Peer Community In Neuroscience

Relationship between age and physical and sedentary stimuli.

Florent Lebon ⓘ *based on peer reviews by* *Lilian Fautrelle* ⓘ *and 1 anonymous reviewer*

Up to now, the automatic approach-avoidance tendency towards physical activity and sedentary stimuli has been studied in various categories of the population. Previous studies showed faster reaction times (RTs) when approaching physical activity stimuli and avoiding sedentary stimuli, especially in healthy young individuals (Cheval et al., 2014; Locke & Berry, 2021). However, the whole spectrum of adulthood has never been tested within the same experiment.

A first strength of the study of Farajzadeh et al. (2023) is that they constructed an online paradigm and analyzed the results of 130 participants aged between 21 and 77 years. It should be noted that this study has been pre-registered (https://doi.org/10.17605/OSF.IO/7GXZR). Overall the authors performed the experiment as first described. They updated their a priori power analysis, including the highest number of predictors (six tested predictors including two interaction effects and a total of eleven predictors). This increased the planned number of participants recruited from 85 to 144. Also, in addition to planned hypotheses, exploratory analyses were conducted to test whether automatic approach-avoidance tendencies toward physical activity and sedentary behaviors were associated with explicit attitudes and the intention to be physically active across aging.

The authors recorded RTs and errors when participants had to approach/move an avatar towards/away from physical activity and sedentary stimuli.

Another strength lies in data analysis and statistical design. To avoid any misinterpretation of the results, which could arise from an increase in RTs relative to age, the authors had the foresight to measure RTs when approaching/avoiding neutral stimuli (ellipses and rectangles).

Taking into account such individuals differences, Farajzadeh et al. confirmed a main tendency to approach physical activity stimuli and to avoid sedentary stimuli throughout the lifespan.

When the participants considered physical activity as the most pleasant and enjoyable (explicit affective attitude toward physical activity), the RTs were shorter when approaching physical activity and avoiding sedentary stimuli, irrespective of age. However, the intention to be physically active did not influence the individual's RTs.

Altogether, the study by Farajzadeh et al. suggests that age and explicit attitudes modulate the time to respond to physical activity and sedentary stimuli.

References:

Cheval, B., Sarrazin, P., and Pelletier, L. (2014). Impulsive approach tendencies toward physical activity and sedentary behaviors, but not reflective intentions, prospectively predict non-exercise activity thermogenesis. PLoS One, 9(12), e115238. https://doi.org/10.1371/journal.pone.0115238

Farajzadeh, A., Goubran, M., Beehler, A., Cherkawi, N., Morrison, P., de Chanaleilles, M., Maltagliati, S., Cheval, B., Miller, M.W., Sheehy, L., Bilodeau, M., Orsholits, D., and Boisgontier, M.P. (2023) Automatic approach-avoidance tendency toward physical activity, sedentary, and neutral stimuli as a function of age, explicit affective attitude, and intention to be active. MedRxiv. https://doi.org/10.1101/2022.09.05.22279509

Locke, S. R., and Berry, T. R. (2021). Examining the relationship between exercise-related cognitive errors, exercise schema, and implicit associations. Journal of Sport and Exercise Psychology, 43(4), 345–352. https://doi.org/10.1123/jsep.2021-0031

Reviews

Evaluation round #2

DOI or URL of the preprint: https://doi.org/10.1101/2022.09.05.22279509
Version of the preprint: 2

Authors' reply, 31 January 2023

Download author's reply

Decision by Florent Lebon ⓘ, posted 24 January 2023, validated 24 January 2023

Second revision - minor comments

Dear Dr Boisgontier,

I thank you for the point-by-point responses and the revised version of the manuscript.

While you provided all the information to respond to the reviewers' comments and mine, and you changed the manuscript accordingly, I noticed a few mistakes in the new version. Also, I think the first paragraph of the discussion could be revised to match the main results of the study (as you already did for the abstract).

Please find my comments below:

- "A total of 21,266 observations was included in the logistic mixed-effects models that had error as outcome (5,654 observations for physical activity stimuli; 5,644 observations for sedentary stimuli; 9,968 observations for neutral stimuli)."

This is unclear whether this number of observations include both error and non-error trials or only error trials (which would be surprising considering the total number of RT trials)

- Typo: "Explicit affective attitude toward physical activity decreased with aged" and "The intention to be physically active decreased with aged"

- "Model 2 (outcome = reaction time) showed a significant interaction effect between age and action direction on error". It should be reaction time instead of error.

- "From age 36 to 57, reaction times to approach and avoid neutral activity stimuli were not statistically different". It should be error instead of reaction time

- "Our results show faster reaction times and fewer errors when approaching compared to avoiding physical activity stimuli before 45 years of age. After this age, reaction times are faster when avoiding compared to approaching sedentary stimuli after this age. These results suggest a tendency to approach physical activity stimuli in younger adults and a tendency to avoid sedentary stimuli older adults."

You should be more cautious when starting the discussion section, as these results correspond to uncorrected data. You should make it clearer or match the main results they reported in the abstract.

I'm looking forward to your responses, before proceeding to the final stage of the recommendation.

Best regards
Florent Lebon

Evaluation round #1

DOI or URL of the preprint: **https://doi.org/10.1101/2022.09.05.22279509**

Authors' reply, 18 January 2023

Download author's reply

Decision by **Florent Lebon** , posted 21 November 2022, validated 24 November 2022

Moderate revisions needed

Dear Ata and Matthieu,

I received the report of 2 independent reviewers. They both raised the importance and the rigor of this study, which has been pre-registered.

As suggested by both reviewers, I would recommend to revise the introduction section, by taking into account the previous literature that also makes sense to you and to deal with the affective and motivational perceptions relative to the practice of physical activity.

In order to gain in visibility (especially for readers who are not in the approach-avoidance field), could you clarify specific points in the method and statistical sections? Especially, how was measured the reaction time and what were the instructions for the participants? Regarding the age factor, did the authors split the group in 3 or in 2 (below and above 45 years old)?

As a suggestion (I leave it to the authors to decide whether it is relevant and feasible), I would propose to adopt another structure of the paper. Instead of having the classical structure (Intro, Material & Method, Results and Discussion), the authors could adopt the following structure: Intro, Result/Discussion (which quickly present the method), and Material & Method (in details). So that the readers focus on the main results and their interpretation, then go to the Method section whether they want to fully understand the statistical analysis.

Best regards,
Florent Lebon

Reviewed by anonymous reviewer 1, 30 October 2022

I appreciate all the words, effort, and manuscript. My comments concern adding psychology literature.
Abstract
Please report statistics to help the reader understand the meaningfulness of the differences. There is much to digest in your abstract. The sentences with the 'but' are confusing as we are on track but then we are not. Hence, statistics I believe will be of assistance to abstract readers.
Introduction
I am in psychology. Hence, I wonder if you need to mention implicit self-theories (e.g., Dweck's work) and approach-avoidance (for instance Elliot (1999) is a great review. Then you have Elliot and Thrash's work with approach-avoidance constructs. It seems implicit self-theories and approach-avoidance personalities or dispositions influence automatic approach-avoidance tendencies. Elliot works seems appropriate somewhere in your manuscript. The Lochbaum et al. (2020) meta-analysis links approach-avoidance goals to objective and subjective physical activity measures.
Elliot, A. J. (1999). Approach and avoidance motivation and achievement goals. Educational Psychologist, 34(3), 169–189. https://doi.org/10.1207/s15326985ep3403_3
Elliot, A. J., & Thrash, T. M. (2002). Approach-avoidance motivation in personality: Approach and avoidance temperaments and goals. Journal of Personality and Social Psychology, 82(5), 804–818. https://doi.org/10.1037/0022-3514.82.5.804
Lochbaum, M.; Zanatta, T.; Kazak, Z. The 2 × 2 Achievement Goals in Sport and Physical Activity Contexts: A Meta-Analytic Test of Context, Gender, Culture, and Socioeconomic Status Differences and Analysis of Motivations, Regulations, Affect, Effort, and Physical Activity Correlates. Eur. J. Investig. Health Psychol. Educ. 2020, 10, 173-205. https://doi.org/10.3390/ejihpe10010015
The Zenko & Ekkekakis and then David Conroy's work makes sense to me as included. Again, there is more out there. I do understand you are assessing automatic approach-avoidance tendencies.
Limitations
Here you can mention the psychology works and the measures. You could suggest the measures in future in future work of this nature.

Reviewed by Lilian Fautrelle ⦿, 03 October 2022

This study investigates the approach-avoidance tendencies toward pictograms of physical activity or sedentary behaviours. This very substantial work explores these conducts and their evolutions according to the ages and the lifestyles of the participants.

To do so, and this is a strong point, the authors collected and analysed using mixed-effects models the reaction times as well as the participant's failed trials. Participants (n=130, [21:77] years old) were categorized in three age classes: younger, middle-aged and older adults. They self-reported the level of their physical activity lifestyle and their intention to be active. Their Body Mass Index was also filled in.

The results highlighted faster reaction times coupled with fewer failed trials in approach behaviours compared to avoidance tendencies toward physical activity stimuli before 45 years old. For participants over

45 years old, the authors reported faster reaction times when performed avoiding behaviors compared to approach behaviors toward sedentary stimuli. This result suggested a tendency to approach physical activity stimuli in younger and to avoid sedentary stimuli in older adults. To go further, the authors revealed throw exploratory analyses that these tendencies toward physical activity were strongly associated with explicit physically active behaviors. At the opposite, no significant association with the intention to be physically active were highlighted.

First of all, this study appears to me well conducted without ethics or scientific misconducts nor conflicts of interest. Overall, the study tends to meet all the necessary excellence criteria. Nevertheless, I could raise the following few questions and clarifications.

In the "Automatic Approach-Avoidance Tendency" during the Introduction section, the pioneer works of Lang that dealt with Approach-Avoidance Tendency depending on emotional, attentional, and motivational contexts appears to be missing to me. This perceptual context would appear to me all the more important as it could may be useful during the discussion / limit section (see later, the last suggestion of the review). The authors took into account the "Explicit Attitudes and Intentions", but what about affective and motivational perceptions linked to the practice of a physical activity? It is a part of human behaviors related to physical activity practices that seemed to me a little bit neglected, at least in the introduction and discussion or limits sections.

I underline here again the clarity of the hypotheses and the pre-registration process of the study which contributes to give this work a great general robustness.

My strongest request for precision comes now and concerns the method section. Even by re-reading several times and with several round trips through the paragraphs and the sections, it is still difficult for me to really reproduce with no doubt the motor task required by the participant in order to respond to the stimuli and achieve the motor behavior of approach or avoidance:

-        "The participant sitting in front of the computer is instructed to use the "U" key to move the avatar up or the "N" key to move the avatar down" but what is the initial position, and in particular the initial position of the hand(s) required in the initial posture? (During the fixation cross and avatar period?)

-        Was it clear to the participant to use only one hand? Was the pointing finger placed above the "J" key or "H" key in the initial position? or elsewhere? Is the hand movement (in the physical world) always congruent with the avatar movement (in the virtual world)? (or should the hand approach the screen to press the n key, and therefore approach the pictogram, to trigger an avoidance behavior of the avatar?)

-        What exactly does "reaction time" represent in this study? How exactly is this duration determined in this study: between which starting event (I supposed the visual stimulus appearance) and which ending event (Is this the moment when the participant releases a button that was pressed in the starting position? or when the candidate presses the U or N key?)

è In some Motor Control studies, the reaction time is the duration between a sensorial stimulus and the beginning of the movement that allows the answer task. In such a case, reaction time is different from the Movement Time and the answer time is the addition of the reaction time plus the movement time.

è However, in other psychology studies, reaction time is a parameter that includes the duration of the answer planification and the duration of the answer execution, even if it is a motor answer. In this case, "Reaction Time" encompasses the movement time.

è Ultimately, I think that more precision on this parameter will be very useful for the readers.

-        Finally, about the physical motor response itself, it seems to be no SOA between the start of avatar appearance and the visual stimulus input (always 1000 ms duration): how to be sure that anticipatory motor response strategies do not emerge in connection with this rhythm, and which could interact with the measured avoidance approach behaviors?

The scoring and statistics work is very substantial, and performed using linear and logistic mixed-effect models. To be fully honest, it was also necessary for me, as I imagine several other readers to come, to re-read the previous statistical methodological work of some of these authors in order to be able to assess and better

look the statistical rigor of this work.

Three age classes are carried out. Younger [21-39] years old, Middle age [40-59] and older adults [60-77]. With regard to this classification, how and why is there a threshold of difference in behavior at 45, i.e. within a age class? ("Our results show faster reaction times and fewer errors when approaching compared to avoiding physical activity stimuli before 45 years of age.") This raises the question of the method of segmentation of age classes a priori and why not again a posteriori when reading the results?

Finally, the authors report an absence of evidence that could plead in favor of an association between automatic attitudes and intentions to be physically active. The intention to be physically active refers to the levers (and brakes) of the physical practice, as well as to the motivations to practice which can vary, in particular with age. In the category of the youngest adults, physical practice could be the result of intrinsic motivation and sources of own pleasure (positive affect, arousal, with high intensity). Conversely, in older adults, motivation could have an extrinsic tendency to respond to recommendations and societal values which could be external of the individual. As such, it could have been useful to collect the subjective evaluation of the affective context that the pictograms engendered in each participant for example by means of a Self-Assessment Manikin. Thus, the subjective measures of affect, arousal and intensity could have been added as regressors to the different models. In this case, perhaps that this perspective could be discussed, mentioned in limit, or why not appear in perspective of further study?

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