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Julia Limmeroth · **Claudia Braun**
Institute of Sports and Sport Science, University of Kassel, Kassel, Germany

"Some hate it, others love it": Formation of automatic and reflective affective processes toward exercising in fitness centers and mountain biking

Supplementary Information

The online version of this article (https://doi.org/10.1007/s12662-022-00803-4) contains supplementary material, which is available to authorized users.

Introduction

People who exercise frequently engage in different types of exercise, such as popular forms like running, working out, and bicycling (Dai et al., 2015). However, the majority of the western world's population do not exercise enough according to the recommendations made by the WHO (Guthold, Stevens, Riley, & Bull, 2018; World Health Organization, 2020). In this sense, Ekkekakis and Zenko (2016) suppose, "exercise can make [only] some people feel better, given certain conditions (p. 408)." Furthermore, not all types of exercise performed in different exercise settings are equally attractive to every exerciser and therefore do not always provide positive affective experiences (Rhodes, Fiala, & Conner, 2009). Some people's favorite activity is exercising in a gym such as weightlifting or cardio whereas others cannot even imagine going to a gym (e.g., Calogiuri & Elliott, 2017). The latter group of people instantly have unpleasant feelings when imagining exercising in fitness center rooms or hold negative opinions of weightlifting on machines, whereas, for example, Rodrigues, Teixeira, Cid, and Monteiro (2021a) assume that people who regularly exercise within the fitness context also show greater positive affect toward the activity itself.

Overall, multivariate factors influence whether people exercise or not as well as which type of exercise or exercise setting they choose. Some type of exercise is much more likely to be tied to a specific setting than others (e.g., Burke, Carron, & Eys, 2006; Calogiuri & Elliott, 2017). For example, you can run on a treadmill, but you can also run on a road or in the woods; however, if you go skiing or mountain biking, you will inevitably perform those activities outside. Therefore, contextual factors, associated motives, and affects shape the image of the respective type of exercise and an individual's reason for exercise (e.g., Box, Feito, Brown, & Petruzzello, 2019; Burton, Khan, & Brown, 2012). For example, Calogiuri and Elliott (2017) show that people who exercise in fitness centers report stronger motives for physical health and sociability, whereas people who exercise outdoors report stronger motives concerning convenience and experiencing nature. In general, it is unlikely that individuals will engage in exercise-related behavior on a regular basis if they feel uncomfortable in this particular setting (Kaushal & Rhodes, 2015). For example, Sudeck, Schmid, and Conzelmann (2016) have pointed out the predictive role of affective attitudes experiences for exercise behavior. In addition to the importance of consciously retrievable affect, motivational aspects and attitudinal components toward exercise, and underlying psychological processes also play a central role in explaining regular exercise behavior (e.g., Rhodes, McEwans, & Rebar, 2019; Teixeira, Silva, & Palmeira, 2018).

According to Chevance, Bernard, Chamberland, and Rebar (2019) and Schinkoeth and Antoniewicz (2017), it can be assumed that exercisers provide more positive automatic affective associations with exercise than non-exercisers. Therefore, the amount or frequency of exercise is interrelated with the automatic affective process toward exercise. However, also the preferred type of exercise or the preferred exercise setting are important for the development of automatic affective processes toward exercise (Antoniewicz & Brand, 2014; Limmeroth & Hagemann, 2020). These underlying psychological processes could probably help to explain why on the one hand some people exercise more than others do and on the other hand, why some people prefer a certain setting and others avoid it (Chevance et al., 2019; Schinkoeth & Antoniewicz, 2017). For this purpose, this study investigated whether people who exercise in specific exercise settings and prefer one specific type of exercise differ in their automatic affective processes toward this type of exercise.

Dual process approaches and the affective–reflective theory of physical inactivity and exercise

Regarding people's exercise setting preferences, their choices between different forms of exercise and their decisions about when or even whether to exercise are affected by numerous factors in many different ways (Bodin & Hartig, 2003; Box et al., 2019). Dual process theories offer a theoretical framework to understand the role of automatic processes in this behavioral regulation process (Rhodes et al., 2019). These approaches assume that two interactive but distinct types of information processing influence human behavior and play important roles in explaining behavioral variations (Evans & Stanovich, 2013). Thereby, researchers distinguish between reflective (type II) and automatic (type I) processing of information (Brand & Cheval, 2019).

The Affective–Reflective Theory (ART), introduced by Brand and Ekkekakis (2018), is a dual-process theory with a default-intervention approach. It focuses directly on exercise and physical (in)activity to conceptualize the psychological mechanisms underlying these behaviors (Ekkekakis & Brand, 2019). ART emphasizes the role of affect for and as part of exercise-related decision-making and provides theoretical assumptions about the processing of affective experiences with exercise, suggesting that exercise experiences influence associative pairing as part of the automatic (type I) process. A central postulation is that experiences with exercise are stored as mental associations in memory. Experiences in the past are linked with their attendant affective responses, as well as their associated "motor tendencies and other somatic manifestations" (Zajonc & Markus, 1982, p. 129). These mental associations rely on repeated (negative or positive) affective experiences that individuals derive from exercise and may be the result of valenced bodily sensations such as bliss or exhaustion. Furthermore, complex and culturally framed emotions such as pride or embarrassment are associated with them (Brand & Ekkekakis, 2018). It is assumed that every time an internal or an external stimulus (e.g., remembering a doctor's advice to start to train in a fitness center) occurs, mental associations are spontaneously activated. Through this, associative pairing of exercise experiences with either a positive or negative affective valence (i.e., affective valuation) takes place with the evocation of a positively or negatively valenced somato-affective reaction (Damasio, 1996). The somato-affective reaction can be described as a "gut feeling" toward exercise that results in an action impulse and, if negative, discourages a person from exercising (Ekkekakis & Brand, 2021). Finally, the automatic affective process seems to be distinct from the reflective process, although both processes possibly interact via reciprocal feedback (e.g. Brand & Ekkekakis, 2018). According to ART, reflective (type II) processes, such as reflective evaluations, can overwrite the automatic action impulse, but only if sufficient self-control is available. Automatic affective processes can thus directly influence exercise behavior, especially when self-control is low (Brand & Ekkekakis, 2018). There is already profound empirical evidence about the interrelation between automatic affective processes toward exercise and the amount and frequency of exercise (Chevance et al., 2019; Schinkoeth & Antoniewicz, 2017).

Much less is known about the specificity of automatic affective processes regarding specific types of exercise or exercise settings (e.g., Antoniewicz & Brand, 2014; Limmeroth & Hagemann, 2020). For example, Antoniewicz and Brand (2014) used the Affect Misattribution Procedure (AMP; Payne, Cheng, Govorun, & Stewart, 2005) to investigate the idea that the preferred exercise setting is relevant for automatic affective processes. They found that exercisers in fitness centers hold more positive automatic associations of fitness-related stimuli than a similar physically active comparison group that preferred other exercise settings. The same existed for the reflective processes. These controlled evaluations were more positive in fitness center exercisers than in the comparison group. However, the correlations of automatic affective and reflective processes were nonsignificant in both groups. Limmeroth and Hagemann (2020) used an Evaluative Priming task (EP; Fazio, Sanbonmatsu, Powell, & Kardes, 1986) to assess automatic affective processes toward running. They combined approaches assuming that the amount of exercise and the preferred exercise setting or type of exercise is important for the formation of automatic affective processes. They showed that highly active runners provided significantly more positive automatic associations toward running than non-exercisers and individuals who exercise less and do not run. Further differences could be found in reflections about the affective attitude toward running.

The present study

The goal of the present study was to provide evidence for differences in automatic affective processes regarding the specific exercise setting or type of exercise in frequent exercisers. Specific exercise setting preference might differ between individuals according to their automatic as well as reflective affective processes. For example, exercising in fitness centers, may be directly linked to the exercise behavior itself (e.g., when you go to a fitness-center, you do workouts or weight lifting etc. and in the vast majority of cases nothing else either). Motivational aspects might also play a role: some motives to exercise are more intrinsically embedded or activity-centered than others. Therefore, especially if the main motive is enjoyment of the specific type of exercise, this should be reflected more strongly in the automatic affective process and of course much more in the reflective affective process. Therefore, the aims of our study are twofold: First, our study can contribute to a better understanding of preferences for specific types of exercise. We assume that exercisers in fitness centers have more positive automatic associations toward fitness-related stimuli than mountain bikers and people engaging in little or no exercise. Regular mountain bikers should provide more positive associations toward mountain bike-related stimuli than exercisers in fit-

ness centers and people engaging in little or no exerciser. Second, the practice of a particular type of exercise also should result in differences in the reflective affective processes (e.g., mountain bikers will provide more positive reflections about mountain biking than exercisers in fitness centers and people engaging in little or no exercise). In detail, the novelty of the present study is whether not only exercisers can be distinguished from non-exercisers, but also whether automatic affective processes are so specific that they can also distinguish between exercise setting preferences. To detect differences in automatic affective processes toward different types of exercise an adequate measurement instrument needs to be established.

Method

Participants

Potential participants were recruited from various settings, such as fitness clubs, university sport, mountain biking courses, the university campus, medical fields, and different city center halls. To answer our research question, we needed one fitness group (FIT), one mountain biking group (MTB) and a group of people engaging in little or no exercise (L-NE). To be part of the FIT or the MTB group, first, individuals had to indicate the particular exercise as their preferred setting (or type). Second, the individuals had to perform their preferred type of exercise for more than 90 min per week and to exercise in general for more than 112.5 min per week[1]. To be part of the L-NE group, participants needed to exercise less than 45 min per week (based on corresponding WHO recommendations; World Health Organization, 2020). Therefore, we differentiated among the three groups using a quasi-experimental design.

In all, 76 individuals were recruited and participated voluntarily in the EP task, but eight of them did not complete the online questionnaire. Three participants were removed because they were too physically active for the L-NE group, and four were removed because they made too many mistakes ($M = 30.31\%$; $SD = 8.25$) during the EP task. Furthermore, one statistical outlier was identified within the amount of exercise and therefore was also removed. Finally, we analyzed the data of 60 participants with the mean age of $M = 30.87$ (standard deviation [SD] = 7.53) and the proportion of women was 33%. A further description of the sample can be found in **Table 1**.

Procedure

Potential participants were invited to the experimental setting or directly tested (in local fitness centers or buildings from the university). A quasi-experimental design was conducted using a computer-based EP task and a short online questionnaire about their reflective affective attitudes (Brand, 2006) and their time spent exercising for the last 4 weeks (Fuchs, Klaperski, Gerber, & Seelig, 2015). First, the participants received general information about the procedure. Second, they completed the EP task. In a further step, they received a QR code or online link to complete the online questionnaire.

The local ethics committee approved the study, and informed consent was obtained from all participants. All procedures followed were in accordance with the Helsinki Declaration and its later amendments.

Power analysis

Based on previous results by Antoniewicz and Brand (2014) and Limmeroth and Hagemann (2020), we began our power analysis for an analysis of variance with the assumption of large effect size (Cohen's $d = 0.80$) for a main effect of "automatic affective process" regarding on the one hand the fitness center setting and on the other hand the mountain biking setting with three groups as independent variable. We set the test power at 0.80, with a type I error rate of $\alpha = 0.05$ for two-sided testing. The statistical power analysis conducted with G*Power 3.1 (Faul et

[1] This represents the recommended mean (at least 71–150 min per week) by the WHO (2020) for vigorous-intensity aerobic physical activity.

Abstract

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J. Limmeroth · C. Braun

"Some hate it, others love it": Formation of automatic and reflective affective processes toward exercising in fitness centers and mountain biking

Abstract

Based on a dual process approach, this study was conducted to test whether automatic affective processes toward exercise are not only interrelated with the amount of exercise but also distinctive for different types of exercise. In a quasi-experimental setting, $N = 60$ participants (30.87 years ± 7.53; 33% female) completed an Evaluative Priming task to assess automatic affective processes toward exercising in fitness centers, mountain biking and exercise in general and completed a questionnaire about their exercise behavior and their reflective affective processes toward each type of exercise. The results showed that the automatic affective processes toward exercising in fitness centers differed significantly among the three groups ($d = 0.74$). Those who regularly exercise in fitness centers ($n = 21$) provided the most positive automatic affective processes, followed by mountain bikers ($n = 16$) and those engaging in little or no exercise ($n = 23$). Automatic affective processes toward mountain biking were nonsignificant between groups ($p = 0.30$; $d = 0.42$). All reflective affective processes assessed via questionnaire resulted in significant differences between the three groups, always in favor of those who often perform the respective exercise. Our results show that automatic affective processes toward exercising in fitness centers are distinctive for the preference for this type of exercise. Furthermore, they underline the importance of choosing an adequate measurement technique to assess automatic affective processes toward exercise, especially if these processes should be indicative for the preference of different types of exercise.

Keywords

Dual-process · Automatic processes · Evaluative priming · Exercise setting · Affect

Table 1 Description of the sample

Group	*N*	Age	Time exercising	Time mountain biking	Time fitness activities
		M (*SD*) years	*M* (*SD*) min per week	*M* (*SD*) min per week	*M* (*SD*) min per week
L-NE	23	31.13 (7.36)	23.86 (35.05)	3.26 (11.04)	9.89 (27.70)
FIT	21	28.43 (8.10)	448.39 (284.80)	0 (0)	336.19 (150.70)
MTB	16	33.69 (6.25)	311.64 (200.17)	177.03 (121.75)	48.75 (84.05)

The variable "time fitness activities" includes all kind of fitness-activities. The variable "time exercising" includes all types of exercise an individual performs
M mean, *SD* standard deviation, *L-NE* people engaging in little or no exercise, *MTB* people who go mountain biking, *FIT* people who exercise in fitness centers

al., 2009) indicated that 66 respondents were required.

Measures

Evaluative Priming Task. Various measurement methods exist to assess automatic affective processes in the context of exercise (for an overview, see Brand & Antoniewicz, 2020). We drew on the experimental methodology introduced by Fazio et al. (1986): the EP. This methodology is based on reaction time and serves to assess automatic processes to predict the corresponding behavior (Eves, Scott, Hoppe, & French, 2007). The task is computer based and involves two task features. We followed the same procedure as Limmeroth and Hagemann (2020) but eliminated their neutral targets[2]. The first feature consisted of the instruction to neglect the primary presented prime stimulus, which, in our task, was a picture. We used 20 pictures for each exercise case (exercising in fitness centers, mountain biking and various types of exercise[3]), and twenty "work on computers" pictures as control category. Each picture was shown twice, which resulted in 160 trials. The second feature is the correct identification of a positive or negative target as quickly as possible (Fazio et al., 1986). Positive and negative valenced words functioned as targets. The adjectives were taken from the Berlin Affective Word List (Vo et al., 2009). Based on the study by Limmeroth and Hagemann (2020), the chosen words had between four and six letters ($M = 5.36$, $SD = 0.80$) and both, positive and negative adjectives had a similar positive or negative valence of $M_{positive} = 1.98$ ($SD = 0.17$) and $M_{negative} = -1.79$ ($SD = 0.17$)[4].

A trial ended by pressing one of two response keys to indicate the positive or negative valence of the presented target. Importantly, prime–target combinations were randomly chosen and presented in each trial. Hermans, Houwer, and Eelen (1994) argue that either response facilitation or response inhibition for the reaction toward a target can be provoked by the valence of the prime. For example, if the target stimulus was correctly identified as positive and the previously presented prime was subjectively evaluated positive, then response facilitation occurred. This trial can be classified as congruent. If the prime–target combination is more incongruent than the contrary effect, so-called response inhibition with a prolonged reaction time occurs (**Fig. 1**).

Fazio and Olson (2003) hypothesize that primes with a similar concept should generate equal valence across several trials. Thus, they have concluded that the evaluation of the underlying concept (in our case, exercising in fitness centers or mountain biking) can be calculated by the amount of response facilitation and response inhibition, the so-called priming effect (Limmeroth & Hagemann, 2020). The mean response latencies of these prime–target combinations are used to calculate the individual priming effect of, for example, the concept of exercising in fitness centers (e.g., Bluemke, Brand, Schweizer, & Kahlert, 2010): [(RT Negative Target | Fitness Prime) – (RT Negative Target | Control Prime)] – [(RT Positive Target | Fitness Prime) – (RT Positive Target | Control Prime)]. The priming effect for exercisers in fitness centers should be greater if fitness center-related primes facilitate responses toward positive targets, while responses toward negative targets are inhibited and thus prolonged.

Trials with responses lasting more than 2000 ms and trials that were answered incorrectly were omitted and randomly repeated during the further test. Two colored stickers visually marked the response keys: 'x' on the left side and 'm' on the right side of the keyboard. Half of the participants reacted with their left index finger toward positive valenced targets, and the other half reacted with their right index finger so that the reaction key sides were counterbalanced. Participants completed the experiment in quiet rooms always using the same computer (Fujitsu Life-book E782 with a 15.6" monitor, a resolution of 1280 × 1024 pixels and a refresh rate of 75 Hz; Fujitsu Technology Solutions GmbH, Munich, Germany). The experiment was programmed with E-Prime 3.0 (PST; Psychology Software Tools, Pittsburgh, PA, USA). The task lasted approximately 15–20 min. Cronbach's alpha for each priming score category was the following: $\alpha_{FIT} = 0.63$; $\alpha_{MTB} = 0.59$ and $\alpha_{EXE} = 0.30$.

Questionnaires. We used a part of the Physical Activity and Exercise questionnaire (BSA)[5] by Fuchs et al. (2015) to cal-

[2] Limmeroth and Hagemann (2020) assume that using neutral adjectives requires more concentration/cognitive resources of the participants and, thus, could possibly make the test more challenging. For this reason, the neutral category was excluded.

[3] We used pictures showing people swimming, golfing, running, climbing; inline skating or performing gymnastics; playing basketball, handball, soccer, volleyball, badminton, tennis or frisbee (see supplementary material).

[4] Positive/negative valence was originally rated on a 7-point scale ranging from –3 (very negative) to 0 (neutral) to +3 (very positive).

[5] The questionnaire is originally in German.

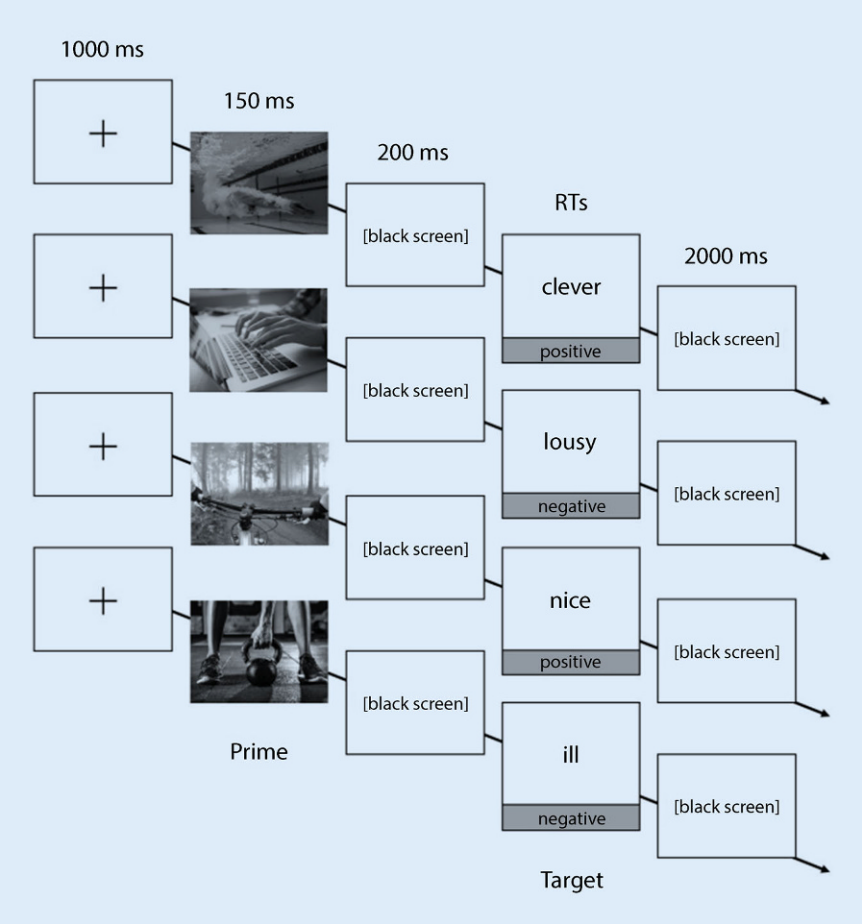

Fig. 1 ▲ The EP procedure with duration of each feature in milliseconds. Note: Target words were originally presented in German. The word-list can be found in the supplementary material. *RT* reaction time

culate the exercise time, mountain biking time and time spent in fitness centers per week. The reflective affective processes toward exercising, mountain biking and exercising in fitness centers (as an output of type II processes) were assessed via the attitude questionnaire by Brand (2006). This instrument consists of four items addressing the participant's reflective affective attitude toward exercising and four items related to one's cognitive attitude. We only used the affective attitude component because past research has shown that it was more distinctive than the cognitive attitude component (e.g., Brand & Schweizer, 2015). We also modified the component to the specific types of exercise: exercising in fitness centers and mountain biking. The components provide a description by means of semantic differentials, which were evaluated by selecting a value between 1 and 9. An example is the following: "Imagine: 'When I think of mountain biking, I feel': not relaxed/extremely relaxed, not satisfied/extremely satisfied, not happy/extremely happy, or not well/extremely well." For each category, the mean score was calculated.

Data analyses

Means and standard deviations were calculated as indicators of the descriptive statistics. We prepared the latency measures in line with common recommendations to facilitate the interpretation of latency outcomes. Referring, for example, to Fazio et al. (1986), Hermans, De Houwer, and Eelen (2001) and Koppehele-Gossel, Hoffmann, Banse, and Gawronski (2020), trials with reactions that were 99% likely to fall outside the "normal" response time and response latencies under 250 ms were classified as outliers and thus eliminated from all subsequent analyses. Participants who achieved error rates over 20% were also excluded. Reaction times were directly expressed in measured milliseconds and used to calculate the priming effect. Consistent with our hypothesis, we fitted several independent one-way analyses of variance with "group" as the between-subject factor and each priming score (automatic affective association) as the dependent variable. In a further step, the reflective variables were analyzed in separate analyses of variance. An alpha level of $p < 0.05$ was set throughout all analyses to indicate significant characteristics. For effect sizes, Cohen's d is reported. The Welch test was used in the case of violations of the sphericity assumption. All analyses were conduct using SPSS 27 (IBM Corporation, Armonk, NY, USA) for Windows.

Results

EP test-related considerations

Overall, the participants identified the target valence on average after $M = 671.53$ ms ($SD = 63.78$) and made few errors in the EP procedure ($M = 4.20\%$; $SD = 3.37$). In general, the participants reacted faster with positive targets ($M = 628.18$, $SD = 56.49$) than with negative targets ($M = 706.68$, $SD = 73.361$). The mean reaction times after the control ($M = 666.05$, $SD = 64.22$), fitness ($M = 665.02$, $SD = 66.70$), mountain biking ($M = 669.16$, $SD = 67.17$) and various types of exercise primes ($M = 669.49$, $SD = 63.46$) were similar. The groups showed no significant differences in their overall reaction times: $F(2, 57) = 1.82$, $p = 0.17$, $d = 0.51$ (FIT: $M = 650.83$, $SD = 63.15$; MTB: $M = 687.14$, $SD = 65.20$; and L-NE: $M = 679.58$, $SD = 61.08$). The data on reaction times and calculated priming effects were distributed normally.

Automatic affective processes

All three automatic affective processes are presented in **Fig. 2**. The automatic affective process toward fitness

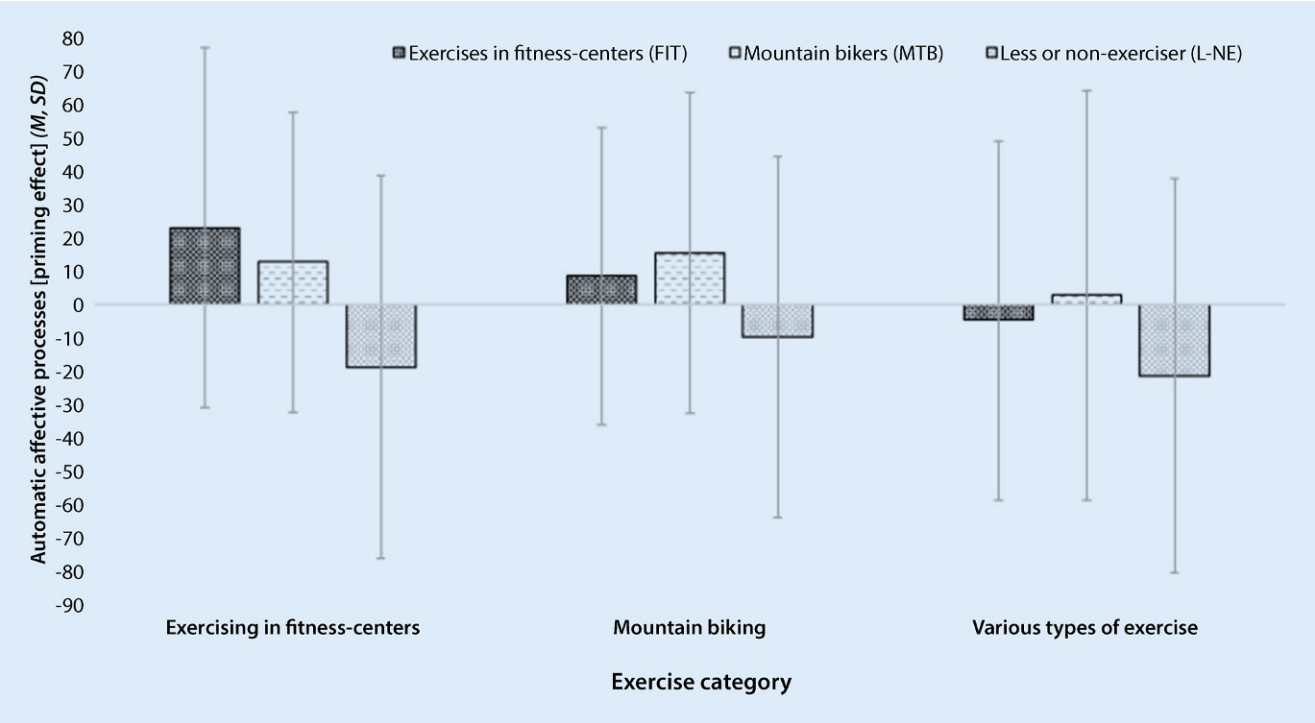

Fig. 2 ▲ Automatic affective processes toward exercising in fitness centers, mountain biking and various types of exercise.
Note: The automatic affective processes towards exercising in fitness centers, mountain biking and exercising at all separated by groups are presented (*error bars* show standard deviations)

showed a significant group difference: $F(2, 57) = 3.98$, $p = 0.03$; $d = 0.74$ (FIT: $M = 23.17$, $SD = 54.01$; MTB: $M = 13.02$, $SD = 44.71$; and L-NE: $M = -18.69$, $SD = 54.13$). The post hoc analysis (via Bonferroni correction) revealed a significant difference between the FIT group and the L-NE group ($p = 0.03$). Neither the automatic affective processes toward mountain biking, $F(2, 57) = 1.24$, $p = 0.30$; $d = 0.42$ (FIT: $M = 8.79$, $SD = 45.10$; MTB: $M = 15.67$, $SD = 48.10$; and L-NE: $M = -9.62$, $SD = 61.52$) nor toward the various types of exercise category showed significant group differences, $F(2, 57) = 0.92$, $p = 0.40$; $d = 0.36$ (FIT: $M = -4.67$, $SD = 57.69$; MTB: $M = 2.81$, $SD = 54.29$; and L-NE: $M = -21.30$, $SD = 59.41$).

Reflective affective processes

All reflective affect scales (fitness, mountain biking and exercise in general) are not normally distributed. However, according to Blanca, Alarcon, Arnau, Bono, and Bendayan (2017), there is wide empirical evidence for the robustness of the F-test against violations of the normal distribution assumption, and ANOVA can still be a valid option. Therefore, we fitted three independent one-way analyses of variance. For two reflective affective scales (fitness and mountain biking), the Welch test was used to correct for violations of sphericity. The descriptive data can be found in **Table 2**.

The results of the reflective affective process about fitness showed a significant group difference: Welch's $F(2,28.66) = 36.70$, $p < 0.01$, $d = 1.78$. Games–Howell post hoc analysis revealed a significant difference ($p < 0.01$) such that the mean level score was higher (more positive affect) in the FIT group than in the MTB group ($M = 3.13$, 95% CI [1.41, 4.85]) and the L-NE group ($M = 3.75$, 95% CI [2.57, 4.94]).

The reflective affective process of mountain biking also demonstrated a significant group difference: Welch's $F(2, 37.33) = 58.16$, $p < 0.01$, $d = 2.73$. Games–Howell post hoc analysis revealed a significant difference ($p < 0.01$) in favor of the MTB group. The mean level score for the affective attitude toward mountain biking was higher (more positive affect) in the MTB group than in the FIT group ($M = 4.03$, 95% CI [2.87, 5.20]) and the L-NE-group ($M = 4.53$, 95% CI [3.26, 5.80]).

In addition, the reflective affective process toward exercise in general differed significantly among the three groups: $F(2, 57) = 25.46$, $p < 0.01$, $d = 1.89$. Games–Howell post hoc analysis showed that the L-NE group had significantly ($p < 0.01$) lower scores (more negative affect) than the MTB group ($M = -2.43$, 95% CI [−3.54, −1.31]) and the FIT group ($M = -2.68$, 95% CI [−3.72, −1.64]).

Potential correlations between automatic and reflective affective processes

For the entire sample, the automatic affective process of fitness was not significantly correlated with the reflective affective process toward fitness ($r = 0.14$; $p = 0.27$) or that of mountain biking ($r = 0.12$; $p = 0.35$); furthermore, the automatic affective processes of exercising

Table 2 Reflective affective processes toward exercising in fitness centers, mountain biking and exercising in general

	Reflective affective process					
	Exercising in fitness centers		Mountain biking		Exercising in general	
Group	*M (SD)*	95% CI	*M (SD)*	95% CI	*M (SD)*	95% CI
L-NE	4.43 (2.12)	[3.62, 5.45]	3.46 (2.18)	[2.52, 4.40]	5.37 (1.76)	[4.61, 6.13]
FIT	8.29 (0.88)	[7.88, 8.69]	3.95 (1.85)	[3.11, 4.79]	8.05 (0.98)	[7.60, 8.50]
MTB	5.16 (2.58)	[3.78, 6.53]	7.98 (1.00)	[7.45, 8.52]	7.80 (1.09)	[7.22, 8.38]

The descriptive data (mean [*M*], standard deviation [*SD*], 95% confidence interval [95% CI]) for each variable is shown separately for each group (measured on a 9-point Likert scale)
L-NE people engaging in little or no exercise, *FIT* people who exercise in fitness centers, *MTB* people who go mountain biking
L-NE little or no exercise, *FIT* fitness center, *MTB* mountain bike

were not correlated with its corresponding reflective process ($r = 0.06$; $p = 0.66$). However, the automatic affective process of fitness was significantly correlated with the reflective affective process toward exercise ($r = 0.29$; $p = 0.02$).

Discussion

The central aim of the present study was to provide further evidence for a more precise relationship between automatic affective processes and a specific exercise setting or type of exercise. In short, we sought to answer the question of whether different types of exercise performed in different settings are (automatically) processed in a different manner in frequent exercisers. The results of this study show that automatic affective processes can be indicative for the preference for exercising in fitness centers. For mountain biking we see a nonsignificant but similar tendency on a descriptive level—with a smaller effect. Automatic affective processes toward various types of exercise show no significant group differences. However, both exercising groups provide more positive scores on a descriptive level than those who engage in no or only little exercise. According to this, our results provide evidence for the assumption that a positive automatic association of a specific exercise setting can reflect a liking for that specific setting and type of exercise. However, due to our results, it does not directly include every type or setting.

Automatic affective processes toward exercising in fitness centers and mountain biking

In particular, it must be emphasized that the significant result according to the automatic affective processes toward exercising in fitness centers is based on the difference between the fitness center group and the little or no exercising group. Compared to the group of mountain bikers, the difference was only found on a non-significant level in favor of the fitness center group. This reinforces the assumption that neither the exercise setting preference nor the amount of exercise alone influence the formation of automatic affective processes, but rather interact in some way (Limmeroth & Hagemann, 2020). Previous research has demonstrated that, first, automatic affective processes can be used to discriminate exercisers from non-exercisers (e.g., Bluemke et al., 2010). Second, these processes correlate with the amount of exercise people engage in (e.g., Schinkoeth & Antoniewicz, 2017). In addition, Antoniewicz and Brand (2014) have shown that automatic affective processes can be used to discriminate between types of highly active exercisers, particularly in a fitness-center setting and Limmeroth and Hagemann (2020) have extended this by showing that the amount of exercise (running) as well as the preference for a specific setting together influence automatic affective processes. Our findings extend this body of evidence in that frequent, fitness-center exercisers provide significantly more positive automatic associations with fitness than individuals engaging in little or no exercise and descriptively, this difference is also evident to similarly active mountain bikers. Notwithstanding, it should be remembered that results on automatic affective processes largely dependent on the stimuli and measure applied in this study and should not be overgeneralized.

However, automatic affective processes toward mountain biking have resulted in a nonsignificant group difference. Nevertheless, a similar tendency can be found as with the fitness center category. One reason may be the relatively small sample size and other factors could have potentially influenced the formation of these processes, which will later be discussed in detail. These results might suggest that exercising is multifaceted, and hence specific types of exercise could be associated with more sharply defined mental representations (Limmeroth & Hagemann, 2020). According to Rhodes et al. (2009), not all exercise settings necessarily provide positive affective experiences for everyone, not even for those who exercise frequently in this setting. Therefore, it more important to choose an appropriate stimulus set to assess specific automatic affective processes. Furthermore, the general context of the presented exercise setting could play an important side effect when evaluating the stimulus set. Being outside is rather associated with pleasurable feelings (e.g., Calogiuri & Elliott, 2017). In addition, after exercising in nature, positive affective states are present or even increase, and negative affect is rather absent or decreases (de Vries et al., 2011). On the one hand, we suppose that the exercise setting, being outside (in nature), could generally provide positive associations. On the other hand, mountain biking is not only be performed outside, it is further defined as a risk sport, an activity on the extreme exercise continuum (Roberts, Jones, & Brooks, 2018), and associated with adrenergic experiences. This image is directly connected with a level of high arousal as well as sensations of fear. Therefore, sensations of fear or adrenaline-charged experiences could have elicited also negative affective associations. However, fear could be perceived in a reappraisal process as

a challenge that needs to be mastered. In a consequence, satisfaction or pride can be experienced and, thus, lead to pleasurable feelings (Willig, 2008). In this sense, the entire association with mountain biking could be an ambiguous and multifaceted one. This represents a possible explanation regarding why automatic affective processes seem to be relatively heterogeneous in our sample. Thereby, selecting a larger sample size could help to clarify this ambiguous result.

Reflective affective processes toward exercising in fitness centers and mountain biking

Regarding all reflective processes assessed by affective attitudes, they revealed in significant group differences such that exercisers who preferred mountain biking had the most positive reflective evaluations of mountain biking. The same occurred for those who preferred exercising in fitness centers and their reflective processes regarding their affective attitude toward exercising in fitness centers. Furthermore, people engaging in little or no exercise had fewer positive reflections about exercising than mountain bikers and exercisers in fitness centers. This underlines the importance of affective processes in general to understand why people exercise or do not (Ekkekakis, Hartman, & Ladwig, 2020). Correlations between the automatic affective processes and their corresponding reflective evaluation were nonsignificant. These results are in line with the assumption that reflective and automatic affective processes can independently contribute to the explanation of a specific exercise behavior (Brand & Schweizer, 2015). Solely, the automatic affective process toward exercising in fitness centers and the reflective affective process toward exercising were significantly correlated. This correlation suggests that exercising in fitness centers could be very directly linked with exercising. In addition, people often exercise in fitness centers to become more physically fit for their preferred type of exercise and to reduce the associated injury risk (Lauersen, Andersen, & Andersen, 2018). Rebar et al. (2016) demonstrated that within the top 20 words people used to describe exercise behaviors, six terms describe exercise, which is related to fitness (center) context like gym workouts, weight lifting, exercise classes or aerobics.

Study limitations and recommendations for future studies

This last point leads directly to the limitations of the study. First, it remains unclear how, if, and under which conditions automatic and reflective processes are correlated (Chevance et al., 2019; Ekkekakis & Brand, 2021). Furthermore, McConnell and Rydell (2014) show that reflective processes can generally be formed or modified more quickly compared to automatic affective processes. According to ART, this could be the reason for the behavioral inconsistency between both processes (Brand & Ekkekakis, 2018). Second, a reaction time-based test to assess this process must be used with caution and with a precisely matched stimuli set for a specific exercise group. An exercising setting such as exercising (indoors) in a fitness center seems to provide more specific contextual cues than exercising in nature (outdoors) such as mountain biking. In this sense, an individual can focus on different aspects within the presented images, which, consequently, lead to various mental associations being triggered. According to this, the challenge is that it remains unclear which mental representation the spontaneous, affective response is based on because the automatic affective process naturally cannot be accessible to consciousness (Evans & Stanovich, 2013). In addition, EP tasks suffer from on-average-limited reliability (e.g., Gawronski & De Houwer, 2014). In our study, reliability varies by category and is definitely insufficient for the various exercise category. However, this category was not the focus of the analysis. Third, the relatively small sample size of 60 participants, especially the small group of only $n = 16$ mountain bikers, should also be seen as a limiting factor of this study. Particularly from this group, many subjects did not participate in the online survey.

Conclusion

Despite these limitations, our study contributes to a better understanding of the differentiation between specific exercise type preferences regarding the corresponding exercise settings and the automatic affective processes toward it. In this sense, we think that it is quite important to use an adequate stimulus set that should fit the sample under study. For future studies, it would be necessary to determine whether the findings obtained from our study can be generalized to other types of exercise. Thus, it might also be interesting to investigate whether there are differences within one type of exercise, such as running, regarding the setting and their expression in the automatic affective process, e.g., running on a treadmill (indoors) vs. running outdoors (in nature). Furthermore, a methodological approach using different stimulus sets to compare them could help to generate knowledge about differences in the underlying automatic processes (Rebar et al., 2016). In addition, our results are also in line with previous research insofar as reflections about affective attitudes toward exercising in fitness centers, mountain biking or any exercise are different depending on the preferred type of exercise (e.g., Kaushal & Rhodes, 2015; Limmeroth & Hagemann, 2020; Rhodes et al., 2019). Furthermore, our findings support the assumptions by Phipps, Hannan, Rhodes, and Hamilton (2021) that automatic and reflective evaluative information are conceptually distinct and that affective experiences in general are key in guiding exercise behavior regardless of whether such processes are automatic or consciously accessible. For future studies, it could be helpful to include potential moderators, which, for example, can compromise cognitive resources such as stress (Wirz, Bogdanov, & Schwabe, 2018) to clarify the relationship between reflective and automatic processes (Friese, Hofmann, & Wanke, 2008). Finally, much more attention should be given to the affective

responses to exercise or while exercising because they importantly shape the probability of engaging in exercise in the future (Ekkekakis & Brand, 2021; Ekkekakis et al., 2020; Rodrigues et al., 2021b).

Corresponding address

Julia Limmeroth
Institute of Sports and Sport Science, University of Kassel
Damaschkestraße 25,
34121 Kassel, Germany
j.limmeroth@uni-kassel.de

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Declarations

Conflict of interest. J. Limmeroth and C. Braun declare that they have no competing interests.

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