

L'exercice physique pour redynamiser l'interception dans les troubles liés à l'utilisation de substances

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Physical exercise as an intervention for treating addictions?

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It has been theorized that physical exercise could be used as an **adjunct intervention** in substance use disorders (SUD):

- ⇒ To **attenuate the response to stressors** increasing consumption urge (e.g., psychosocial stressors).
- ⇒ To generate a response of the reward system, offering an **alternative to the rewarding effect** previously produced by substance consumption.

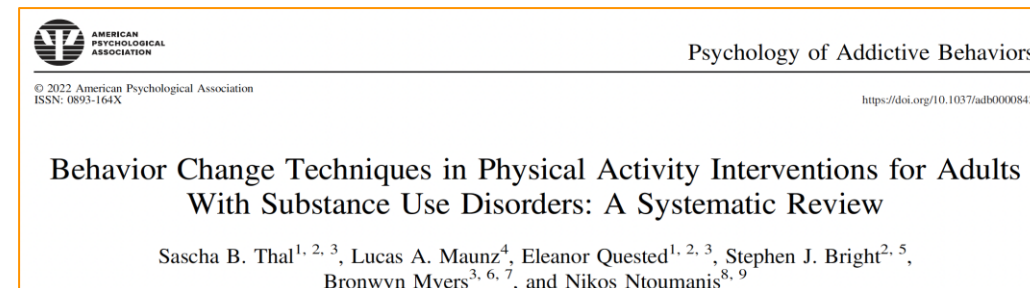
Physical exercise as an intervention for treating addictions?

Meta-analyses indicate that the **efficacy** of physical exercise interventions is **currently limited**:

- ⇒ only acute effects on the urge to consume.
- ⇒ short term impacts in substance use reductions and abstinence rates.
- ⇒ high levels of dropout rates (25%–40%).

To **identify new components** of physical exercise interventions that can significantly increase their impact on treatment outcomes.

Physical exercise interventions in substance use disorders is increased by **adding components that help individuals to regulate their behaviors while exercising**.



Physical exercise as an intervention for treating addictions?

To capitalize on mismatches between anticipated and experienced bodily states

Craving as a mismatch between current and desired bodily states

The (transient) unavailability of reward is felt physiologically through negatively valenced feelings (e.g., frustration) or tensions which, pushing him/her to use the drug.

There is a **discrepancy** between the current bodily state and the bodily state that will result from substance consumption.

This **mismatch between current and desired bodily states** leads to aversive interoceptive states, which progressively force the individual to explore the environment to get the substance.

ANNALS OF THE NEW YORK ACADEMY OF SCIENCES

Issue: *The Year in Cognitive Neuroscience*

The insula: a critical neural substrate for craving and drug seeking under conflict and risk

Nasir H. Naqvi,¹ Natassia Gaznick,² Daniel Tranel,^{2,3} and Antoine Bechara^{2,4}

Mismatches between predicted and actual bodily states during abstinence

- When it comes to individuals **aiming at reducing or stopping their consumption**, due to their **memories of withdrawal**, craving is often perceived as implying overwhelming and uncontrollable bodily sensations.
 - However, daily-life craving states are **not usually experienced as intense** by quitting-motivated users.
 - The urge to consume **is also stronger** in current than in past-consumers.
- ⇒ There appears to be a **mismatch of intensity** between the anticipation and the actual experience of craving in individuals aiming at reducing or stopping their consumption.
- ⇒ This might lead current users to **overestimate** how difficult it will be for them to resist the desire to consume, which could ultimately increase the resistance to change.



Physical exercise as an intervention for treating addictions?

To capitalize on mismatches between anticipated and experienced bodily states

The impact of mismatches between anticipated effort and experienced effort on the level of pleasure experienced during physical exercise

The perception of physical effort as a mismatch between current and desired bodily states

Modulation in exercise intensity is closely conditioned by afferent feedback from the body (i.e., a feedforward mechanism), but also by the anticipated duration of exercise, i.e. *teleoanticipation* processes.

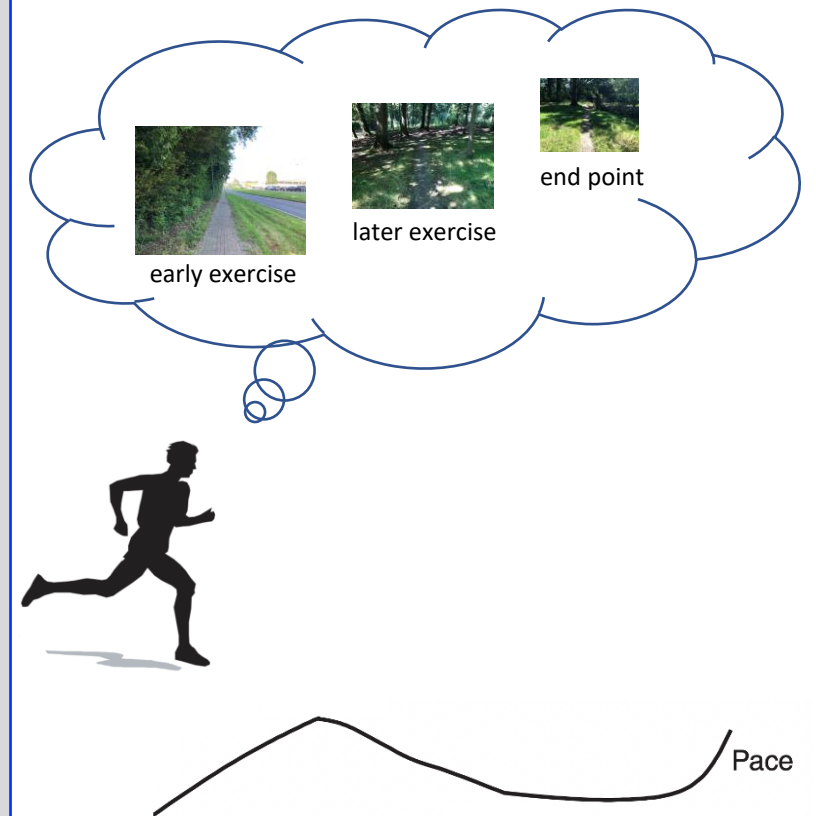
This dynamic usually result in *pacing strategies* (i.e., effort management across an exercise bout) to prevent from metabolic and biomechanical failures while exercising (e.g., fatigue accumulation, slower rates of neuromuscular recovery).

A key aspect in the perception of physical effort is thus the continuous processing of bodily-oriented *prediction errors*.

- ⇒ It refers to the difference between values of anticipated and actual interoceptive states.
- ⇒ e.g., experiencing *unexpected* weakness in the beginning of a running session would generate a strong prediction error, which will serve as a signal to the brain to adjust the speed of the run.

The Role of Information Processing Between the Brain and Peripheral Physiological Systems in Pacing and Perception of Effort

Alan St Clair Gibson,^{1,2} Estelle V. Lambert,¹ Laurie H.G. Rauch,¹ Ross Tucker,¹ Denise A. Baden,³ Carl Foster⁴ and Timothy D. Noakes¹



Mismatches between predicted and actual bodily states in individuals with low fitness levels

Few studies have examined prospective physical exertion and its **alignment** with experienced physical exertion.

Preliminary evidence revealed that the **overestimation** of an anticipated physical effort is associated to lower frequency of physical exercise, negative attitudes about exercise, higher body mass index, as well as poor cardiorespiratory fitness (for a review, see Haile et al., 2015).

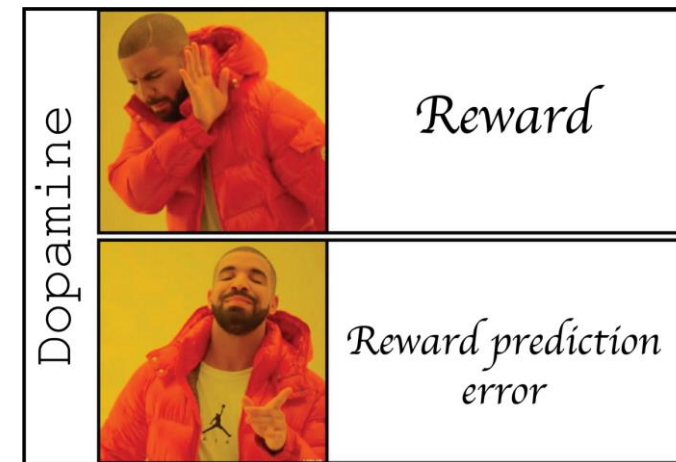
There is a negative relationship between physical exertion and affective/pleasure responses (e.g., Ekkakakis et al., *Sports Medicine*, 2011).

The usefulness of examining prospective thinking of physical exercise: prediction error as a key marker

Mismatches between the intensity of anticipated effort and actual effort generate *prediction error* signals that constitute key inputs for the pleasure experienced during physical exercise.

⇒ *Positive prediction error*: physical exercise sessions that are less effortful than predicted should induce higher level of *experienced pleasure* during physical exercise.

⇒ *Negative prediction error*: physical exercise sessions that are more effortful than predicted should decrease the level of *experienced pleasure*.



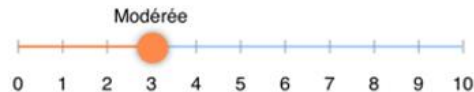
A snapshot of Reward Prediction Error Models

Do error predictions of physical exertion inform on the level of pleasure while running?

A.

< Back Début de session

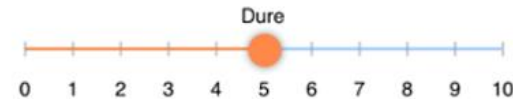
✓ Quelle intensité d'effort t'attends-tu à ressentir lors de cette session ?



B.

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✓ Quelle a été l'intensité d'effort ressenti durant ta session?



✓ Quel a été le plaisir ressenti durant ta session ?

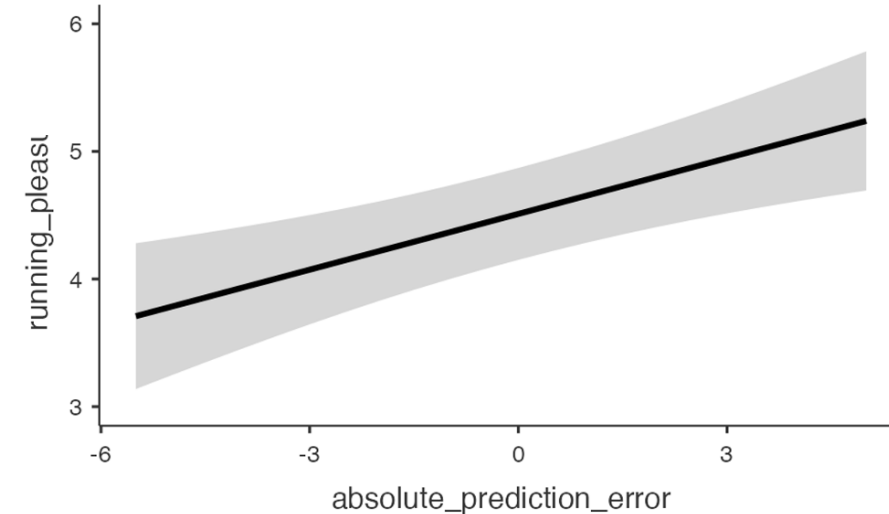


C.

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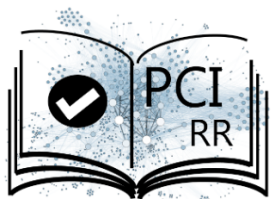


Duration	33:10.4
Average speed	7.42 km/h
Total distance	4.10 km
Calories burned	564
Max heart rate	204 bpm
Avg heart rate	162 bpm



$$\text{running_pleasure} \sim 1 + \text{absolute_prediction_error} + \text{distance} + \text{average_speed} + (1 + -\text{absolute_prediction_error} | \text{participants})$$

STAGE 2



Do prediction errors of perceived exertion inform the level of running pleasure?

Damien Brevers, Guillaume Martinent, İrem Tuğçe Öz, Olivier Desmedt, Bas de Geus

<https://osf.io/4t8xn>

version 1

READ REPORT ON SERVER

This is a stage 2 based on:

Do error predictions of perceived exertion inform the level of running pleasure?

Damien Brevers, Guillaume Martinent, İrem Tuğçe Öz, Olivier Desmedt, Bas de Geus

<https://osf.io/y8d9m>

Status: **RECOMMENDED**

Physical exercise as an intervention for treating addictions?

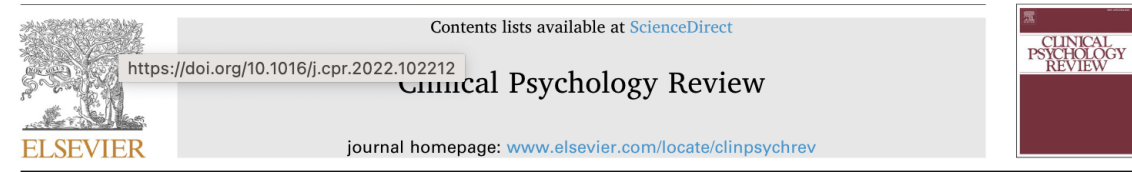
To capitalize on mismatches between anticipated and experienced bodily states

The impact of mismatches between anticipated effort and experienced effort on the level of pleasure experienced during physical exercise

Perspectives for psychological interventions

Training the « know-how reflectivity »

- To develop and test programs that help individuals to find the **optimal mindset** toward exercising:
 - Most individuals with SUD who initiate an exercise program do so after long periods of sedentary living, potentially coupled with a low level of cardiorespiratory fitness and high bodyweight, but also with the physical consequences of their SUD.
- **Expectation violation** intervention to increase **self-efficacy** toward physical exercise:
 - Expectation violation is a psychological intervention that requires individuals to focus on the inconsistencies between the expectation and the actual experience .
 - Individuals with high level of self-efficacy look at difficulties (here: a negative prediction error) as challenges rather than threats.
 - Building physical exercise programs centered on expectation violation should increase the level of self-efficacy toward physical exercise by challenging the fact that physical exercise should be inherently linked to a pleasurable experience (the universal “feel better” effect of exercise).



Review

Using expectation violation models to improve the outcome of psychological treatments

Winfried Rief^{a,*}, Matthias F.J. Sperl^{a,b,1}, Kristina Braun-Koch^a, Zahra Khosrowtaj^a, Lukas Kirchner^a, Leonora Schäfer^a, Rainer K.W. Schwarting^a, Sarah Teige-Mocigemba^a, Christian Panitz^{a,c,d}



To conclude ...

Applying PE programs to SUD should benefit from implementing prospective, momentary, and retrospective effort/pleasure intensity ratings.

⇒ This dynamic should help to increase the adherence to PE and, therefore, lead individuals with SUD to further experience the physiological and psychological benefits of PE.

⇒ Applying expectation violation intervention should help could lead individuals with SUD to face the fear and avoidance toward future states of craving.

REVIEW ARTICLE

Physical Exercise to Redynamize Interoception in Substance use Disorders

Damien Brevers^{1,2,*}, Joël Billieux^{3,4}, Philippe de Timary^{1,5}, Olivier Desmedt³, Pierre Maurage¹, José Cesar Perales⁶, Samuel Suárez-Suárez^{1,7} and Antoine Bechara⁸



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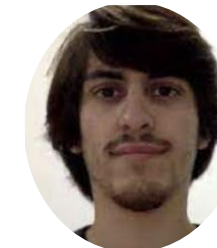
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Antoine Bechara

Looking forward to new collaborations 😊

Thank you for your attention !

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