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Affective–Reflective Theory of physical inactivity and exercise

Foundations and preliminary evidence

Insufficient physical activity is one of the ten leading global risk factors for mortality (World Health Organization, 2009), with worldwide prevalence ranging from 16.6 to 34.5% for adults and between 77.5 and 84.0% for school-age adolescents (World Health Organization Global Health Observatory, 2010). These estimates are based on self-reports and are, therefore, likely underestimating the degree of inactivity. In this context, "insufficient" is defined as less physical activity than recommended in evidence-based guidelines. For example, healthy adults are advised to accumulate (in bouts of at least 10 min) a minimum of 150 min of moderate-intensity aerobic physical activity per week (or at least 75 min of vigorous-intensity aerobic physical activity or a combination of moderate and vigorous aerobic physical activity), in addition to performing muscle-strengthening activities on two or more days (World Health Organization, 2010).

Exercise is defined as "a subset of physical activity that is planned, structured, and repetitive and has as a final or intermediate objective the improvement or maintenance of physical fitness" (Caspersen, Powell, & Christenson, 1985, p. 126). Exercise represents an efficient way of avoiding the health disadvantages of physical inactivity. However, most people fail to perform regular exercise.

This article presents a theory that is intended to explain why people in a state of physical inactivity do or do not initiate action for exercise. The theory focuses on the psychological processes that govern momentary behavior and deals specifically with exercise-related feelings; it emphasizes the concept of situated decisions about exercise (Brand & Schweizer, 2015) and consequences for behavior change.

The imperative to expand theoretical horizons in exercise psychology

Exercise psychology emerged as an academic discipline in the late 1960s, with the goal of describing and explaining the psychological factors that are associated with participation in exercise and supporting the development of exercise-related interventions. One of these factors is motivation. Since the early days of the discipline, numerous exercise psychologists have investigated why some people are motivated to adopt and then maintain exercise as an element of their lifestyle, whereas others are unsuccessful in doing so. However, after more than half a century of research, the track record of exercise psychology is mixed (e. g., Rhodes & Yao, 2015). In terms of publication of scientific papers and textbooks, exercise psychology is a flourishing academic discipline, with many researchers still attracted to the issue of exercise motivation. Exercise psychology has also succeeded in making evidence-based interventions for exercise motivation part of the broader public-health discourse (e. g., Nigg, 2013). On the other hand, meta-analyses examining the effectiveness of these intervention programs have typically concluded that the effect sizes are small (overall average of 18 meta-analyses: d = 0.26, 95% confidence interval [CI] 0.21–0.31; see Ekkekakis & Zenko, 2016) and results have largely failed to meet expectations.

Thus far, the issue of exercise motivation seems to have been approached from a narrow meta-theoretical perspective (Ekkekakis & Zenko, 2016). The most popular theoretical approaches to exercise motivation (i. e., social cognitive theory, Bandura, 1986; theory of planned behavior, Ajzen, 1985; transtheoretical model, Prochaska & DiClemente, 1984; self-determination theory, Deci & Ryan, 1985) focus on how people *reflect on* their thoughts and feelings. This perspective, however, likely exaggerates their capacity and willingness to make *rational decisions* in order to achieve *desired goals*. Alternative approaches, especially those emphasizing the role of affect, feelings, and emotions, offer models that treat human action as partly intuitive and impulsive, but have been largely neglected (Ekkekakis, 2017).

This article refines earlier work on the significance of exercise-related affect for exercise motivation (e. g., Ekkekakis & Dafermos, 2012) and the role that automatic evaluations of exercise play in exercise-related decision-making and behavior (e. g., Brand & Schweizer, 2015). The article then introduces the *Affective–Reflective Theory (ART) of physical inactivity and exercise*, which focuses on the implications of momentary affective evaluations for exercise-related actions and choices.

The ART of physical inactivity and exercise differs from other psychological theories presently used to investigate exercise behavior change and maintenance in at least three important ways. First,

it focuses on the role of *affect and automaticity*. Second, it is an *exercise psychological account*, explicitly connected to what we know about the pleasant and unpleasant experiences that occur during exercise (cf. Ekkekakis, 2003). Third, it can explain why individuals sometimes thoughtlessly *maintain* their present state of physical inactivity. This is especially important because, to date, the behavioral phenomenon of sedentary lifestyle has posed a theoretical challenge to exercise psychology (Biddle & Gorely, 2014). ART offers a novel account of it.

It is important to note that the ART of physical inactivity and exercise builds on a foundation of previous theoretical proposals; its main merit is that it represents an attempt to integrate elements from existing concepts and theories that have so far been either neglected or not linked to one another within the discipline of exercise psychology. Thus, one of the main purposes of this introductory article is to discuss how the theory was derived and how it relates to earlier work.

The ART of physical inactivity and exercise represents an innovative approach to thinking about behavior change. Importantly, we are not advocating the rejection of current theories (which emphasize reflection, rationality, and behavioral goals) nor is it our aim to discredit conventional approaches to behavior change. Instead we hope to reframe current theoretical approaches to exercise motivation by embedding them within a broader psychological context. In a nutshell, the ART of physical inactivity and exercise is a dual-process theory that emphasizes the role of momentary and anticipated affect, but without losing sight of the fact that cognitive insight and more complex reflection are important and necessary to long-term changes in exercise behavior as well.

Main theoretical roots and underlying concepts

The fundamental inspiration for the ART of physical inactivity and exercise was the social psychologist Lewin's (1943, 1951) proposal that, in order to accurately explain behavior, psychological models must first consider the exact moment at which the behavior occurs. This proposition and some of its consequences will be described first. Then, the theoretical roots and concepts from which the ART of physical inactivity and exercise were developed will be explained. These are the hedonistic perspective on motivated behavior, the automatic evaluation effect, the evaluation-behavior link, and the dual-process view of behavioral decision-making.

Lewin's force-field analysis

Lewin, an important figure in modern social psychology, developed his influential field theory in the 1940s. Field theory postulates that human behavior and behavior change should be understood in terms of the "forces" and "tensions" that move us to action (Lewin, 1943). Its three central assumptions are (1) that behavior is a consequence of the totality of the situation around us, (2) this situation can be described in terms of fundamentally interrelated factors that constitute a dynamic field, and (3) the dynamic field has more influence on behavior than past experience or future desires.

According to Lewin, the dynamic field or "life space" contains the person and his or her psychological environment (i. e., the environment as subjectively perceived by that person) as related to his or her needs. Needs (and quasi-needs, whose salience varies over time, depending on the situation) are the central motivational concept in Lewin's field theory. Needs release energy and transform "regions" in the person into "tension systems" whenever they give rise to an intention or an intentional action (intentions and intentional actions arise from needs and at goals). "Vectors", namely forces that act on a person, determine the direction in which a person moves through his or her psychological environment. Vectors "push" a person towards an attractive (positively valenced) region and "repulse" that person from a region he or she thinks will increase tension (negatively valenced). Typically, at least two vectors (the "force" and "counterforce") act on a person at the same time, maintaining a "quasi-equilibrium" or creating a tension system. "Locomotion" through the psychological environment—in other words, behavior change—can thus be seen as resulting from the interaction of the two forces.

Force-field analysis (Lewin, 1951) is a simple conceptual framework that reminds us to take into account both the driving and restraining forces associated with the transition to another, perhaps opposite, behavior (**Fig. 1**). In order to change, an individual must first identify and "unfreeze" the driving and restraining forces holding him or her in the current state of quasi-equilibrium; the change ("transition") is achieved by increasing the drivers, reducing the restraints, or both, in order to create an imbalance of forces. Finally, the system must be brought back into quasi-equilibrium ("refrozen").

Applying Lewin's ideas to the context of physical inactivity, let us imagine a situation in which someone is sitting on the sofa and is reluctant to do anything different. According to Lewin, that this person's motivation for behavior change and exercise may not yet be strong enough can only be one part of the explanation. The other part is that a restraining force is holding this person back in this situation. The ART of physical inactivity and exercise suggests that momentary affective responses to a situation act as such a restraining force.

Affective responses to exercise and hedonistic thinking in exercise psychology

In the past few years, the voices arguing that the role of affect in exercise motivation might be substantially underestimated in contemporary theoretical work have grown louder (e. g., Ekkekakis & Dafermos, 2012; Sudeck, Schmid, & Conzelmann, 2016; Wienke & Jekauc, 2016). Affect is a broader concept than mood and emotion, and core affect is defined as a "neuro-physiological state consciously accessible as a simple, primitive, nonreflective feeling most evident in mood and emotion but always available to consciousness" (Russel & Feldman Barrett, 2009, p. 104). Most importantly for the work presented here, *core affective*

valence characterizes all states in which a person feels good or bad, including free-floating pleasure and displeasure, as well as pleasant and unpleasant moods and emotions; it is experienced constantly although its nature and intensity can vary over time (Ekkekakis, 2013, p. 38).

Affective responses to exercise, especially core affective valence reported under different exercise intensities, and the link between these affective responses and future exercising, have received considerable research attention in the past few years. There is convincing experimental evidence (see the review by Ekkekakis, Parfitt, & Petruzello, 2011) that many people begin reporting negative changes in core affective valence (reduced pleasure or even displeasure) during exercise performed at an intensity that approximates the ventilatory or lactate threshold, (a level of intensity at which lactate begins to accumulate in the blood). Above this threshold, negative changes in core affective valence become universal, before variability re-emerges after exercise has ended. With regard to the behavioral consequences of these responses, a growing number of studies show that a positive change in core affective valence during exercise is reliably linked to future exercise (with small to medium effect sizes), whereas post-exercise affect is unrelated to future behavior.

Psychological or motivational hedonism (partial psychological hedonism; Murphy & Eaves, 2016) posits that, in general, individuals tend to seek pleasurable experiences and avoid displeasure (Rozin, 1999). This must not be misunderstood as implying that seeking pleasure and avoiding displeasure is postulated to be the one and only ultimate source of all human motivation (Ekkekakis & Dafermos, 2012). Nevertheless, hedonistic theories differ significantly from most theories presently used in the study of exercise motivation, which are based on a cognitive core and assert that, once enough information is available (e. g., about the health benefits of exercise and personal relevance of goals), individuals will inevitably make the rational decision to change their behavior and will be motivated to do so,

Abstract · Zusammenfassung

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Affective–Reflective Theory of physical inactivity and exercise. Foundations and preliminary evidence

Abstract

This article introduces a new theory, the Affective–Reflective Theory (ART) of physical inactivity and exercise. ART aims to explain and predict behavior in situations in which people either remain in a state of physical inactivity or initiate action (exercise). It is a dual-process model and assumes that exercise-related stimuli trigger automatic associations and a resulting automatic affective valuation of exercise (type-1 process). The automatic affective valuation forms the basis for the reflective evaluation (type-2 process), which can follow if self-control resources are available. The automatic affective valuation is connected with an action impulse, whereas the reflective evaluation can result in action plans. The two processes, in constant interaction, direct the individual towards or away from changing behavior. The ART of physical inactivity and exercise predicts that, when there is an affective–reflective discrepancy and self-control resources are low, behavior is more likely to be governed by the affective type-1 process. This introductory article explains the underlying concepts and main theoretical roots from which the ART of physical inactivity and exercise was developed (field theory, affective responses to exercise, automatic evaluation, evaluation-behavior link, dual-process theorizing). We also summarize the empirical tests that have been conducted to refine the theory in its present form.

Keywords

Motivation · Implicit · Explicit · Dual system · Self-control

Die Affective-Reflective Theory zur Erklärung von körperlicher Inaktivität und Sporttreiben. Grundlagen und erste Studienergebnisse

Zusammenfassung

Der Beitrag stellt eine neue Theorie vor, die Affective-Reflective Theory (ART) zur Erklärung von körperlicher Inaktivität und Sporttreiben. Sie erlaubt Verhaltensvorhersagen in Situationen, in denen Personen entweder im Zustand körperlicher Inaktivität verbleiben oder körperlich aktiv werden. Zu Grunde liegt ein Zwei-Prozess-Modell, mit welchem davon ausgegangen wird, dass auf Bewegung (Sport im weiteren Sinne) bezogene Reize spontane Assoziationen auslösen und eine automatische affektive Valuation bewirken (Typ-1-Prozess). Diese unwillkürliche affektive Bewertung bildet die Grundlage für eventuell darauffolgende reflexive Bewertungen (Typ-2-Prozess), wenn ausreichend Selbstregulationsressourcen vorhanden sind. Die automatische affektive Valuation liefert einen Handlungsimpuls, aus den reflexiven Bewertungen können Handlungspläne resultieren. Aus dem Zusammenspiel der beiden Prozesse entsteht entweder Verhaltenswechsel oder es verbleibt das momentane Verhalten. Wenn der automatische affektive und der reflexive Prozess diskrepante Ergebnisse liefern und Selbstregulationsressourcen aufgebraucht sind, sagt die ART voraus, dass eher der affektive Typ-1-Prozess Einfluss auf das Verhalten gewinnt. Der vorliegende Beitrag führt in die Grundgedanken der ART ein, erklärt zugrundeliegende Konzepte und die wesentlichen theoretischen Hintergründe, aus denen heraus die ART entwickelt wurde (Feldtheorie, affektive Folgen von Bewegung und Sporttreiben, automatische Evaluationen, Evaluations-Verhaltens-Kopplung, Zwei-Prozess-Modelle). Außerdem werden die empirischen Untersuchungen, die soweit schon zur Entwicklung der ART beitragen haben, zusammengefasst.

Schlüsselwörter

Motivation · Implizit · Explizit · Zwei-System-Theorien · Selbstkontrolle

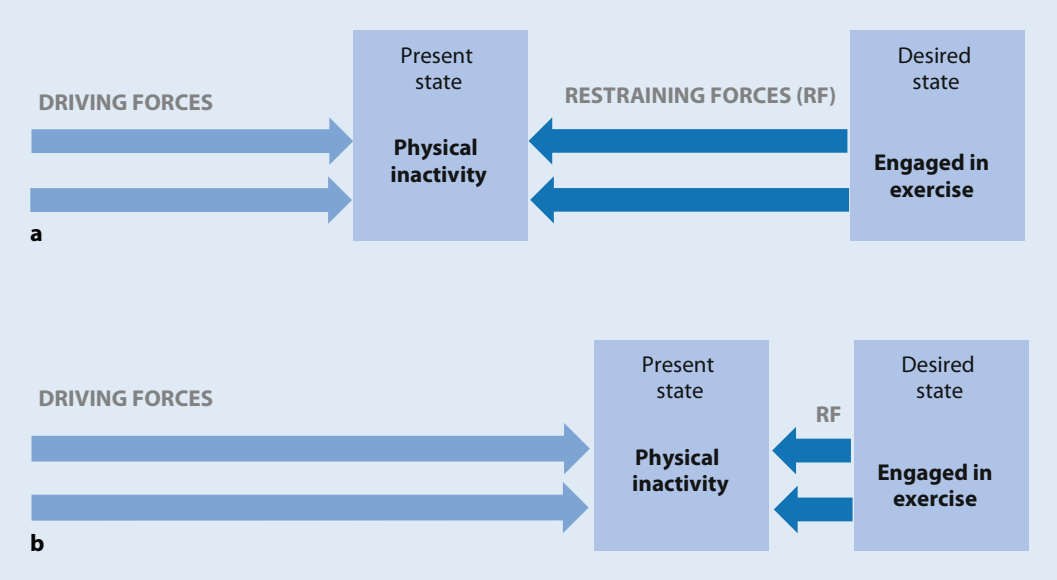

Fig. 1 ◄ An illustration of Lewin's force field analysis as applied to a physically inactive person in quasi-equilibrium between forces driving and restraining him or her from altering this state of physical inactivity (**a**) or in conditions where transition to exercise-related behavior is more likely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

more or less regardless of any hardship they have to endure in the process.

We believe that negative core affective valence during exercise reflects such hardship (Ekkekakis, 2003), especially for sedentary, low-active, or obese individuals (e. g., Ekkekakis, Vazou, Bixby, & Georgiadis, 2016). The ART of physical inactivity and exercise adds a hedonistic perspective to theoretical accounts of exercise motivation by postulating that core affective valence can strongly influence deliberative reasoning about exercise engagement and effort; it further suggests that, under certain circumstances, core affective valence may have a direct, immediate impact on behavior through behavioral urges.

Affective evaluation, automatic evaluation, and the evaluation-behavior link

Investigating the role of evaluative mental processes in order to understand why people do the things they do has a long history in social psychology (Briñol & Petty, 2012). The contemporary view is that evaluations are the basis of attitudes (e. g., Fazio, 1990; Zanna & Rempel, 1988). Although it has long been recognized that affective evaluations contribute to attitude formation (e. g., Rosenberg & Hovland, 1960; Thurstone, 1946; Zajonc, 1980), discussion of the distinct, influential "pre-cognitive" effect that affective evaluations may have on evaluative judgment and behavior has, to date, been neglected or marginalized in exercise psychology (Bodur, Brinberg, & Coupey, 2000; Ekkekakis & Zenko, 2016). This may be partly an historical accident, in that the emergence of exercise psychology as a discipline (in the 1960s, e. g., see Buckworth & Dishman, 2002) followed the so-called "cognitive revolution" in psychology, which had began in the 1950s (e. g., see Miller, 2003).

The cognitive revolution brought a new and influential perspective to research on the psychological mechanisms of behavior change. Fishbein and Ajzen (1975) suggested that all mental evaluations are based on beliefs about the object of evaluation. They introduced cognitive constructs like "intention" and "planning" to bridge the gap between evaluative judgments (attitudes) and behavior, and, importantly, argued that behavior change was a product of *reasoned* action. Researchers in exercise psychology readily adopted this view (and similar cognitive approaches to behavior change, e. g., social cognitive theory; Bandura, 1977), probably because, at the time, it appeared as the most promising approach to behavior modification.

There were, however, social psychologists who resisted the zeitgeist and refused to abandon the notions of precognitive affect and affective evaluation. They began exploring the issues of when and under what circumstances affective evaluation would influence behavior. For example, Zajonc (1980, p. 151) insisted that "preferences need no inferences" and Fazio (1986, 1990) concurred that presentation of an attitude object automatically activates an individual's memory of the evaluation associated with that object.

Today automatic evaluations are defined as the immediate affective (positive or negative) responses a person has towards an event or stimulus (Bargh, Chaiken, Raymond, & Hymes, 1996; Murphy & Zajonc, 1993). According to Fazio (2001), these automatic evaluations

> *...alert us to the presence of objects that have the potential for hedonic consequences and promote hedonically meaningful categorisations of such objects. We are likely to notice those objects that can provide reward or satisfaction, those that we have personally defined as likeable and can benefit from approaching. Likewise, we are likely to notice those objects toward which we have developed strongly associated negative evaluations, ones that we wish to avoid if at all possible (p. 129).*

The automatic evaluation effect has been unequivocally established in experimental social psychology (De Houwer & Hermans, 2001). Only a few years ago, researchers in exercise psychology started to apply this idea in their research, exploring correlations between automatic

evaluations and exercise behavior (e. g., Bluemke, Brand, Schweizer, & Kahlert, 2010; Calitri, Lowe, Eves, & Bennett, 2009).

Likewise, research in experimental social psychology showed that activated evaluations could stimulate immediate approach-avoidance motor responses (e. g., Chen & Bargh, 1999; Seibt, Neumann, Nussinson, & Strack, 2008). These studies substantiated the assumption that there is a direct evaluation-behavior link and concluded that valenced behavior can be activated automatically by affective stimuli (Krieglmeyer, De Houwer, & Deutsch, 2013; see Phaf, Mohr, Rotteveel, & Wicherts, 2014, for a more skeptical perspective). This line of research has not yet influenced theoretical thinking within exercise psychology. To the best of our knowledge, so far there has been only one experimental study that has examined the effect of activated automatic evaluations on complex exercise behavior (Antoniewicz & Brand, 2016a; reviewed below).

The ART of physical inactivity and exercise is at the core of this emerging line of exercise psychology research. The theory assigns central importance to automatic affective associations of exercise and postulates that these associations give rise to action impulses directly. Assumptions about the conditions under which these action impulses are translated into complex behavior were derived from the general framework of dual-process theories, which is described in the next section.

The dual-process approach to feelings, thought, and behavior

As described in cognitive and social psychology, dual-process theories suggest that behavioral phenomena are the results of two qualitatively different mental processes. Type-1 processing is supposed to be fast and automatic in the sense that it requires minimal cognitive resources and effort, whereas type-2 processing is supposed to be generally slower and reflective and takes the form of more controlled reasoning (Evans, 2008; Evans & Stanovich, 2013).[1]

One reason why many different labels for type-1 and type-2 processes have been used by researchers in the field (e. g., type-1: implicit, contextualized, associative, heuristic, experiential, impulsive; type-2: explicit, abstract, propositional, analytic, rational, reflective) is that different models often emphasize different aspects of human thought, affect, and behavior. For example, the associative-propositional processes in evaluation (APE) model (Gawronski & Bodenhausen, 2006, 2011; see below) applies exclusively to these mental processes and uses the implicit-explicit terminology. On the other hand, the reflective-impulsive determinants model (Strack & Deutsch, 2004; see below) emphasizes the links with social behavior and thus refers to reflections and impulses as the processes that underlie such behavior. We will describe these two models, since they are most relevant to our work, using their original terminology, but also draw links between this terminology and the broader type-1 vs. type-2 distinction.

Associative and propositional processes in evaluation. The APE model describes two kinds of evaluative responses (Gawronski & Bodenhausen, 2006, 2011). Implicit evaluation occurs spontaneously as the personal "default" response to an object and is defined as the outcome of associative processes, namely the activation of object-related mental associations in memory (type-1 process). The pattern of activation of object-related associations depends on the input stimulus and the preexisting structure of associations in memory (Smith, 1996). In other words, in different contexts, the same object may activate different subsets of associations. The net valence of the concepts activated by the object defines the valence of the individual's "gut" affective reaction to the object and thus his or her implicit evaluation of it.

According to the APE model, this affective "gut" reaction forms the basis of propositional (type-2) processing from which the explicit evaluation of the object develops. Propositions are mentally represented statements, such as beliefs about facts and values. Propositional processing within the APE model is thus inherently concerned with translating the subjective valence of the affective "gut" reaction (e. g., an unpleasant feeling) into a propositional statement (such as "I dislike exercising"), which can then be related to other stored propositional beliefs that are considered relevant to an explicit evaluation. Sometimes the propositional evaluation implied by the "gut" reaction is consistent with other salient propositions (such as "everyone in my family hates exercise") and endorsed in a verbally reported explicit evaluation. On other occasions, however, propositions that are incompatible with the "gut" reaction, but still judged as relevant at least at that moment in time (e. g., "just today my doctor advised me to start exercising regularly"), may lead the individual to reject (deliberately disregard, suppress, or override) his or her affective "gut" reaction. The result is an implicit-explicit evaluation discrepancy. Most likely at the subconscious level, individuals will try to avoid the aversive feelings induced by such discrepancies (Festinger, 1957) and restore consistency by rejecting one of the propositions (e. g., "disliking exercise is not rational") or by searching for additional propositions that will help temporarily resolve the discrepancy (e. g., "starting exercise tomorrow is as good as starting today").

Importantly, the type-2 process involved in rejecting the proposition implied by the affective "gut" response in one particular situation does not necessarily permanently deactivate or eliminate the automatic association that gave rise to it. However, as a result of the presumed interactions between spontaneous asso-

[1] It is important to note that dual-process theorizing has also been the target of criticism. At the core of this ongoing debate is the point that single-process propositional accounts may be sufficient for the explanation of observed empirical phenomena (e. g., Kruglanski & Gigerenzer, 2011). Following this debate (e. g., see the reply by Gawronski, Brannon, & Bodenhausen, 2017) is theoretically fruitful and necessary for further advancement in exercise psychology but beyond the scope of the present article.

ciations and propositional reasoning, every activation of an evaluative process leaves a trace in memory. Therefore, the propositional processes involved in generating an evaluation *can* create new associations or attenuate existing ones. In the same way, every momentarily activated association that is translated into and processed as propositional information *can* increase the salience and relevance of stored propositions. The results of these interactions can be understood in terms of fundamental learning principles, such as a reinforcement mechanism. Consequently, evaluative processes tend towards self-reinforcement unless new information (e. g., behavioral experience, cognitive information) is available for activation in the future (i. e., in a situation, in which a new evaluative process is triggered).

Experimental evidence supporting the fundamental postulates of the APE has been compiled into two comprehensive reviews (Gawronski & Bodenhausen, 2006, 2011). Numerous empirical social-psychological studies draw on the APE as a broad explanatory framework for the role of type-1 processes in social cognition and behavior but only a few recent articles in exercise psychology have done so (e. g., Berry, Rodgers, Markland, & Hall, 2016; Brand & Antoniewicz, 2016).

Reflective and impulsive determinants of behavior. Another influential framework for interpreting the complex relationship between type-1 and type-2 processes is the reflective-impulsive model (RIM; Strack & Deutsch, 2004). Although the RIM shares certain important assumptions with the APE model (e. g., about the fundamentally associative nature of type-1 processes), there are also notable differences between the two. The RIM, for example, assumes that the two processes are invoked simultaneously but independently (i. e., not in the default-interventionist logic of the APE, in which the implicit association gives the default value for further propositional processing such that all type-2 processing depends on initial type-1 input). Most of these differences are the subject of unresolved theoretical debates (see Evans & Stanovich, 2013, for a critical review of the dual-process/dual-system approach in general), and are beyond the scope of this article. What makes the RIM especially relevant to the present theoretical proposal (the ART) is its focus on how the two types of processes affect behavior.

According to the RIM, the interplay between the impulsive and the reflective systems can be generally described as *competition for control* over the overt response. It is assumed that information entering the perceptual gates will always be processed in the impulsive system, that this processing is mediated by an approach-avoidance motivational orientation, and that a behavioral schema (i. e., sensory-motor cluster) will be activated as a result. The impulsive system is viewed as a system of experiential primacy, in which automatic thoughts and feelings arise spontaneously through activation of learned associations. Depending on its intensity and the availability of self-control resources (Baumeister & Heatherton, 1996), a stimulus may also enter and be processed in the reflective system. In this case, by weighing beliefs and knowledge, an intention can be formed in the reflective system and an appropriate behavioral schema in the impulsive system may be activated.

As a result of independent processes in the reflective and impulsive systems, two behavioral schemata can be activated at the same time. These schemata may be concordant (directed towards the same or similar goals, e. g., approach-approach) or divergent (e. g., approach-avoidance). When divergent behavioral schemata are activated and self-regulatory resources are depleted (Muraven, Tice, & Baumeister, 1998), the schema from the impulsive system will likely prevail and be expressed behaviorally. In contrast, when self-regulatory resources are available, reflective operations are possible (e. g., distracting attention from the tempting stimulus, emphasizing the rational consequences of one behavioral option), thus, enabling the reflective system to control overt behavior (Hofmann & Friese, 2017). Evidence supporting the validity of the central assumptions and predictions of the RIM has been comprehensively reviewed by Strack and Deutsch (2004) and, more recently, by Deutsch, Gawronski, and Hofmann (2017).

Affective–Reflective Theory (ART) of physical inactivity and exercise

In the context of exercise psychology, dual-process approaches provide an innovative theoretical framework for interpreting the interplay between automatic and reflective processes and how this interplay can affect overt behavior. The ART of physical inactivity and exercise, described in the next section, builds on the theoretical ideas outlined above. This is followed by a review of empirical results that were used to refine the ART in its present form.

Outline of the theory

The ART of physical inactivity and exercise focuses on the very moment at which an exercise-related perception happens. External stimuli (e. g., hearing a doctor's advice to start exercising) and internal stimuli (e. g., remembering the doctor's advice to exercise) trigger automatic associations related to the object of evaluation (i. e., exercise-related stimuli) and, for example, the individual's current, momentary state of physical inactivity. The individual's automatic affective *valuation* (i. e., tacit assignment of positive/pleasant or negative/unpleasant valence, in contradistinction to a reflective *evaluation*) and the connected action impulse amount to a force driving the individual to change his or her state, or a force actively restraining the individual from changing the present state. The automatic affective valuation serves as the basis for a controlled, reflective evaluation that draws on relevant propositional information (encoded affect and cognition). This controlled response can result in an action plan. The action plan and the action impulse can be concordant (both approach-oriented or both avoidance-oriented) or discrepant. The availability of self-control resources determines whether the predominant influence on behavior would be type-1 or type-2 processing (**Fig. 2**).

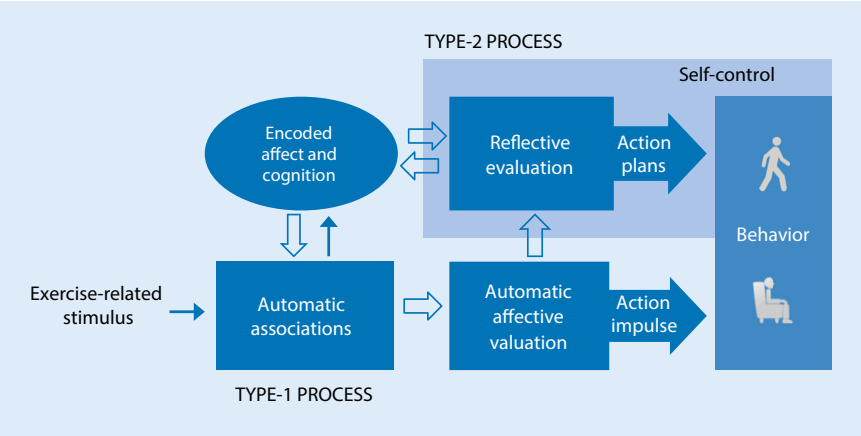

Fig. 2 ▲ Graphical illustration of the Affective–Reflective Theory (ART) of physical inactivity and exercise

Affective valuation and the type-1 process. As noted, affective valuation is defined here as tacitly assigning to a stimulus a positive (association with pleasure) or a negative (association with displeasure) value, either as a result of repeated experiences of emotions mediated by cognitive appraisals (e. g., pride, embarrassment) or as a result of repeated experiences of core affective reactions not necessarily mediated by cognitive appraisals (e. g., sense of physical reinvigoration, pain, bodily discomfort). In this sense, we use the term "affective valuation" (the tacit assignment of valence in an associative pairing, involved in type-1 processing) to highlight the postulated difference from "evaluation". As used in the social cognition literature and cognitive theories of emotions, an "evaluation" implies some degree of cognitive appraisal (even if instantaneous, spontaneous, or subconscious) and involvement of prefrontal cortical pathways. As such, we use the term "evaluation" to refer to the type-2 process of reflectively appraising a propositional stimulus as "good" (useful, beneficial, healthy) or "bad" (harmful, unsafe, unhealthy). This distinction is necessary to accommodate the fact that, unlike social situations, in which pleasant or unpleasant emotional responses follow the cognitive appraisal of symbolic concepts and socially or culturally defined constructs (e. g., power hierarchies, social status, self-worth), exercise is not only a social stimulus but also a physical or somatic stimulus. As such, it can induce not only social emotions but also salient responses of pleasure and displeasure that arise from the body directly, in noncognitively-mediated fashion, linked to homeostatic perturbations or other dysfunctions (e. g., the acidity of anaerobic metabolism or the inflammation of an arthritic knee).

The ART of physical inactivity and exercise assumes that the perception of a stimulus related to an exercise-related object activates automatic associations, which typically involve connections to the directly triggered concept (exercise) as well as associations linked, for example, to the present state of physical inactivity. The affective valence of the resulting situated automatic affective valuation is determined by the relative strength of the various associations, such as strong positive associations with "indolence" and weaker negative associations with "exercise". The more or less pleasurable state given by the automatic affective valuation may or may not reach awareness (Strack & Deutsch, 2004) and is directly linked (Chen & Bargh, 1999) to a discrete approach or avoidance impulse vis à vis the behavior implied by the stimulus. The whole process, from stimulus perception to action impulse, is a fast, automatic and effortless, inherently affective type-1 process.

The type-2 process. Subject to the availability of self-control resources (Hofmann, Friese, & Wiers, 2008), a slower and more effortful type-2 process (which is more likely to be consciously monitored; Strack & Deutsch, 2004) will follow the automatic affective valuation. The type-2 process includes propositions of varying affective load. Propositions about affective states connected with "exercising" and physical inactivity are derived from previous experience and mental simulation (e. g., beliefs about anticipated affective experiences). Higher-level cognitive operations, such as deliberative reasoning about one's needs and values (self-determination theory; Deci & Ryan, 1985), the pros and cons of behavior change (social cognitive theory; Bandura, 1986), or subjective beliefs (theory of planned behavior; Ajzen, 1985) may also contribute to this process. It is important to emphasize that the ART of physical inactivity and exercise does not further specify the content of the higher cognitive operations that are part of the type-2 processing and generate the controlled evaluation. Type-2 processing can result in action planning (e. g., formation of behavioral goals, intentions). Action plans, as well as action impulses, can represent a driving or restraining force with respect to a potential alternative to ongoing behavior.

Process interaction. The type-1 and type-2 processes are theorized to have distinct phylogenetic origins and neuroanatomical substrates (Bechara, 2005; Bickel et al., 2007) and are psychologically interconnected. First, automatic associations are retrieved from learned exercise-pleasure and exercise-displeasure pairings and related propositions. Second, every activation of an association leaves traces in the associative network (Strack & Deutsch, 2004). Third, provided that self-control resources are available, the automatic affective valuation informs type-2 processing. This part of the interaction qualifies the ART of physical inactivity and exercise as a *default-interventionist model*, in which the fast and effortless automatic affective valuation is the default-response upon which the slower, controlled response is based. The automatic affective valuation can be rejected as a basis for the reflective evaluation or can "color" the subsequent controlled process. The resulting feedback loop (the automatic

affective valuation feeding into the controlled evaluation, which can be stored in memory and can contribute to future automatic associations) is a prerequisite for learning, i. e., the formation of future valuations and evaluations with connected behavior.

Links to behavior. The action impulse (always a single impulse) and action plans (sometimes more than one) can occur independently of each other. Action plan(s), the result of type-2 processing, and the action impulse, the result of type-1 processing, may be concordant (e. g., the action impulse to pack one's workout bag now plus the intention to follow the doctor's advice and start exercising) or discrepant (e. g., the action impulse is to remain seated whereas the intention is to get up and do some exercise). We assume that the action impulse will generally prevail when self-regulatory resources are low (Baumeister & Heatherton, 1996; Englert, 2016; Hofmann, Friese, & Wiers, 2008).

Driving and restraining forces. The assumption of a possible approach-avoidance conflict (i. e., that the results of the automatic affective valuation and the controlled evaluation can be and remain incompatible) marks a fundamental difference between ART and other theories of exercise motivation. Theories, such as the theory of planned behavior, social cognitive theory, and self-determination theory, provide good explanations of the forces driving individuals to adopt the alternative behavior (exercise) but offer no account of the potential restraining forces. From the perspective of these theories, the explanation for why individuals change their behavior and become physically active is essentially the same explanation for why physically inactive people may maintain their present state of physical inactivity (e. g., remain sedentary), namely that their motivation to change is not strong enough. This is what the ART of physical inactivity and exercise adds: although the outcome of the controlled reflection might be a plan to, for example, set off on a cycle ride, the inactive person might not have changed his or her behavior and actually implemented this plan *because* at that moment the restraining action impulse derived from the automatic valuation (pleasurable core affect) associated with being seated was stronger. In sum, the ART of physical inactivity and exercise may be better suited than other theories to explain why, at a given moment, physically inactive people prefer to remain physically inactive.

The ART of physical inactivity and exercise complements current views on how psychological interventions can help individuals change their behavior and exercise more regularly. It emphasizes the role of one's automatic affective valuation of a behavior. According to ART, an individual's positive affective reaction to the subjective notion of exercise derived from automatic processing (and the connected approach-oriented action impulse) will provide no restraining force to counter controlled reflections and action plans that are also directed towards exercising. On the other hand, a negative automatic affective response to the notion of exercise will drive the physically inactive person to maintain his or her current avoidant behavior. In that case, self-regulatory resources (Englert, 2016; Muraven, et al., 1998) would need to be engaged to tip the behavioral balance towards the controlled process (in this case, generating an action plan to start exercising now) and thus initiate a change in behavioral state (Hofmann, et al., 2008).

Preliminary empirical evidence

The ART of physical inactivity and exercise was developed within the framework of the perspectives and theories outlined in the introductory part of this article, but it has also been progressively refined on the basis of results from a series of exercise-related studies. These empirical studies are summarized below.

The ART of physical inactivity and exercise emphasizes the role of automatic affect. In a laboratory-based priming study, Antoniewicz and Brand (2014) compared highly active exercisers who reported that they usually avoided indoor exercise settings to exercisers who reported that they regularly exercised in a fitness center. They found that only the indoor exercisers showed positive affective responses to genuinely neutral Chinese ideographs that were preceded by subliminal presentations (7-ms presentation time) of fitness center primes. These results provide evidence of affective misattribution (Murphy & Zajonc, 1993). This study showed that unconsciously perceived exercise-related (valenced) stimuli generate positive and negative affective responses in exercisers. Thus, the study provided evidence of the validity of a central assumption of the ART of physical inactivity and exercise, namely of the existence of a detectable *automatic* affective response to exercise-related objects of evaluation.

While the aforementioned study (Antoniewicz & Brand, 2014) used an adapted version of the Affective Misattribution Procedure (Payne, Cheng, Govorun, & Stewart, 2005), other studies have used variants of the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998). The principle underlying the IAT is that it compares the relative strength of association of the concept of exercise with positive attributes (e. g., good, like, pleasurable) and negative attributes (e. g., bad, disliked, unpleasant). Despite methodological criticism of the IAT (e. g., Hughes, Barnes-Holmes, & De Houwer, 2011) and perhaps due to the relative robustness of its measurements and ease of administration, the IAT is regarded as the method of choice for assessing automatic evaluations (Nosek, Greenwald, & Banaji, 2007), especially in the domain of applied social cognition research. In our context, using the IAT brings the advantage that measurements adequately reflect the automaticity of the valuative process. A disadvantage may be that IAT measures may also reflect, at least in part, a cognitive representation of the pleasant or unpleasant feelings related to exercise. However, with the concept of "valuation", as defined earlier in this article, we suggested an additional somato-affective core alongside cognitive appraisal.

A few exercise-related studies have exploited features of the IAT and investigated correlations between the two associative foci ("exercise" and "good" versus "exercise" and "bad") and exercise behavior (Antoniewicz & Brand, 2016a, 2016b). For example, the Antoniewicz and Brand

study (2016b) showed that positive associations with exercise prospectively discriminated between adherers and non-adherers to a 14-week exercise course, whereas negative associations did not. With regard to the ART of physical inactivity and exercise, studies like these provide evidence that both positive and negative automatic associations contribute to the evaluation process and these may vary between individuals (e. g., between exercisers and non-exercisers).

Numerous studies have investigated self-reported affective responses to exercise and shown that negative affect during exercise is associated with exercise avoidance, especially in sedentary populations (e. g., Ekkekakis & Dafermos, 2012; Rhodes & Kates, 2015). Likewise, there are several reports of positive correlations between automatic affective evaluations (we will use "evaluation" in all cases where this term was used in the original study) and self-reported exercise volume (Bluemke et al., 2010; Chevance, Caudroit, Romain, & Boiché, 2017), as well as one prospective longitudinal study, in which more positive automatic evaluations predicted objectively monitored attendance at an exercise course (Antoniewicz & Brand, 2016b).

Antoniewicz and Brand (2016a) demonstrated that automatic affective evaluations are connected to an action impulse. In one experiment, they showed that automatic affective evaluations of exercise can be altered using an exercise-related evaluative conditioning task, in which pictures of exercise and inactivity (the conditioned stimuli) were systematically paired with affectively valenced images (unconditioned stimuli, e. g., photos illustrating negative or positive bodily sensations and feelings). In another experiment, with a separate sample, participants spontaneously chose lower or higher exercise intensities on a cycle ergometer after having learnt negative or positive associations in the evaluative conditioning task, respectively. Taken together, these two experiments suggest that associations of the concepts of physical inactivity and exercise with positive or negative feelings are a consequence of associative learning, and that negative versus positive automatic affective evaluations of exercise can create an action impulse to avoid or expose oneself to physical effort.

Another study focused on the default-interventionist relationship between automatic and controlled affective evaluations of exercise (Brand & Antoniewicz, 2016). The authors devised a sequential paradigm to assess the pairing of automatic and controlled evaluations. The paradigm consists of an assessment of the participant's automatic affective response (step 1), followed by immediate disclosure of this result to the participant (step 2) and elicitation of the participant's rating of the discrepancy between his or her reflective affective evaluation and the automatic affective response that had just been disclosed (step 3). Brand and Antoniewicz (2016) tested hypotheses about correlations between participants' reports of their automatic-reflective evaluative discrepancy and their recorded 14-week attendance frequency at a health and fitness club. The results showed that participants' health and fitness club visits were less frequent if their net (automatic plus reflective) affective evaluation of exercise was negative. Participants were also asked what their ideal exercise frequency was (exercise sessions per week). Those with negative automatic evaluations of exercise, indicating that their reflective evaluation was more positive, were less likely to achieve their ideal attendance rate. This indicates that behavioral inconsistency, namely a mismatch between one's desired and actual exercise behavior, may result from an unduly positive reflective evaluation of exercise in combination with rejection of a spontaneous (automatic) negative reaction as a valid basis for the reflective evaluation of exercise (idealized evaluation hypothesis; Brand & Antoniewicz, 2016, p. 637).

Conclusion

This article introduced the ART of physical inactivity and exercise and explained its main theoretical roots and underlying concepts. The ART is a default-interventionist dual-process theory that emphasizes the importance of automatic positive and negative associations for subsequent physical inactivity or exercise. It is a theory grounded firmly in exercise psychology and linked closely to research on affective responses to exercise. It suggests that the automatic valuation of exercise and physical inactivity (which is connected to an immediate action impulse) is the basis from which subsequent, more complex affective and cognitive operations (e. g., weighing beliefs and values, action planning) can arise. In this way, the ART complements and attempts to incorporate findings from the numerous studies on exercise motivation that were inspired by cognitivist theorizing (e. g., theory of planned behavior, social-cognitive theory, self-determination theory) and emphasize the role of rational thinking in behavioral choices. The ART goes beyond other theories in that it offers an explanation—other than lack of motivation to change—for why many people remain in a state of physical inactivity; it proposes that the core affective valence associated with the current state of physical inactivity is more positive than the affective valence associated with exercise. This article outlined the empirical findings which led us to formulate this integrative theoretical account.

We hope that authors in exercise psychology will find this outline intriguing and relevant to their work. We also hope that the ART will inspire empirical studies designed to test hypotheses derived from the ART postulates. We certainly recognize that further theoretical elaboration of the ART of physical inactivity and exercise is warranted. Exploration of issues relating to adequate testing of automatic affective valuations, learning and interindividual differences (e. g., in trait self-control; Englert, 2016) would be particularly useful.

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Compliance with ethical guidelines

Conflict of interest. R. Brand and P. Ekkekakis certify that they have no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript.

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