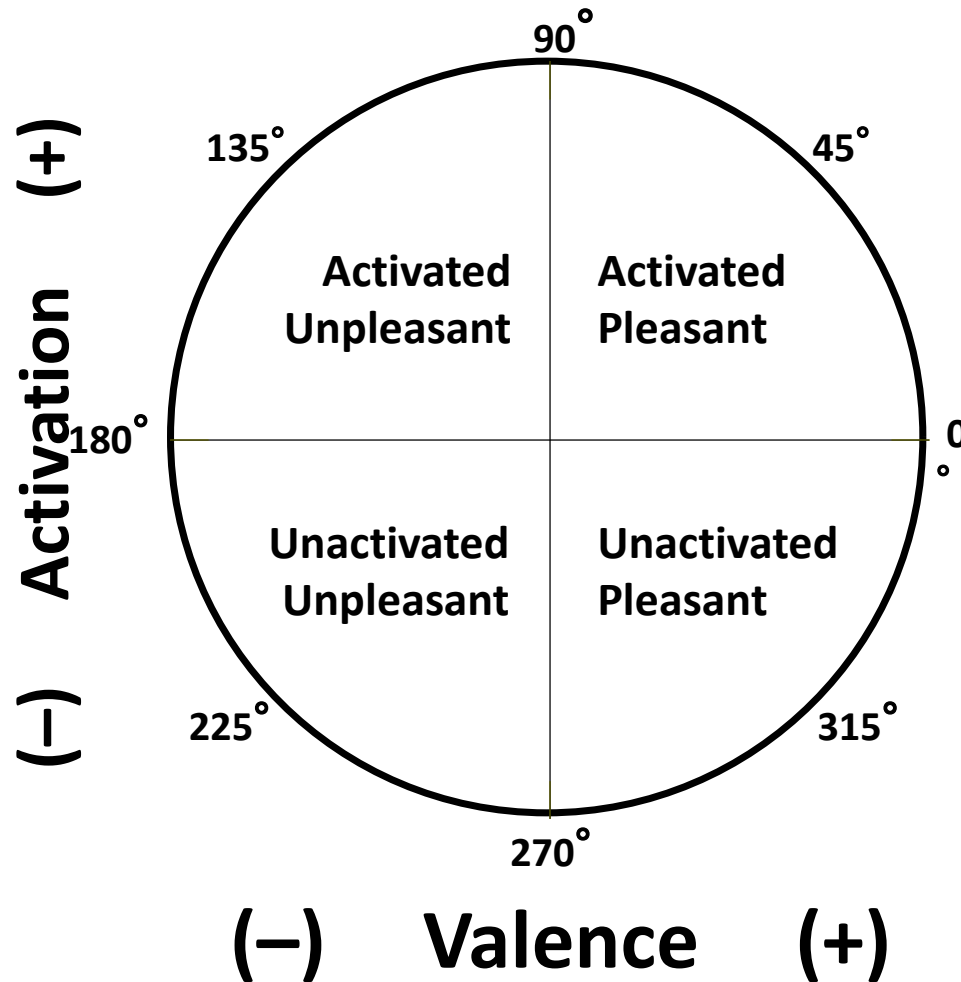
- For many years (up to 1999) scientific community believed that there is an ideal intensity for creating the best affective responses.
- However...
 - Many positive affective responses can be instigated through both low and high intensities
 - Moderate intensity does not always cause the best effects
 - No valid psychobiological mechanisms

The inverted U Model

- Lack of specific and accurate theoretical model
- Intensity: Based on HR and objective measures of HR measurement
- Individual differences in affective response (i.e. pleasure/displeasure)

THE CIRCUMPLEX MODEL OF AFFECT & THE DUAL MODE THEORY

The circumplex model of affect proposed by Russell (1980)



The Dual Mode Theory

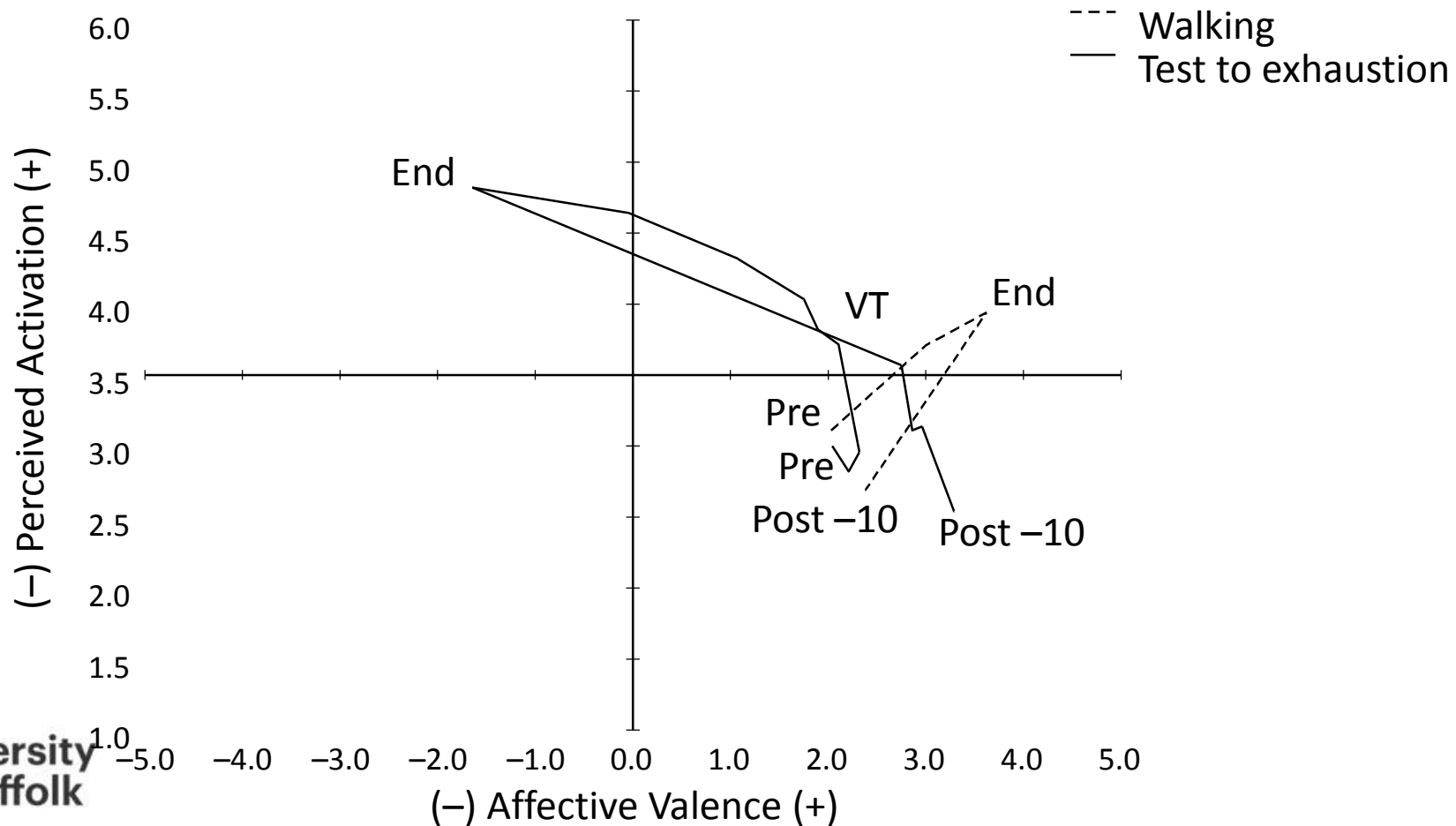
- Based on evolutionary adaptive perspective
- Emotion relates to both:
 - **Cognitive** appraisal processes (i.e. self-efficacy, achievements, personality variables)
 - **Physiological** variables (i.e. signals of baroreceptors, thermo-receptors, visceroreceptors in the muscles, heart, lungs)

Defining features of affect, emotion and mood

Construct	Defining features	Intensity and time	Cognitive mediation	Example
Affect (core affect; basic affect)	Basic and generic valenced (pleasant/unpleasant) responses	Varied	A cognitive appraisal might be involved when affect is a component of emotion or mood, but is not necessary; affect can occur independently	Feeling 'good', pleasant
Emotion	Affective states resulting from an appraisal of specific events	Usually high intensity; short duration	Cognitive appraisal of a specific eliciting event	Proud or ashamed
Mood	Diffuse affective states not resulting from specific events but more likely associated with general views at a point in time	Lower intensity; can be prolonged	Cognitive appraisal of larger issues or events in the distant past or future	Irritable or jovial



Affective responses to two bouts of physical activity. The horizontal dimension represents self-rated displeasure to pleasure and the vertical dimension represents perceived activation. 'Pre' indicates the beginning of each activity, 'End' indicates its end and 'Post -10' indicates 10 minutes after the end. Note: VT: ventilatory threshold.



Affective responses to varying levels of exercise intensity, proposed by Ekkekakis and colleagues (Ekkekakis, 2003; Ekkekakis *et al.*, 2005)

Intensity range	Affective reaction to exercise	Variability of response	Influencing factors
Moderate – clearly below ventilatory threshold	Pleasure	Homogeneous	Cognitive factors play a small role
Heavy – close to the ventilatory threshold	Pleasure or displeasure	Variable	Cognitive factors play a major role
Severe – clearly above ventilatory threshold	Displeasure	Homogeneous	Interoceptive factors play a major role

Next generation of affect measurement

- Based on Gas Exchange Point or Lactate Threshold → Turning point

Below



Positive report of affect & likely occurring after cool-down

At



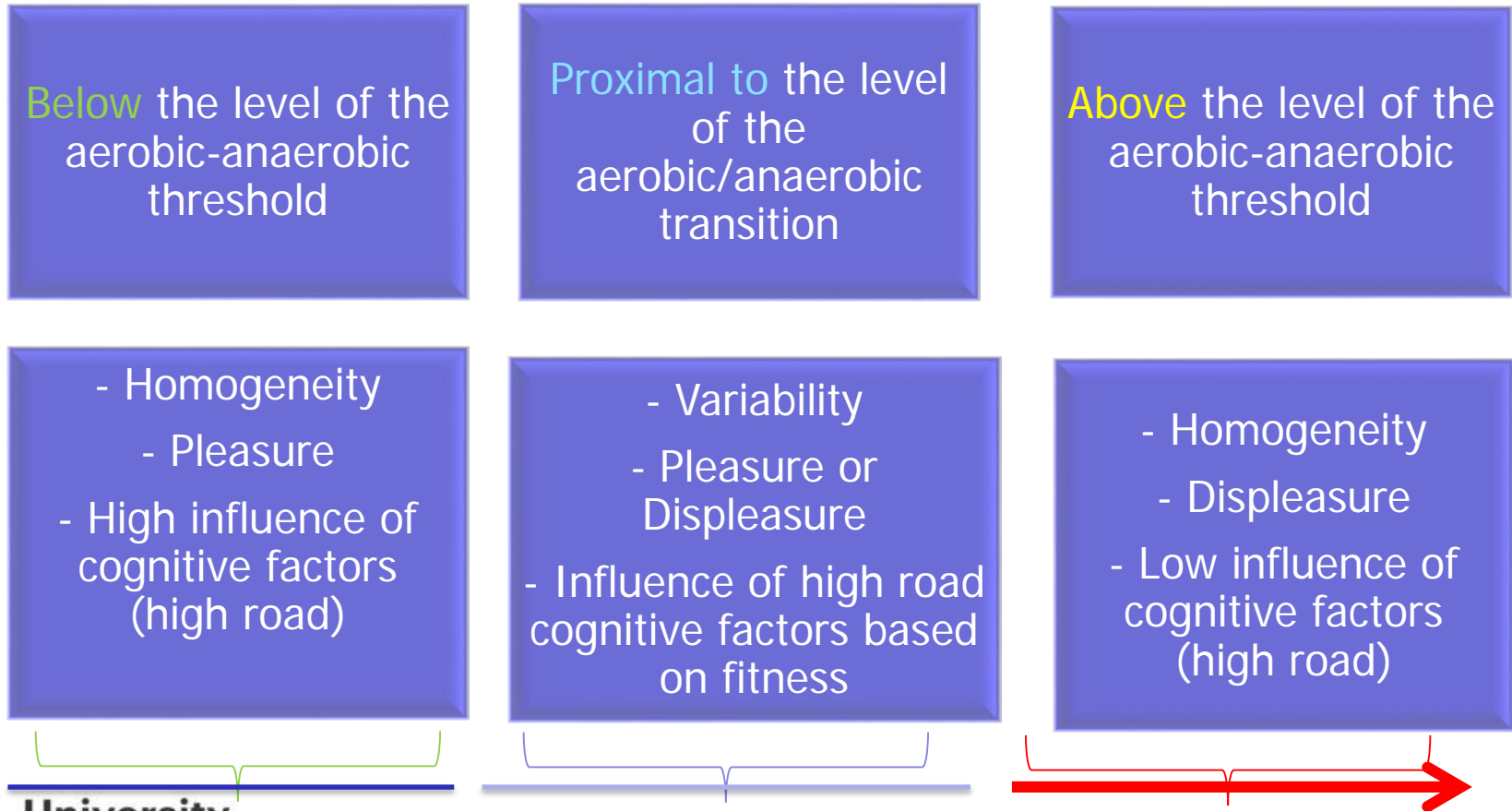
Variable response of affect

Above



Decline of reported affect

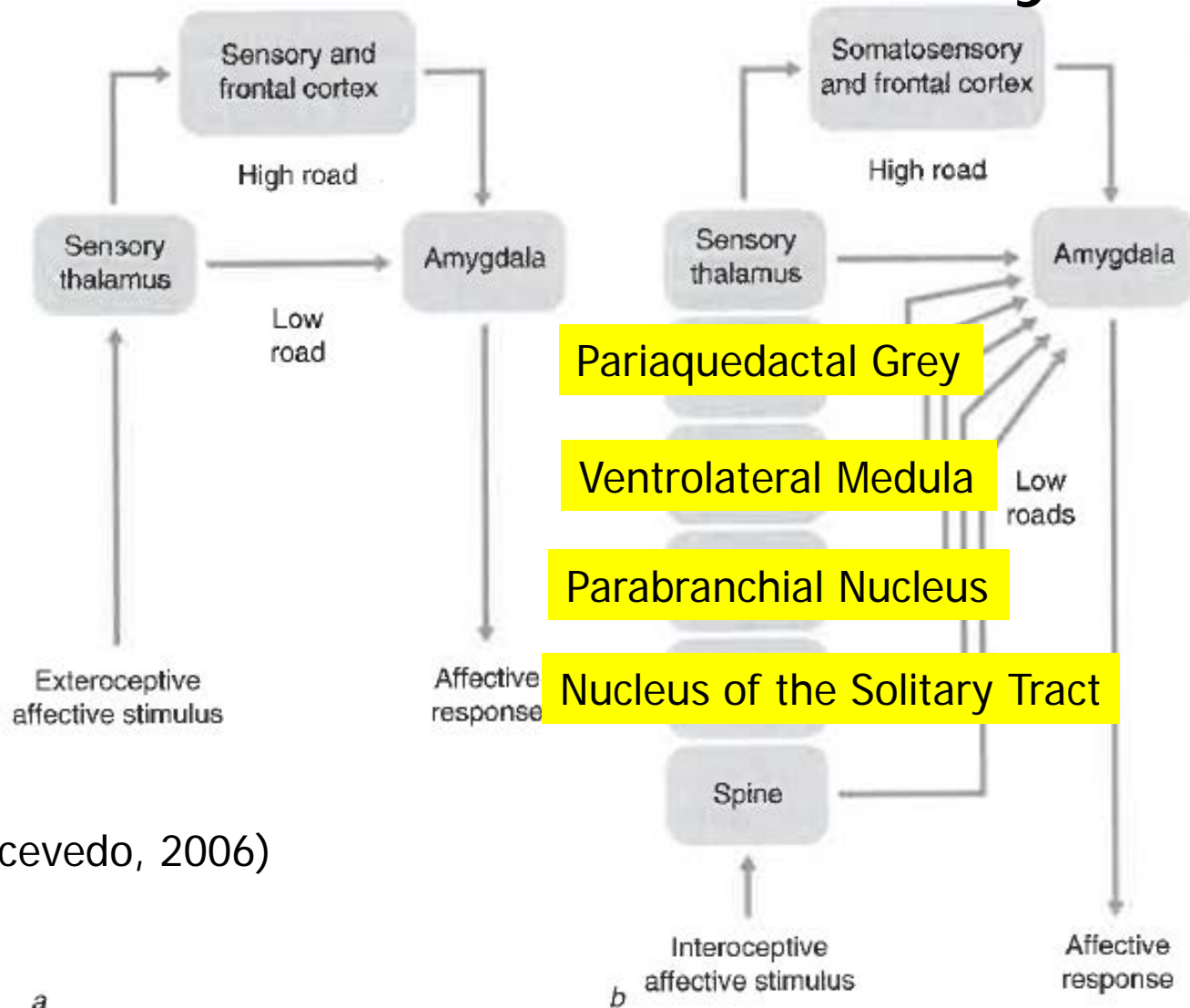
Dose-response based on the dual-mode theory



Neuroscientific evidence

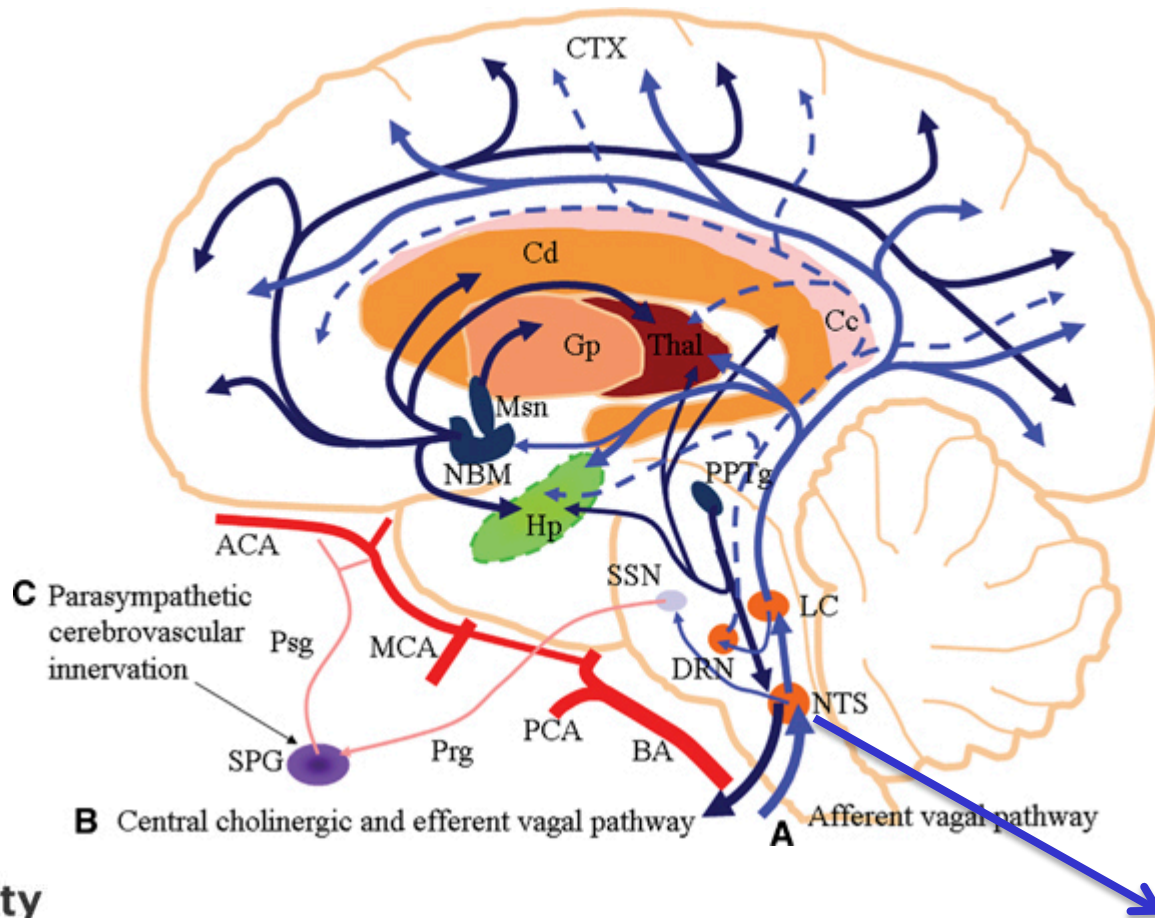
- The system collecting and relaying interoceptive information is **highly sensitive** to variations in the intensity of internal signals
- **Interoceptive** information signaling relates to both cortically mediated and non-cortically mediated pathways
- Gating mechanisms are capable of redirecting interoceptive signals to **subcortical** pathways when the intensity exceeds certain **critical threshold**

Cortical and subcortical ways



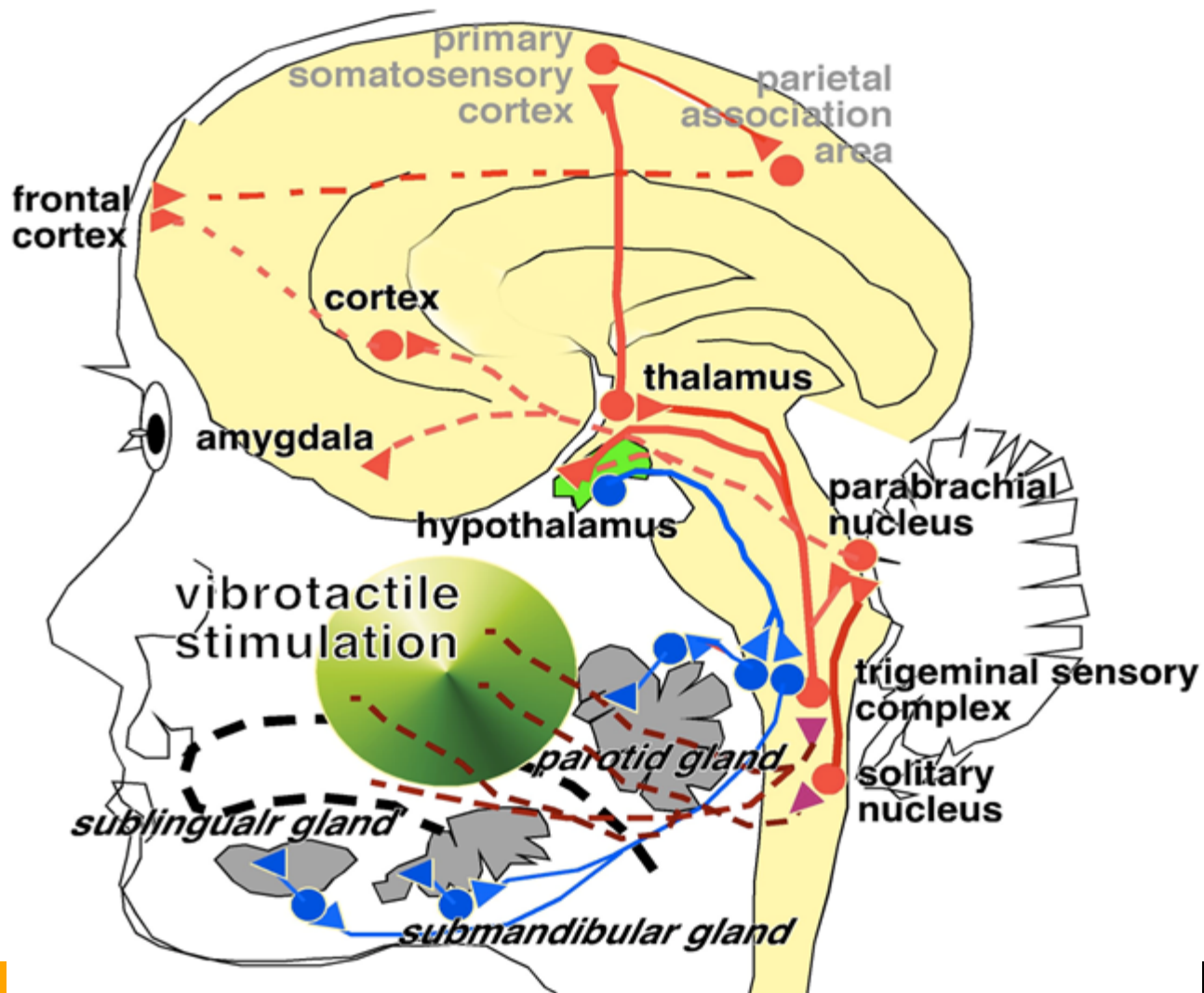
(Ekkekakis & Acevedo, 2006)

Low roads explained: NTS



Nucleus of the Solitary Tract

Low roads explained: Parabranchial Nuclei



Low road in the human brain

- In addition to the sensory thalamus, **subcortical** pathways to the amygdala **originate in the spine**, Nucleus of the Solitary Tract (NTS), Parabrachial Nucleus (PB), Ventrolateral Medulla (VLM) and Pariaqueductal Gray (PAG)
- Multiple intense stimuli from the internal environment of the body can be possibly explained from an evolutionary standpoint having a more **immediate and severe** implications for survival and adaptation than exteroceptive stimuli

High intensity → Negative affective response

- **Depletes** energy resources (other than lipids)
- The range of survivor is limited:
 - Lactate accumulation and hydrogen ions (**lactic acidosis**)
 - **Catecholamines** are released leading HR and Systolic Blood Pressure (SBP) to their limits
 - **HR & SBP** are too high to sustain life for long
 - Increase in frequency and depth of **ventilation**
 - Recruitment of **low-efficiency fast-twitched muscle fibers**
 - **Increases in oxygen cost** of work and coordination patterns
 - Homeostasis is **threatened!** (similar to a heart attack)

However...

- Why the response to high intensity is so variable?
- If this road of affect (the Low Road) is so strong representing **toxic** effects for human system, how come we fail to notice evidence of **unified responses to high intensity**?

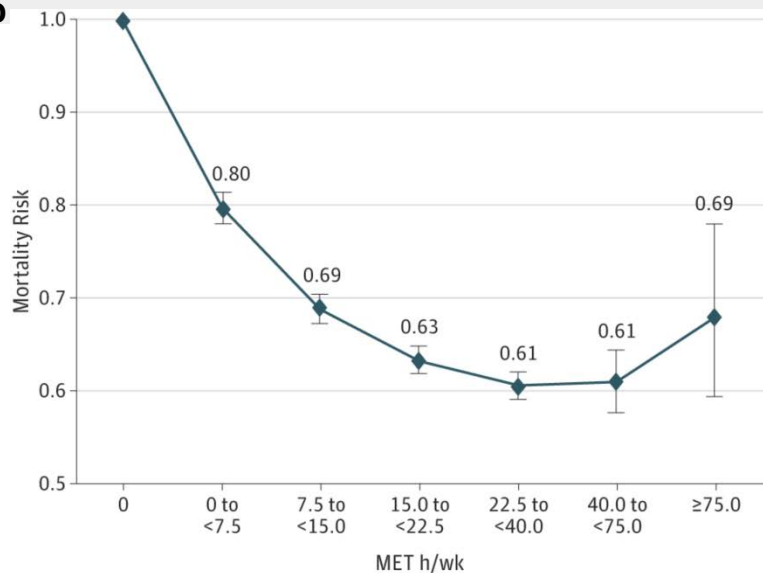
High intensity & affective responses

- High self-efficacy is influencing and mediating this procedure
- A more self-efficacious person responds with more positive affect in relation to a less efficacious one
- When stimuli become **too trivial** or overwhelming cognitive factors are expected to **correspond less to affective responses**

Theories and Models of Exercise Behavior: Individual & Social Cognitive Approaches

Emmanouil (Manos) Georgiadis, PhD.

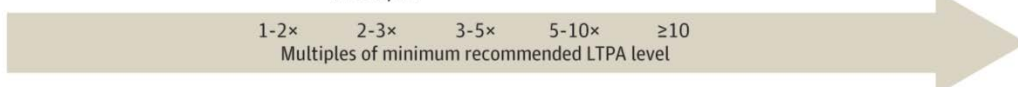
From: **Leisure Time Physical Activity and Mortality: A Detailed Pooled Analysis of the Dose-Response Relationship**



1MET= 1 kcal/1kg /hr

METs per exercise intensity

Intensity	from	to
Low	1.1	2.9
Moderate	3.0	5.9
High	6.0	...



Hazard Ratios (HRs) and 95% CIs for Leisure Time Moderate- to Vigorous-Intensity Physical Activity and Mortality dose-response curve and category-specific HR estimates of exercise levels compared with the federally recommended minimum of 7.5 metabolic equivalent (MET) hours per week. Models were stratified by cohort and use age as the underlying time scale. The model was adjusted for sex, smoking (never, former, current, or missing), alcohol (none, <15 g/day, 15 to <30 g/day, or ≥30 g/day), educational level (dropout, high school, post-high school training, some college, college graduate, post college, or missing), marital status (married, divorced, widowed, single, or missing), history of cancer, history of heart disease, and body mass index (calculated as weight in kilograms divided by height in meters squared) (<18.5, 18.5 to <25.0, 25.0 to <30.0, 30.0 to <35.0, or ≥35.0). The dotted line between categories illustrates an assumed dose-response curve rather than individual data points.



THINKING,
FAST AND SLOW



DANIEL
KAHNEMAN

WINNER OF THE NOBEL PRIZE IN ECONOMICS

System 2

Longer
Surer

de-biasing logical thinking statistical thinking solicit review consider alternatives
suspend judgment REFLECTION get more data formal models

Faster
Looser

norms memorable examples REFLEX assumptions
emotions cognitive heuristics habits coherence

System 1



System 1



Fast



Unconscious



Automatic



Everyday
Decisions



Error prone

System 2



Slow



Conscious



Effortful

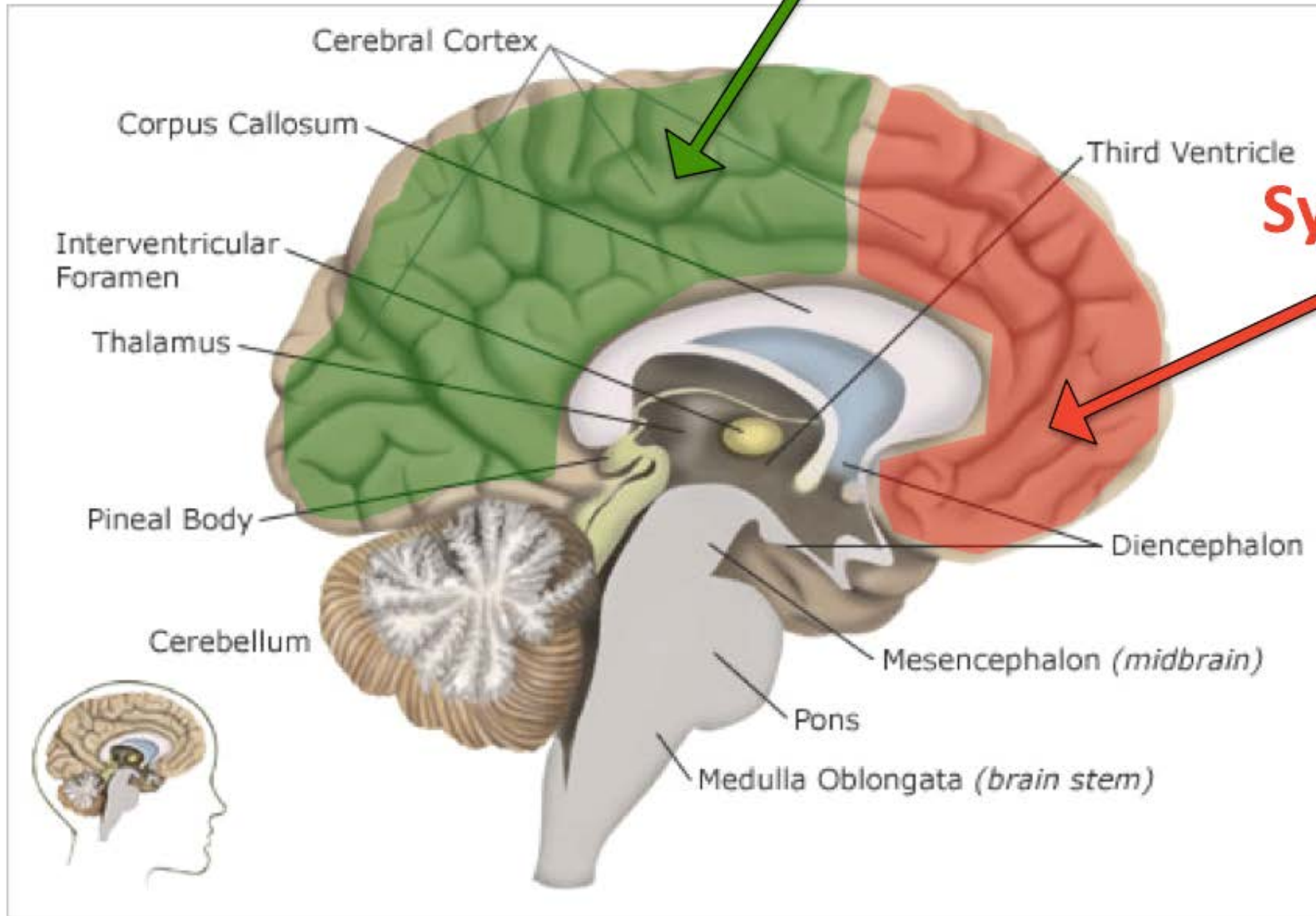


Complex
Decisions



Reliable

System 1



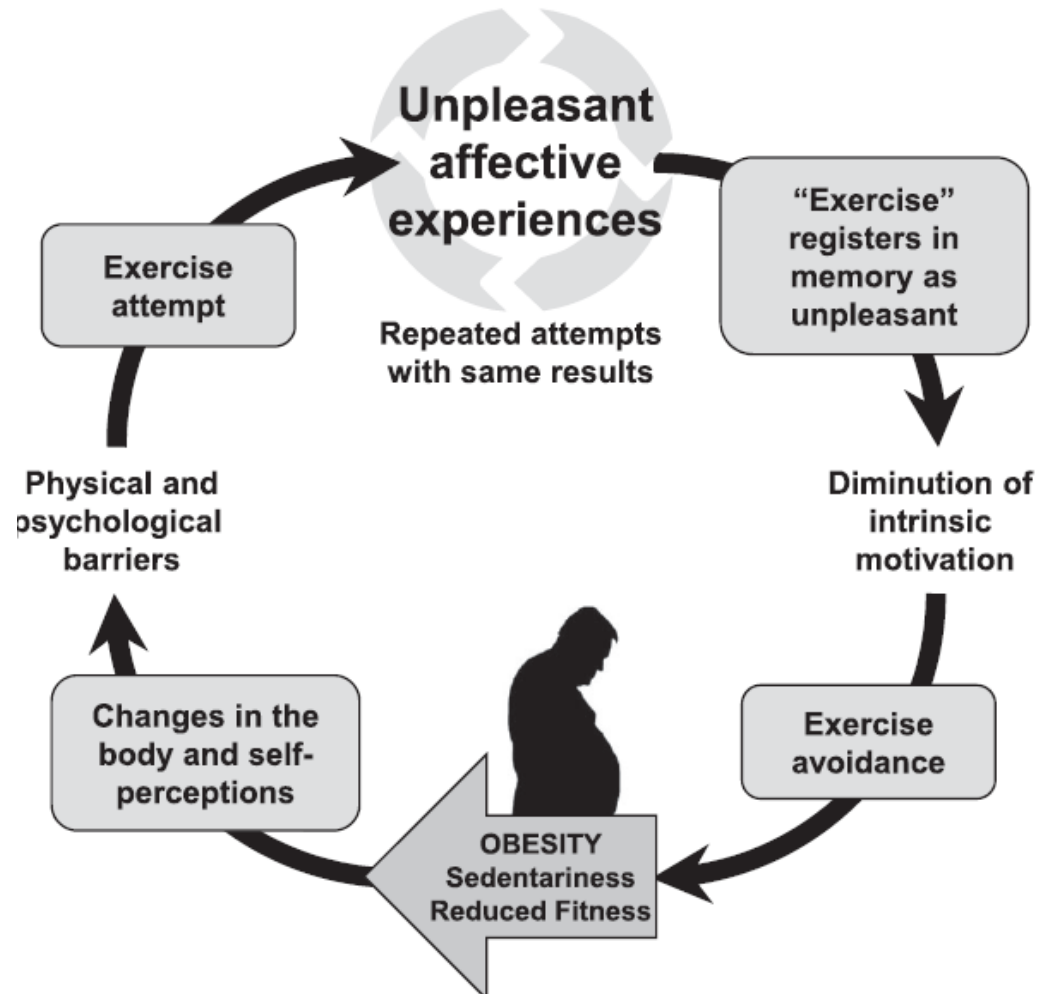
System 2

The mysterious case of the public health guideline that is (almost) entirely ignored: call for a research agenda on the causes of the extreme avoidance of physical activity in obesity

P. Ekkekakis,¹ S. Vazou,¹ W. R. Bixby² and E. Georgiadi³

obesity reviews (2016)

doi: 10.1111/obr.12369



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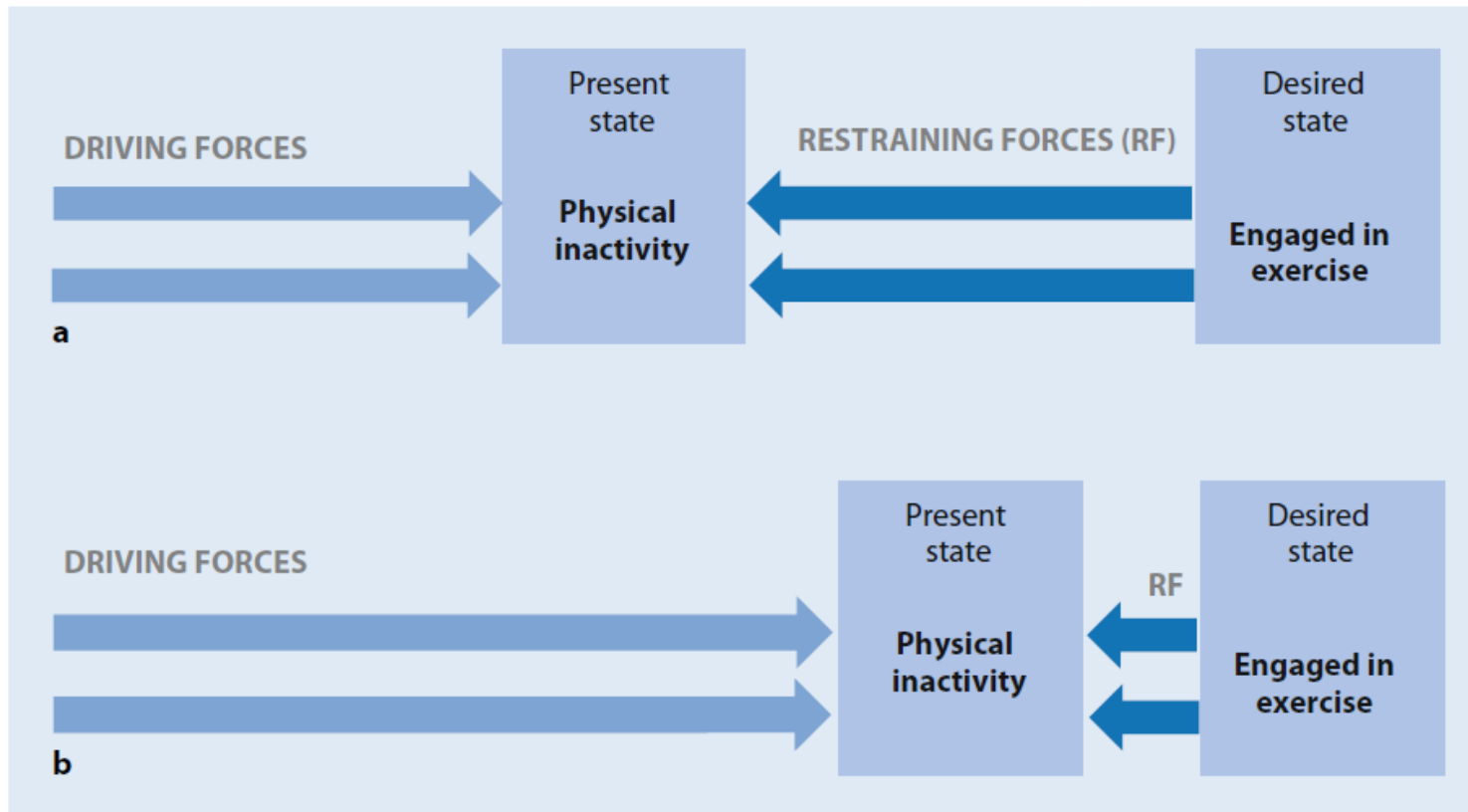
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Affective–Reflective Theory of physical inactivity and exercise

Foundations and preliminary evidence



Ger J Exerc Sport Res

<https://doi.org/10.1007/s12662-017-0477-9>

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Accepted: 16 October 2017

Fig. 1 ◀ An illustration of Lewin's force field analysis as applied to a physically inactive person in quasi-equilibrium between forces driving and restraining him or her from altering this state of physical inactivity (a) or in conditions where transition to exercise-related behavior is more likely (b)

Affective–Reflective Theory of physical inactivity and exercise

Foundations and preliminary evidence

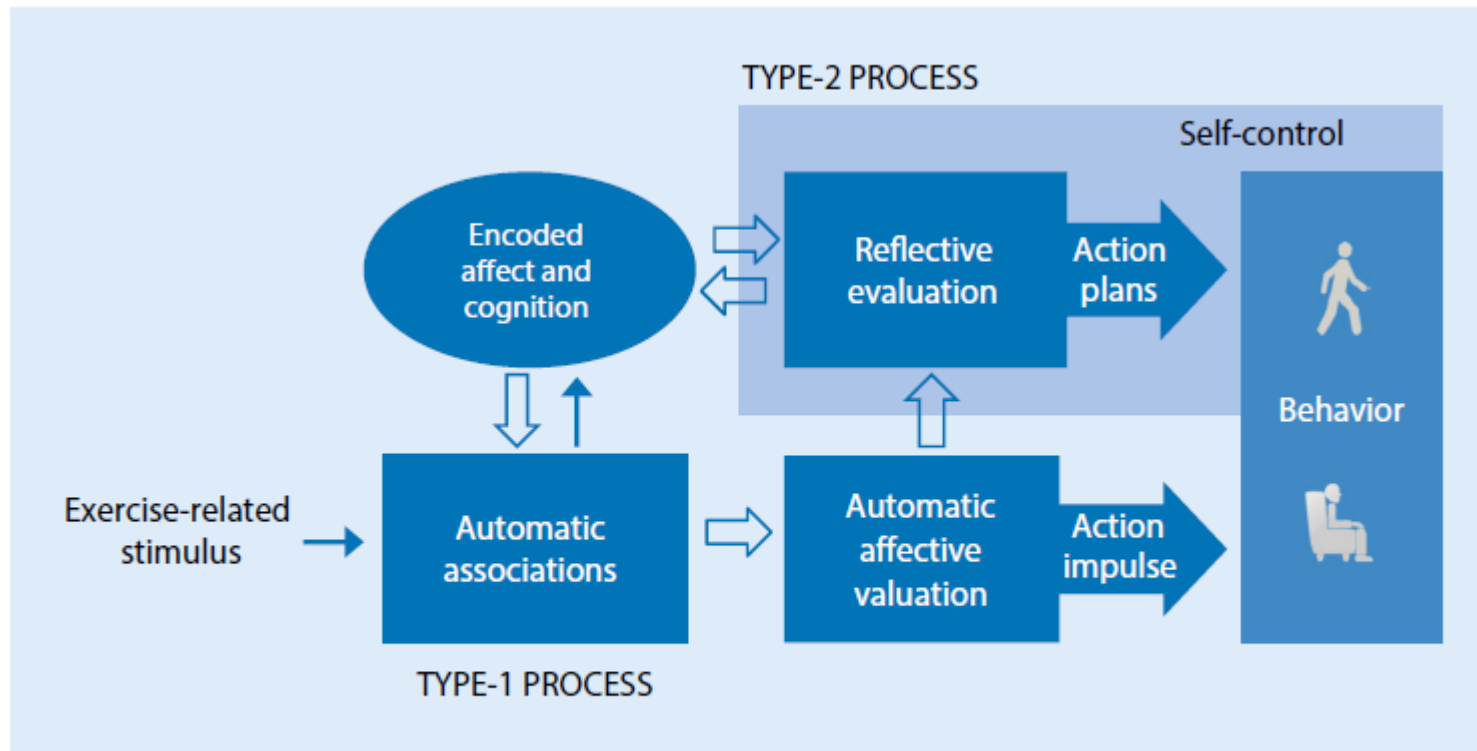


Fig. 2 ▲ Graphical illustration of the Affective–Reflective Theory (ART) of physical inactivity and exercise

Ger J Exerc Sport Res

<https://doi.org/10.1007/s12662-017-0477-9>

Received: 2 June 2017

Accepted: 16 October 2017

What do we need to know as practitioners?

- We need to be extra careful with the exercise intensity we prescribe as practitioners
- Taking on board the current fitness level is the safest way to create a positive affective experience out of every exercise attempt!
- High intensity is not applicable to every individual no matter how frequently s(he) exercises.

COGNITIVE MODELS

Motivation Defined

- Degree of determination, **drive, or desire** with which an individual approaches (or avoids) a behavior.
- **Direction and intensity** of one's effort.
- Origin:
 - Intrinsic: Motivation from within
 - Extrinsic: Motivation from an outside force

Intrinsic & Extrinsic Motivators

Examples of intrinsic and extrinsic motivators for exercise behavior.

INTRINSIC

Fun

Sense of challenge

Personal improvement

EXTRINSIC

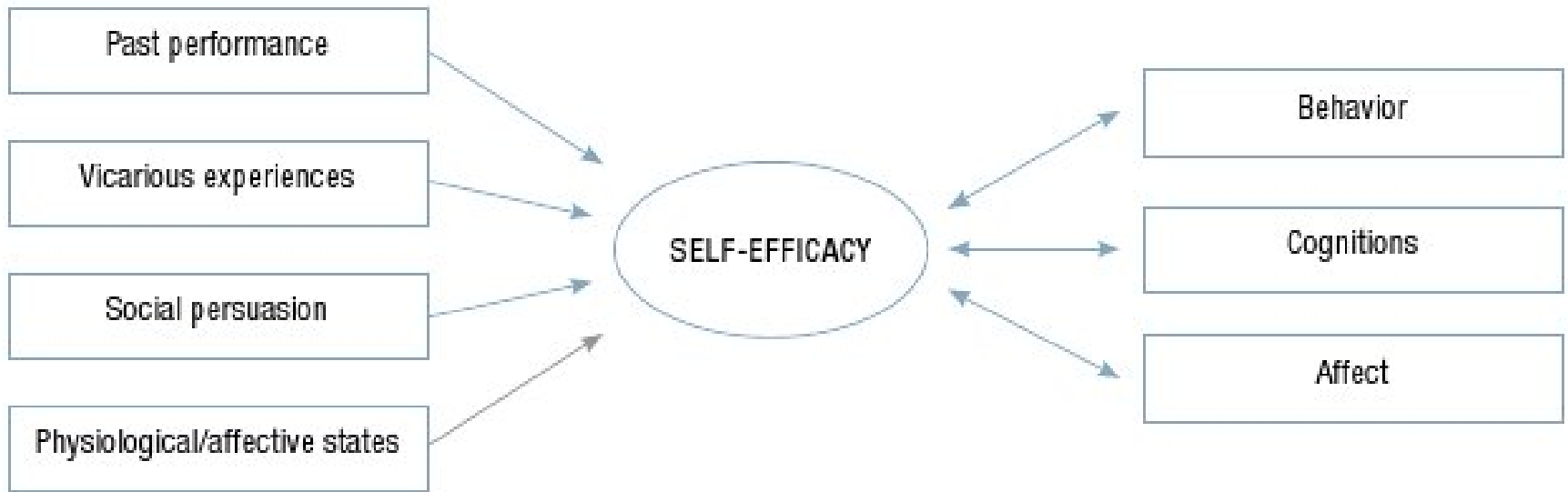
Health (e.g., prevent heart disease)

Social recognition/praise

Tangible reinforcers*

SELF-EFFICACY THEORY OF EXERCISE ADHERENCE

Self-Efficacy Theory



Source: Adapted from Bandura (1986).

Sources of Self-Efficacy

- Past performance accomplishments
- Vicarious experiences
- Verbal persuasion
- Physiological and affective states

Measuring Self-Efficacy

- Assess self-efficacy at different *levels*
- Assess self-efficacy *strength* at each level
- *Specificity*

Example of Measuring Self-Efficacy

- Self-efficacy for jogging (task self-efficacy)

Using the scale below, circle the number that best represents how confident you are that you can jog each of the following distances during a single session without stopping.

	NO CONFIDENCE AT ALL											EXTREMELY CONFIDENT
a. 1 mile	0	10	20	30	40	50	60	70	80	90	100	100
b. 2 miles	0	10	20	30	40	50	60	70	80	90	100	100
c. 3 miles	0	10	20	30	40	50	60	70	80	90	100	100
d. 4 miles	0	10	20	30	40	50	60	70	80	90	100	80
e. 5 miles	0	10	20	30	40	50	60	70	80	90	100	50
f. 6 miles	0	10	20	30	40	50	60	70	80	90	100	10
g. 7 miles	0	10	20	30	40	50	60	70	80	90	100	0
h. 8 miles	0	10	20	30	40	50	60	70	80	90	100	0
i. 9 miles	0	10	20	30	40	50	60	70	80	90	100	0
j. 10 miles	0	10	20	30	40	50	60	70	80	90	100	0

Exercise Barrier Self-Efficacy

Please rate how confident you are that you could exercise under each of the following conditions over the next 4 weeks. Place the appropriate number from the scale below on the line following the statement.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Not at all
confident

Somewhat
confident

Completely
confident

Over the next 4 weeks, I am confident that I could be physically active ...

1. When I am tired. _____
2. During or following a crisis. _____
3. During bad weather. _____
4. When I am anxious or stressed. _____
5. When I am on vacation. _____
6. When there are competing interests (like my favorite TV show). _____
7. When I have a lot of work or schoolwork to do. _____
8. When I haven't reached my exercise goals. _____
9. When I don't receive support from my family or friends. _____

SELF-DETERMINATION THEORY (SDT)

Key Ideas of the SDT

- People seek challenges to satisfy three basic psychological needs:
 1. Self-determination
 2. Competence
 3. Relatedness
- Three *types* of motivation drive behavior:
 1. Intrinsic motivation
 2. Amotivation
 3. Extrinsic motivation

(continued)

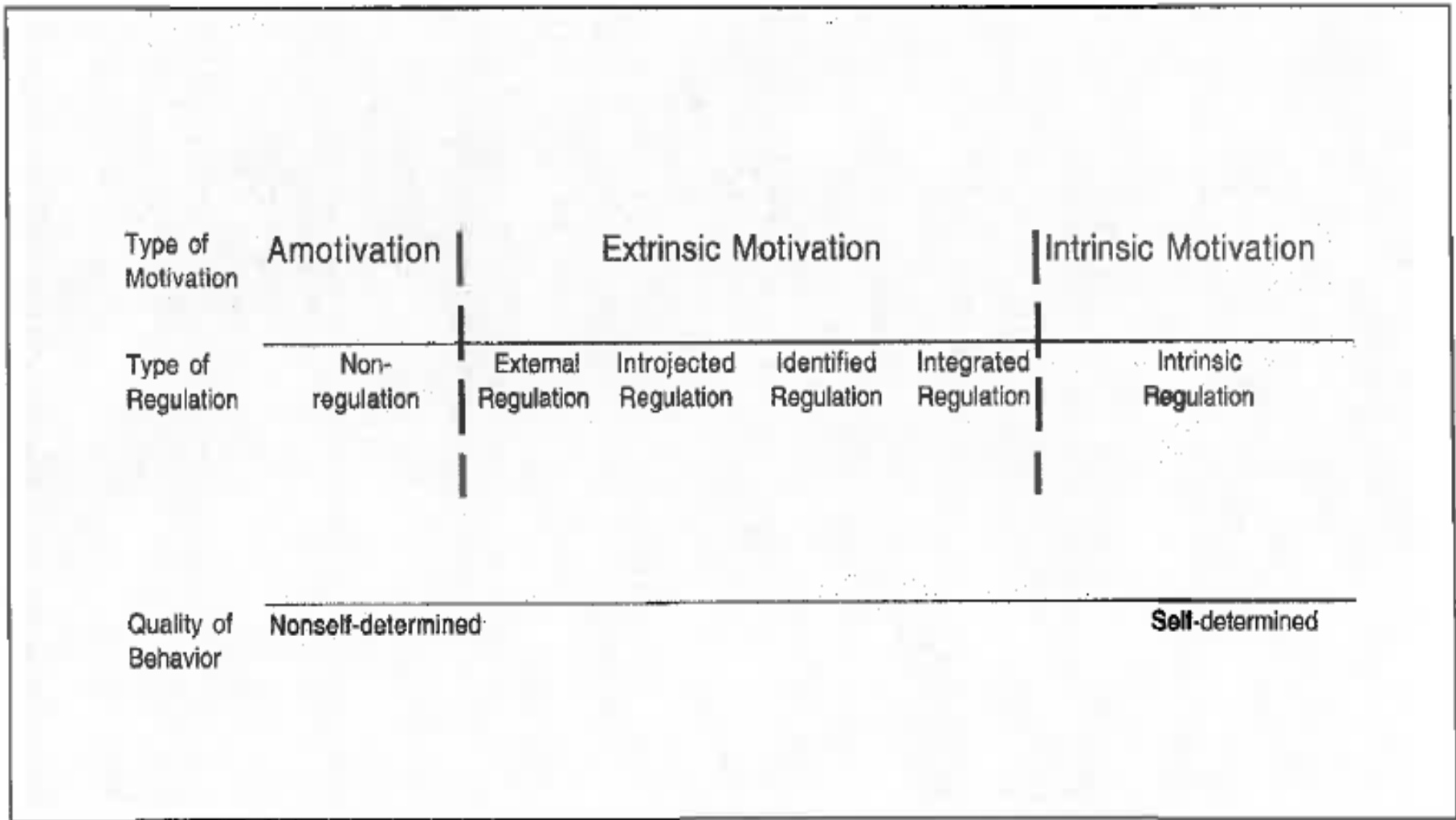


Figure 1.1. The Self-Determination Continuum, with Types of Motivation and Types of Regulation.

Self-Determination Theory



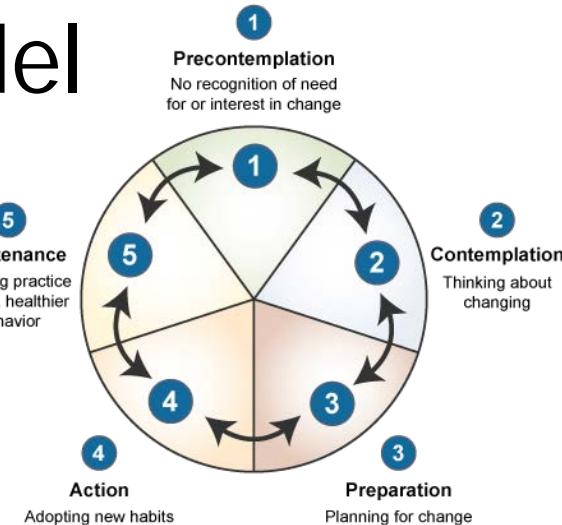
Source: Adapted from Deci & Ryan (1985).

TRANSTHEORETICAL MODEL (TTM)

TTM

- Aiming to influence:
 1. How individuals think about exercise
 2. How individuals feel about themselves
 3. How environment shapes our behaviour

Transtheoretical Model



1.

Precontemplation

- No intention to exercise in the future

2.

Contemplation

- Intentions to start within the next six months

3.

Preparation

- Intention to start in immediate future (in the next month)

4.

Action

- Exercising for less than 6 months

5.

Maintenance

- Exercising for six months (and continuing)

Moving Through the Stages: Processes of Change

- Experiential processes
 - e.g., consciousness raising, self-reevaluation
- Behavioral processes
 - e. g., stimulus control, reinforcement management

Definitions and examples of interventions associated with each of the processes of change in the transtheoretical model.

exhibit 4.2

PROCESS	DEFINITION	INTERVENTION EXAMPLE
Experiential Processes		
Consciousness raising	Seeking new information and a better understanding of exercise	Read pamphlets, talk to a health care professional about the benefits of exercise
Self-reevaluation	Assessing how one thinks and feels about oneself as an inactive person	Consider whether being inactive is truly in line with one's values
Environmental reevaluation	Considering how inactivity affects the physical and social environment	Find out the costs of inactivity to the health care system
Dramatic relief	Experiencing and expressing feelings about becoming more active or remaining inactive through exercise	Imagine the feelings of regret and loss for not having prevented the loss of health
Social liberation	Increasing awareness of the social and environmental factors that support physical activity	Seek out information about exercise groups and resources in the community, workplace, etc.
Behavioral Processes		
Self-liberation	Engaging in activities that strengthen one's commitment to change and the belief that one can change	Announce one's commitment to exercise to family and friends; stay positive and remind oneself "I can do it!"
Counterconditioning	Substituting physical activities for sedentary activities	Go for a walk after dinner rather than watch television
Stimulus control	Controlling situations and cues that trigger inactivity and skipped workouts	Plan ahead for a busy period at work/school and schedule exercise on a calendar
Reinforcement management	Rewarding oneself for being active	Establish goals and reward oneself for achieving them
Helping relationships	Using support from others during attempts to change	Buddy up with a friend who is also trying to start an exercise regimen

Indications of behaviour change

- Shifts in decision balance sheet (prons vs. cons)
- Increases in Self-efficacy

Pros (Advantages) and Cons (Disadvantages) of a Health-Related Behavior: The Example of Exercise

Pros

- I would be healthier if I exercised more regularly.
- I would feel better about myself if I exercised more regularly.
- Other people would respect me more if I exercised more regularly.

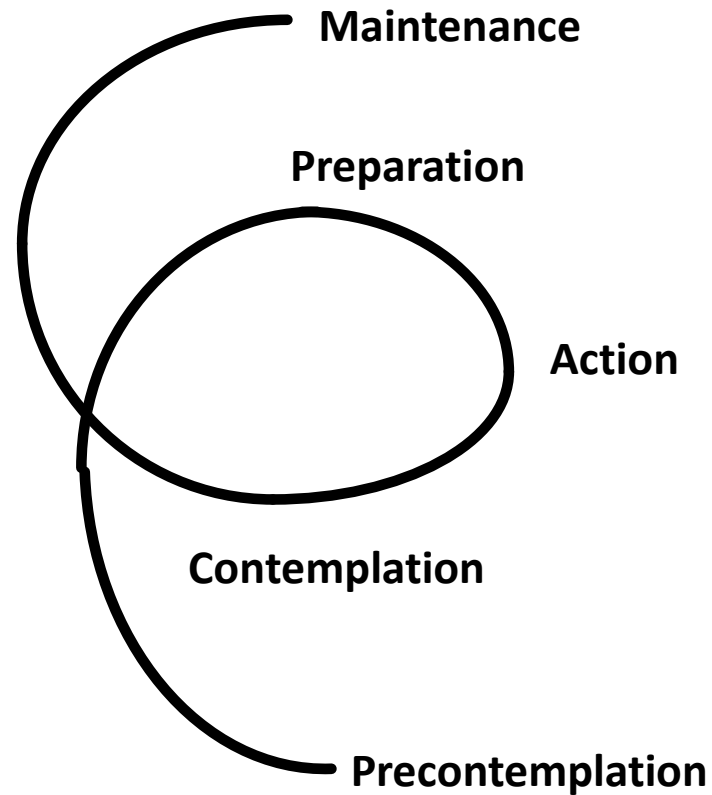
Cons

- I would probably be sore and uncomfortable if I exercised more regularly.
- If I exercised more regularly, my family and friends would get to spend less time with me.
- I would feel that I was wasting my time if I exercised more regularly.

Defining stages of the Transtheoretical Model (TTM)

Stage	Meeting criterion level of physical activity?	Current Behaviour	Intention to meet criterion level of physical activity?	Practical label
Precontemplation	×	Little or no physical activity	×	'I won' t' or 'I can' t'
Contemplation	×	Little or no physical activity	✓	'I might'
Preparation	×	Small changes in physical activity	✓	'I will'
Action	✓	Physically active for less than 6 months	✓	'I am'
Maintenance	✓	Physically active for more than 6 months	✓	'I have'

Cyclical stages of behaviour change



Questions for estimating SES

Questionnaire for determining a person's current exercise stage.

“Regular exercise” is any planned physical activity (e.g., brisk walking, aerobics, jogging, bicycling, swimming, rowing, etc.) performed to increase physical fitness. Such activity should be performed three to five times per week for 20 to 60 minutes per session.

DO YOU EXERCISE REGULARLY ACCORDING TO THAT DEFINITION?

- 1. Yes, I have been exercising regularly for **MORE** than six months.
- 2. Yes, I have been exercising regularly for **LESS** than six months.
- 3. No, but I intend to start exercising regularly in the next 30 days.
- 4. No, but I intend to start exercising regularly in the next six months.
- 5. No, and I do **NOT** intend to start exercising regularly in the next six months.

Results

If you checked the last box, you are in the precontemplation stage.

If you checked the fourth box, you are in the contemplation stage.

If you checked the third box, you are in the preparation stage.

If you checked the second box, you are in the action stage.

If you checked the first box, congratulations! You are in the maintenance stage.

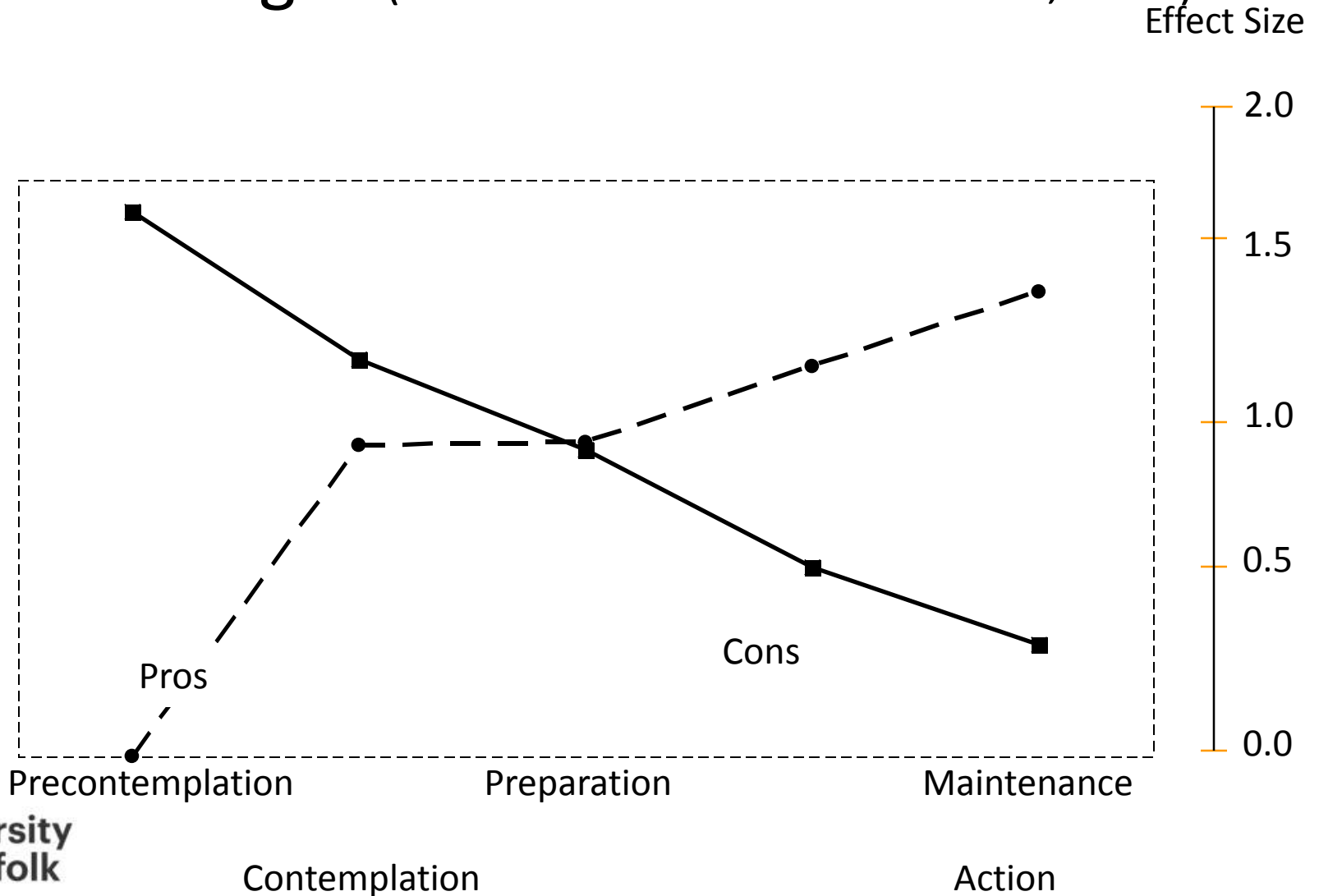
Source: Adapted from the Exercise: Stages of Change—Short Form. Available at www.uri.edu/research/cprc/

Example items assessing decisional balance ('pros' and 'cons') for exercise (Marcus and Owen, 1992).

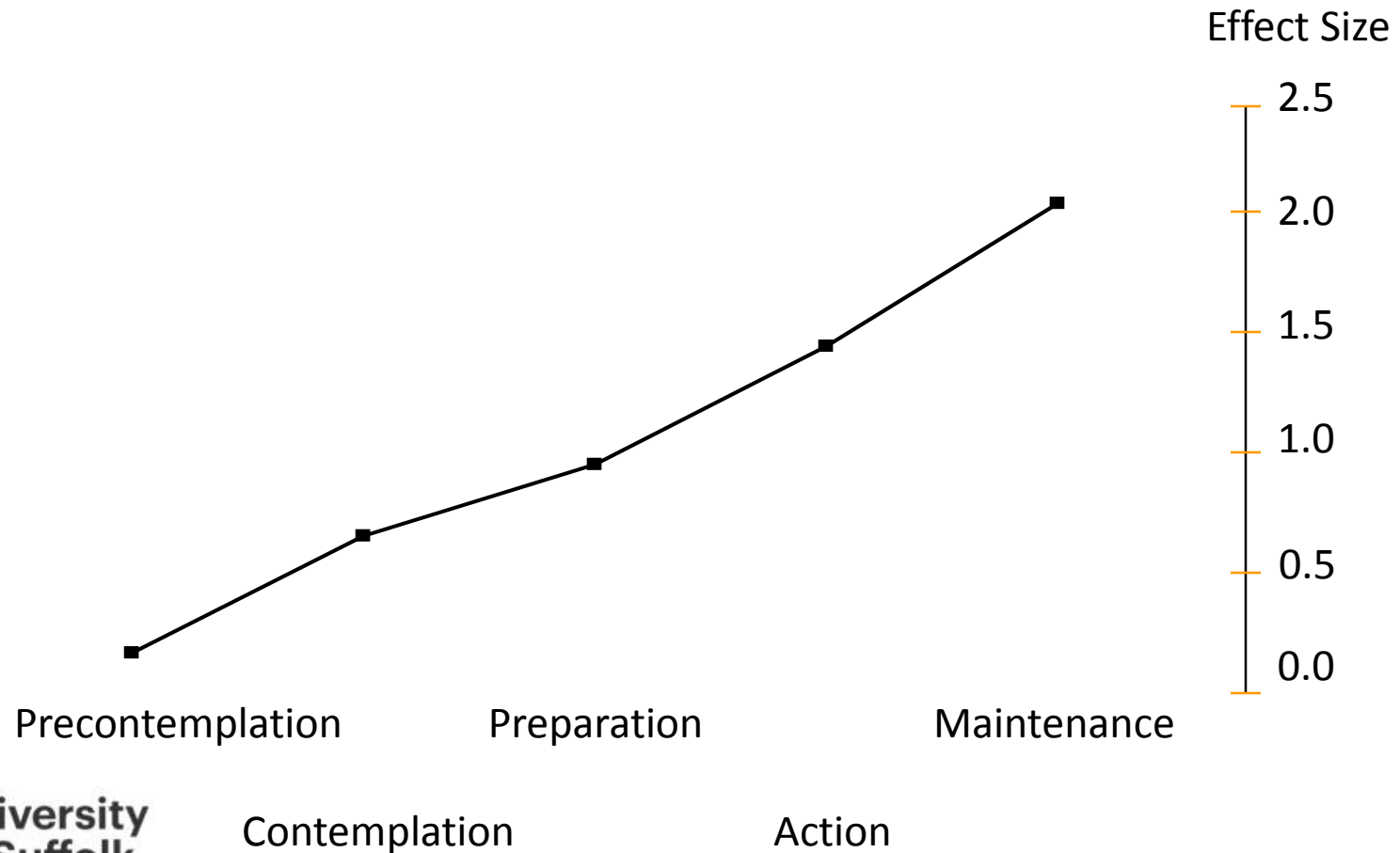
A 5-point Likert scale is used to score responses (not at all important = 1 to extremely important = 5).

- 1 I would be healthier if I exercised regularly
- 2 I would feel better about myself if I exercised regularly
- 3 Other people would respect me more if I exercised regularly
- 4 My family and friends would get to spend less time with me if I exercised regularly
- 5 I would feel that I was wasting my time if I exercised regularly
- 6 I would probably be sore and uncomfortable if I exercised regularly

Changes or differences in pros and cons across stages (data from Marshall and Biddle, 2001)



Changes or differences in self-efficacy across stages (data from Marshall and Biddle, 2001)



Types of Adherence and Compliance *(continued)*

Table 8.1 Behavioral Examples of Exercise Noncompliance

Type of compliance	Behavioral example
Noncompliance Person chronically underuses an exercise program.	Person is given an exercise prescription but fails to initiate a program, completes only part of the program, or begins the program and then quits.
Erratic noncompliance Person claims to be too busy, forgetful, or stressed or experiences a sudden problem.	Person fails to incorporate exercise as part of a daily routine, is physically uncomfortable performing physical activity, or considers exercise to be one more thing to do rather than a stress reliever.
Unwitting noncompliance Person does not complete a prescribed or expected protocol.	Person misunderstands the task or instructions; exercises incorrectly, often resulting in poor outcomes (e.g., no weight loss, minimum fitness gains); is unable to travel to an exercise facility; experiences injury or pain; cannot afford fitness equipment or club membership; or lacks social support.
Intentional noncompliance Person no longer feels the need to exercise, fears injury or discomfort, dislikes exercise, refuses to change lifestyle, or denies exercise benefits.	Person resists starting or maintaining an exercise program despite suggestions from a medical or fitness specialist and generates reasons for not exercising.

Measuring Adherence

1. **Appointment attendance**: Who fails to attend prearranged appointments or programs.
2. **Detecting** non-responders: Determine if client is properly following the program.
3. **Self-report**: Asking non-responders about their adherence.

Ways to Determine Adherence

1. **Attendance** at predetermined events (e.g., exercise class, appointments, meetings)
2. **Self-report** (i.e., the person indicates own adherence to the program)
3. **Record keeping**, in which the person completes an attendance chart, monitoring progress

(continued)

Ways to Determine Adherence

(continued)

4. **Testing** (e.g., lipids profile, aerobic or strength fitness testing)
5. Number of **contacts** with staff or coaches
6. Number of **appointments** kept
7. **Interviews** with others with whom the person usually keeps in contact (e.g., peers, family members, other professionals, other program attendees)

(continued)

Ways to Determine Adherence

(continued)

8. **Electronic** methods (e.g., Internet, iPods, texting)
9. **Pedometers** (recording step counts)
10. **Accelerometers** (recording step counts and speed)
11. **Heart rate** monitors

E-Health Technology

- Using the Internet as a source of health information and behavior
- Defined as applying Internet and related technologies to improve the access, efficiency, effectiveness, and quality of clinical practice used by organizations, practitioners, and consumers to improve and maintain good health

www.Exerciseismedicine.org

Six Steps to Achieving Exercise Adherence

1. Have **realistic** expectations and be patient.
2. **Do not** focus on body weight.
3. Receive **instruction** on proper ways to exercise.
4. **Schedule** exercise times and places.
5. Create a **social support** network.
6. Feel a sense of **achievement**.

DO's and DON'Ts for promoting PA

- Do:
 - Emphasize **personal** mastery
 - Promote perceptions of **choice**
 - Promote intrinsic fun and **excitement** of exercise
 - Promote a sense of **purpose** by teaching the value of PA for optimal function and quality of life
- Don'ts:
 - Overemphasise peer **comparison**
 - Misuse **extrinsic** motivation
 - Turn exercise into a *chore* or a bore
 - Create **amotivation** by spreading fitness misinformation