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A SPLENDID article explicating the details of the Theory of Reasoned Action and how habits develop.

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Physical exercise habit: on the conceptualization and formation of habitual health behaviours

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Abstract

An observation one can make when reviewing the literature on physical activity is that health-enhancing exercise habits tend to wear off as soon as individuals enter adolescence. Therefore, exercise habits should be promoted and preserved early in life. This article focuses on the formation of physical exercise habits. First, the literature on motivational determinants of habitual exercise and related behaviours is discussed, and the concept of habit is further explored. Based on this literature, a theoretical model of exercise habit formation is proposed. More specifically, expanding on the idea that habits are the result of automated cognitive processes, it is argued that physical exercise habits are capable of being automatically activated by the situational features that normally precede these behaviours. These habits may enhance health as a result of consistent performance over a long period of time. Subsequently, obstacles to the formation of exercise habits are discussed and interventions that may anticipate these obstacles are presented. Finally, implications for theory and practice are briefly discussed.

Introduction

Physical exercise promotes health in a variety of physiological and psychological ways in both adolescents and adults. Exercise, if carried out regularly and with sufficient physical intensity, is associated with increased strength and flexibility, reduced cardiovascular diseases risk, and may contribute to a more effective treatment of stress and depression (Blair *et al.*, 1992; Bijnen *et al.*, 1993; Sallis and Patrick, 1994). Regular exercise may thus contribute to an enhancement of health in all people.

At first sight, physical activity (e.g. jumping, walking, running) seems to be a natural part of children's daily life that, once learned, does not require intentional efforts and planning to set in motion. In other words, at these ages decisions to exercise are supposed to be made in a rather 'mindless', automatic fashion and can therefore be described as rather *habitual*. However, when growing older, many children in industrialized western countries gradually pursue and maintain an inactive lifestyle, probably partly due to concurrent daily activities such as watching television, playing video games and driving cars (Gortmaker *et al.*, 1990; Robinson *et al.*, 1993). For instance, a longitudinal study conducted by Kemper (1995) shows that the level of physical activity among a group of Dutch adolescents decreases strongly as soon as they pass the age of 14 years old. Similar patterns have been observed in American youth (Kelder *et al.*, 1993). These results suggest that children's daily physical activity habits are quite short lived and may therefore fail to carry over to adulthood. Although there are few prospective studies on the health benefits of exercise habits in childhood and adolescence, it seems plausible to assume that these health benefits cannot be saved up, thus loosing their potential value for later life.

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Therefore, just like other health behaviours executed on a daily basis (e.g. dental care, wearing seat-belts, eating non-fattening food, using contraceptives) it is important to promote and (re)establish exercise habits early in life so they may persist into adult years. Indeed, efforts have been undertaken to design educational or other intervention programs aimed at motivating adolescents to develop life-long patterns of physical activity, though with relatively little success (Sallis *et al.*, 1992; Aarts *et al.*, 1997). A better understanding of the process of exercise habit formation may thus be crucial to guide the further development of effective programs.

In the last two decades considerable progress has been made in understanding and predicting the initiation of human behaviours (Theory of Reasoned Action, Fishbein and Ajzen, 1975; Theory of Planned Behaviour, Ajzen, 1985), and especially individuals' decision to behave in a healthy way (Health Belief Model, Janz and Becker, 1984; Protection Motivation Theory, Rogers, 1983). Also, models of behaviour change and maintenance have been proposed and empirically tested for a variety of health behaviours (Prochaska, 1994). However, although this research has thrown more light on the reasoned-based and planned nature of exercise behaviour, little theoretical and empirical attention has been given to the process of habit formation.

The present paper describes a theoretical model of exercise habit formation, and the effects of attitudes, perceived social norms, behavioural control and exercise experiences on the initiation and persistence of exercise habits. The proposed model is heavily based on behavioural and cognitive research in the domain of social psychology, and may be characterized as a slightly modified version of general models of habitual exercise behaviours. In fact, the modification primarily concerns explaining the role of memory of past exercise experiences and emphasizing cognitive processes involved in the acquisition of exercise habits.

First, current empirical and theoretical literature on motivational determinants of physical exercise habits and related behaviours will be discussed. Subsequently, the model of habit formation will be outlined. Finally, we will scrutinize the obstacles to developing long-life exercise habits and focus on interventions aimed at promoting and reinforcing habitual physical exercise patterns, which may anticipate these obstacles.

Theoretical background

Extensive decision making in exercise behaviour

In general, psychological research on the origins of goal-directed human behaviours relies on models of rational choice. Fishbein and Ajzen's (1975; Ajzen and Fishbein, 1980) attitude–behaviour model, also known as the Theory of Reasoned Action, probably constitutes the most influential and well-documented model. The Theory of Reasoned Action postulates that attitudes (i.e. the desirability of the behaviour which is supposed to be based on a personal trade-off between the perceived positive and negative consequences of performing the behaviour), together with subjective norms (representing the experienced social pressure), are the antecedents of behavioural intentions, which in turn are supposed to precede behaviour.

Because the attainment of goals (e.g. jogging non-stop over a distance of 5 km) is subjected to some degree of uncertainty, Ajzen (1985, 1991) has added a third concept to the prediction of behaviour, i.e. Perceived Behaviour Control, representing one's perception of how easy or difficult it is to perform the behaviour. The notion of Perceived Behavioural Control is quite similar to self-efficacy beliefs in Bandura's Social Learning Theory (1977). Ajzen (1991) places this construct within a more general framework of the relations among attitudes, perceived social norms, intentions and behaviour, which has resulted in the Theory of Planned Behaviour. According to Ajzen (1991), perceived control, which encompasses both internal factors (e.g. skills, knowledge, adequate planning) and external factors (e.g. facilitating conditions, availability of resources), is proposed to exert an impact on behaviour in two ways. Firstly, it affects

behaviour indirectly, i.e. through the mediating role of intentions. In this version, Perceived Behavioural Control has motivational implications for intentions. For instance, individuals who believe that they have neither the skills nor the opportunities to exercise are unlikely to form intentions to engage in it even if they hold favourable attitudes and experience social pressure to perform the behaviour. Second, it may have a direct influence on behaviour. This version, therefore, assumes that perceived control equals actual control. Consequently, performance of the behaviour depends not only on motivation (i.e. intentions) but also on adequate control over the behaviour in question. Thus, the fewer skills and opportunities individual's possess, and the more obstacles they anticipate, the less likely they will enact their intentions.

Ajzen and Fishbein (1980) and Ajzen (1991) have devoted much work to the assessment of their concepts. Furthermore, they maintain that 'external' variables (e.g. demographic factors, the presence of the physical and social environment) influence reasoned behaviour indirectly, i.e. given the correct measurement procedure, external variables are proposed to be mediated by, or interact with, attitudes, perceived social norms and control in the prediction of behaviour. Whereas some social scientists may argue against this proposition, the Theory of Planned Behaviour has provided no set of reasoned ideas specifying how these more *distal* external variables affect the more *proximal* behavioural variables. The Theory of Planned Behaviour is, therefore, a theory of the most proximal causes of behaviour.

The predictive value of the theory is solid (Sheppard *et al.*, 1988; Eagly and Chaiken, 1993) and it has been applied in a number of studies on exercise behaviour (for a review, see Blue, 1995; Godin, 1994).

Taken together, both the models of reasoned action and planned behaviour emphasize the deliberate character of individual choice. The models seem to assume that choices are made consciously, e.g. people exercise because they have consciously decided to do it; their decision follows from their belief that exercising is associated with more favourable consequences than not exercising, and their conviction that they have the opportunities and skills to exercise and thus obtain the expected favourable consequences. These decisions may either be based on information acquired and provided by the physical and social environment, stored in memory or by simply observing ongoing behaviours of significant others.

The role of habit in exercise behaviour

When considering exercise behaviour, the models of reasoned action and planned behaviour seem to ignore one important aspect of physical activity, i.e. its repetitive nature. That is, if on one day individuals exercise in order to achieve a specific goal (e.g. feeling fit), they are likely to use the experiences of that behaviour in a decision concerning a similar opportunity to exercise on a next day. After all, when performing the behaviour one learns about the favourable and unfavourable consequences of it. In other words, decisions to exercise are strongly influenced by experiences gained from previous exercise events. However, Fishbein and Ajzen (1975) and Ajzen (1991) acknowledge that previous behaviour may influence later behaviour—they presume that behaviour produces feedback that influences subsequent attitudes and perceptions of social norms and control. Moreover, it is expected that with increased practice Perceived Behavioural Control is directly related to behaviour, since it gradually becomes a substitute for actual control, i.e. adequate performance ability or skills. Thus, they suggest that the impact of past behaviour on later behaviour is, within the confines of their model, mediated by perceptions of desirability, social norms, control and intentions to execute the behaviour.

However, it may be questioned whether individuals go through such a contemplative decisional process, as described above, when they make the same decisions over and again. Moreover, past behaviour can influence subsequent behaviour directly. For instance, Triandis (1980) suggests that deliberate intentions may become irrelevant in guiding behaviour when the behaviour has been

performed repeatedly in the past and has become habitual. In fact, Triandis (1980) hypothesizes that intention and habit interact in the prediction of later behaviour. In a related vein, Dishman (1982) observed that starting an exercise program is reliably predictable from attitudinal variables, whereas persistence is typically not. This suggests that repeated behaviours may be largely determined by *habit* rather than by reasoned action. Or as behavioural decision theorists would state: habitual decisions '...may be the product of an earlier, more reasoned strategy which have become mechanical in order to realize the economy of not having to go through the whole strategy selection process each time the decision task is encountered' (Beach and Mitchell, 1978, p. 443). In other words, when behaviour is performed many times, one does not need to weigh pros and cons or to check up one's attitudes and behavioural control in order to arrive at a choice. When habits are formed, subsequent behaviour may be associated with, and automatically triggered by, the specific situational cues that normally precede it.

Indeed, studies that have included a measure of habit (i.e. self-reported frequency of past behaviour) suggest that in the case of physical exercise intentions are insufficient to account for the variability in the prediction of actual behaviour. It has been shown that a measure of habit may contribute to the prediction of exercise, in addition to the traditional predictors, such as attitudes and intentions (Bentler and Speckert, 1981; Valois *et al.*, 1988; Dzewaltowski *et al.*, 1990; Reynolds *et al.*, 1990; Godin *et al.*, 1993). Furthermore, there are a still growing number of studies in other behavioural domains, such as blood donation, seat-belt use and travel mode choice behaviour, that empirically corroborate the idea that habit and intentions interact in the prediction of later behaviour, i.e. intentions are less predictive of behaviour as habit increases in strength (Bagozzi, 1981; Mittal, 1988; Montano and Taplin, 1991; Verplanken *et al.*, 1994; Aarts, 1996).

In common parlance, the term habit is often used interchangeably for behaviour that is performed on a regular basis. Accordingly, on an operational level habit is often measured by self-reported frequency of past behaviour. However, for the present purpose three features of habit, as the concept is used here, are worth considering. First, psychologists generally conceptualize habits as the learning of sequences of acts that have become automatic responses to specific situations, which may be functional in order to satisfy specific needs, or to obtain certain goals (James, 1890; Watson, 1914; Triandis, 1980; Ronis *et al.*, 1989). Habits are characterized by a goal-directed type of automaticity; habitual behaviours are instigated by a specific goal-directed state of mind in the presence of triggering stimulus cues, e.g. when Theo puts on the personal computer upon entering his office or as in the present context when Herman starts to exercise after coming home from work. Secondly, in the traditional view of habit formation, satisfactory experiences enhance the tendency to repeat the same course of action, mainly because the behaviour becomes more strongly associated with the goal one initially wished to attain (e.g. a 'cycling–feeling fit' link or a 'playing squash–seeing friends' link). Conversely, dissatisfaction weakens the link between behaviour and goal, decreasing the probability a person will continue the behaviour. Therefore, habit strength increases as a result of repetitions of positive reinforcements. Thirdly, it should be noted that the habit concept is strongly rooted in behaviourist approaches to learning theory, typically emphasizing that cognitive processes play no role in the stimulus control of behaviour. Nevertheless, habits are cognitive processes, however automatic and routinized they may be. In terms of cognitive psychology, habitual exercise behaviour may be conceived of as mentally represented structures in which a certain situation is strongly associated with the goal to exercise that is chronically pursued in that situation (*cf.* the concept of schemas or scripts; Abelson, 1981). The habitual chosen type of exercise can then automatically and immediately be activated upon the instigation of the goal to exercise (see Bargh, 1989; Bargh and Gollwitzer, 1994; on the subject of automatic cognitive responses of routinely performed goal-directed behaviours).

Thus, when a person nearly always cycles directly after coming home from work (i.e. the more abstract goal of 'cycling after work'), that goal will eventually become automatically activated within that situation, just as do other behaviours routinely performed in everyday life, e.g. habitually using the car to go to work (Goodwin, 1977; Verplanken *et al.*, 1994; Aarts and Dijksterhuis, submitted).

Reasoned action and habit can be considered as two extremes of a continuum. In cases that goal-directed behaviours are neither automatic nor the result of extensive deliberation, the decision maker may employ something like a heuristic decision-making strategy to arrive at a choice. This heuristic choice process can be conceived of as a kind of cognitive shortcut, in which, for example, one does not scrutinize all the consequences of performing the behaviour but very quickly ponders on the most salient advantages of the behaviour to ascertain its desirability, or simply establishes whether the same behaviour can be executed (e.g. checking up one's agenda).

So far current literature on determinants of physical exercise habit has been discussed. In addition, we elaborated on the concept of habit and proposed that exercise habits are the result of automated cognitive processes. The following section focuses on the second goal of this paper, i.e. integrating our knowledge about determinants of physical exercise habits into a model of exercise habit formation.

Description of the model

It should be emphasized that the proposed model should be conceived of as a part of a hypothetical more general model encompassing the concepts usually incorporated in models of physical exercise, fitness and health, e.g. socio-demographic, biological and genetic factors (Bouchard *et al.*, 1994). The present focus is on a limited aspect of exercise behaviour, in particular on the proximal psychological causes, the way in which habits are formed, and the effects of exercise experiences and habit on subsequent decisions to exercise. The proposed model is schematically presented in Figure 1.

First of all, it should be noticed that individuals' decisions to exercise occur in and are influenced by the social and physical environment surrounding them. Therefore, as such this environment may exert impact on exercise behaviour in all stages of the decision-making process. For instance, persuasive messages about exercise in the school and media, as well as social pressure experienced from friends may enhance individuals' motivation to exercise in the near future. Also, observing behaviour of significant others may affect one's decision to exercise and, therefore, to imitate it (a process called vicarious learning; Bandura, 1977). Furthermore, the present climate is likely to influence the type of exercise behaviour individuals exhibit.

When at a given time one feels a need to exercise, one will consider one's perceptions of desirability, social norms and control associated with the behaviour in order to form an intention and come to a choice. In the case one has little or no previous experience with the behaviour, and feels that insufficient information is available to make a choice, one may seek additional information externally for further subjective validation of one's perceptions (e.g. by checking books and magazines or by simply consulting others who have experience with the behaviour in question). Once the goal to exercise is set, the deliberately formed intention will be implemented, resulting in actual performance. This initial contemplative decision process is depicted in the upper part of Figure 1.

The elaborate decision process, as described above, is meant to optimize the quality (or subjective utility) of the choice. Nevertheless, in performing the chosen course of action, one may discover that things are not quite as pleasant as one expected them to be. For instance, one may have chosen to cycle and ends up soaking wet, and eventually in bed with a terrible cold. Or, one chooses to attend an organized fitness program and learns that some parts of the program are unpleasant or very difficult to perform, and may even lead to serious injuries. Such concrete unsatisfactory experiences directly feed back onto perceptions of

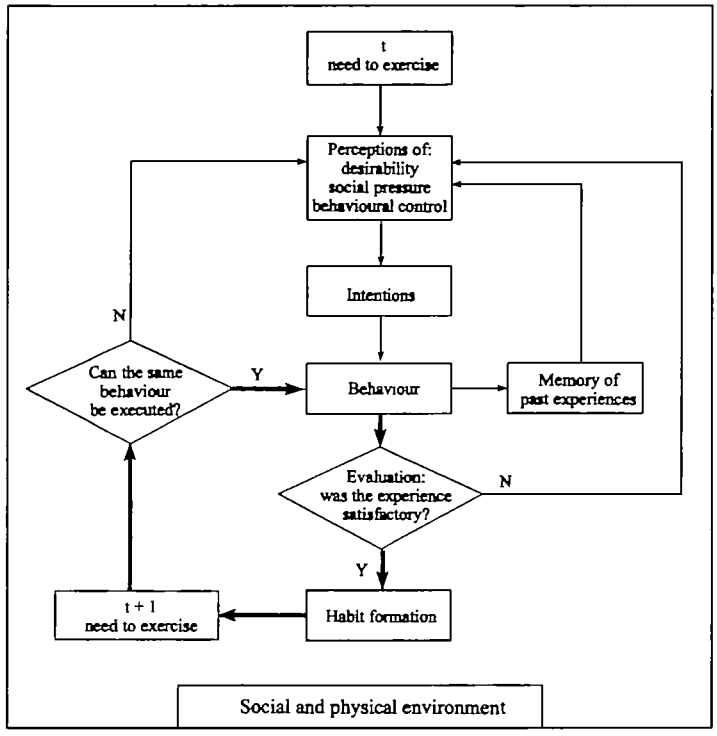

Fig. 1. Model of physical exercise and habit formation. The bold arrows indicate the formation process. Although the exit arrows of the diamond-shaped boxes suggest a deterministic model, the theoretically proposed contingencies are probabilistic.

the chosen course of action, by adjusting one's attitudes or perceptions of control towards the behaviour. Attribution theories (Weiner, 1986), for instance, describe how such experiences may alter perceptions of control. Any next attempt to exercise will have to start from scratch at the top of the model, but now with updated perceptions.

If the exercise experience turns out to be satisfactory, an enhanced tendency to repeat the action emerges. The satisfactory experiences may initially bolster one's attitudes or feelings of behavioural control and one may learn that the previously proposed goal can be accomplished (e.g. 'the experiences of running after my work were nice, so I like to run after my work and I am able to do it again'). In other words, all these favourable learning outcomes reinforce the need to choose the same course of the action when facing the same situation next time and thus making the recurrence of the behaviour more likely, if possible. That is, the recurrence of the behaviour is contingent on the opportunity to perform the behaviour under similar, if not identical circumstances. For instance, weather conditions are likely to affect the choice to exercise outdoors. Therefore, individuals probably first have to learn (or to recognize) whether and when the same behaviour can be executed to satisfy a certain need. This very first process of potential repetition is depicted most left of Figure 1.

It seems plausible, though, that with increased practice the contemplative decision process may gradually change into a more heuristic one via memory of past behavioural experiences. That is, over time, cognitive shortcuts will develop, basically because the trade-offs between the costs and benefits of exercising and beliefs about behavioural control need not to be considered over and again once their outcomes are stored in, and readily

retrievable from, memory (*cf.* Fazio, 1990). In addition, as the same behaviour is performed more often, and thus certain events occur together repeatedly, these events may be combined or 'compiled' into a single episodic instance (Anderson, 1982). That is, what began as a sequence of actions ('if I come home from work and it is a sunny day, then I put on my shorts' followed by 'if I have putting on my shorts, then I go outside and start to run') may end up as one procedural mega-step ('if I come home from work on a sunny day, then I put on my shorts, go outside and start to run'). Physical exercise becomes a built-in part of the 'after work script', so to speak. Once evoked by situational cues, this well-learned script may guide attention and behavioural decisions within that situation. As a result, the need for deliberate planning, in the sense of checking up on pros and cons, gradually diminishes. It may, therefore, be argued that the core features of heuristic processing concern the retrieval from memory of conclusions reached and decisions made in previous choice processes. In terms of the proposed model, this type of 'learning' is represented by the feedback of past behaviours into memory and the influence of memory of exercise events on perceptions.

Now, genuine habit formation, in the sense of the development of routinized, automatic decisions on courses of action and their subsequent execution, only occurs in those instances in which the same behaviour is repeatedly followed by satisfactory outcomes. In terms of the postulated model, the probability increases that for any next time the same decision to exercise is actually implemented, if the usual performance of the behaviour is not obstructed by obstacles. Thus, in a sense, habit can be said to be formed to some degree by one single experience. Of course, additional positive experiences with the chosen type of exercise will further enhance the strength of the habit, and thus contribute to the further automatization of choosing and performing the same behaviour. All that the behaviour requires to occur is the instigation of the goal to act in memory, which in turn is supposed to be triggered by the situational cues that usually precede the behaviour (i.e. stimuli in the social and physical environment). Habitual exercise is incorporated in routinized daily activity patterns. The feedback loop in bold arrows in the bottom left of Figure 1 represents this habit formation process.

In sum, as in current literature on models of physical exercise, we assume that initiation of exercise is largely determined by deliberate decision making (attitudes, experienced social pressure, perceived behavioural control). With continued repetition and more practice the underlying decisional process of exercise gradually shifts from an extensive—via a heuristic—to a rather automatic one. Eventually, a habit has been formed that no longer needs to be guided by reasoned considerations.

Obstacles to develop a habit

In the habit formation process just described, there are many obstacles to the development of exercise habits. First, the person may not know which types of exercise behaviour promotes health or that a sedentary lifestyle will have negative effects for health in the long term. Therefore, individuals may not be motivated to start any type of health-enhancing exercise behaviour.

Second, despite health beliefs the person may never decide to attempt a certain activity, because it seems not desirable enough. This suggests that the initiation of exercise behaviour does not merely rely on having knowledge about the relationship between exercise and health. In addition, individuals will also base their decision to exercise on other, non-health-related consequences.

Third, after trying the behaviour and learning about its consequences and/or its difficulty, the person may decide to quit the action. This may be because the expected outcomes of the chosen type of exercise are not immediately obtained, basically because they are only visible in the long term (a problem related to many health behaviours). Also, when performing the behaviour persons may encounter unanticipated negative consequences. On the other hand, individuals may have created personal goals that are rather difficult to achieve. For example, jogging over a distance of 5 km may be a relatively more difficult task for untrained

persons than cycling 10 km (notice that both types of activities can be done in 30 min). Therefore, individuals should be encouraged to choose a type of exercise behaviour that leads to immediate satisfactory experiences and can be executed within the boundaries of their personal capabilities. In other words, in order to develop exercise habits, focusing on both proximal outcomes and goals is more effective than directing attention to distal ones.

Fourth, the possibility to carry out the same behaviour any next time constitutes an important link in the chain of repeated exercise behaviour and the development of a habit. For example, time constraints and lack of facilities have been found to be the main reasons why individuals do not maintain an exercise program (Dishman, 1991). Therefore, the degree of (internal and external) control over the behaviour is an important element in the process of habit formation and its livelihood (Prochaska, 1994). This suggests that relatively simple exercise behaviours (e.g. walking, cycling) may more easily become habitual than behaviours that are rather complex (e.g. attending an organized fitness program), because the latter behaviours are more subjected to facilities, and probably need more intentional effort and planning to occur. Moreover, activities such as walking and cycling can be incorporated in existing routinized daily life, e.g. choosing the bicycle as mode of transport to go to work.

To review, in order to be effective, educational and other intervention programs for the promotion of health-enhancing physical exercise habits, should stress and include a wide variety of aspects. They should (1) provide information about the types of exercise behaviours that have clear health consequences; (2) stress short-term advantages to increase the probability of immediate satisfactory experiences; (3) recommend individuals to choose a specific type of exercise behaviour they are able to perform successfully and stress challenging goals that are proximal, rather than distal; and (4) provide resources and opportunities that enable individuals to perform the type of exercise they like at any time they want to enjoy it.

Conclusions and discussion

In the present article we have focused on habitual behaviours, i.e. physical exercise, that have a clear positive effect on health. Based on current literature on habitual exercise behaviours we proposed a theoretical model of exercise habit formation. Although some authors maintain that physical exercise behaviours may never become habitual (Valois *et al.*, 1988), scrutinizing the concept of habit more thoroughly made us believe they can. It was argued that exercise behaviours may become capable of being automatically activated by the situational features that usually precede that behaviour, just as do other habitual behaviours that are routinely performed in everyday life. When behaviour is not habitual, people may not repeat the action because they have forgotten about it or they have made a deliberate decision and changed their minds. Therefore, in order to attain favourable health benefits individuals should be encouraged to develop exercise habits. After all, exercise habits, as the concept is used here, are automatically evoked and do not need much intentional effort or extensive planning: the behaviour may thus be consistently and frequently performed for a long period of time.

Moreover, it was argued that exercise habits may be established, especially when they can be incorporated in existing lifestyles, e.g. such as walking and cycling. These behaviours can be considered as moderate intensity activities, and moderate physical exercise is associated with positive health consequences, if habitually performed. This line of argument concurs with the remarkably new look at health-related physical activity promotion, typically emphasizing that physical exercise should be conceived of as an integral part of habitual daily routines, rather than reasoned-based decisions to exercise in leisure time (Wimbush, 1994; *Health Update*, 1995; Pekka, 1996). This is not to say that vigorous physical exercise should not be promoted. We only want to stress that individuals should be encouraged to perform exercise behaviours they perceived as desirable as well as feasible that eventually become habitual.

Walking may thus be a promising target behaviour to be promoted, because this type of exercise does not require special equipment, a formal facility or fellow participants (Hillsdon *et al.*, 1995). Moreover, walking serves as an alternative mode of transport, not only to enhance health. Accordingly, fostering walking may reduce the current problems associated with excessive car use, such as environmental pollution and traffic congestion. A similar line of reasoning may apply to cycling and other types of exercise.

Although this article focuses on exercise habits, the present theoretical notions of habit formation may also pertain to other habitual health behaviours, e.g. eating non-fatty food, brushing one's teeth. As long as the same principles of learning and automatization apply to them as well, any type of repetitive behaviour requires less and less mental effort and conscious attention, and thus may eventually become habitual, i.e. if an individual frequently and consistently pursues the same goal within similar situations.

In addition, the present theoretical propositions as to the formation of a habit may also provide helpful insights into the steps that are required to break *un*healthy habitual behaviours. For instance, changing unhealthful habits via the attitude–intentions–behaviour route seems an inefficient enterprise, because the behaviour is no longer guided by intentions. Traditional persuasive communications aimed at changing attitudes might be effective for weak habit target groups, e.g. to prevent them from developing unwanted habits. The model proposed in this article may therefore lead to the consideration of alternative strategies to break unhealthful habits. This might be attempted, for example, by employing economic measures that reduce the attractiveness of the unwanted habitual behaviour or by adopting more severe measures that prevent individuals from performing the habit, enabling them to take alternative courses of actions. Once habit strength is reduced, information campaigns aimed at changing attitudes may be more successful in terms of behavioural changes.

The reviewed literature and the postulated model draw attention to some important issues that need to be addressed in future research. First, it is worth emphasizing that in studies on habitual behaviours most researchers operationalize habit as self-reported frequency of past behaviour. However, it has been argued that this operationalization is somehow problematic (Ronis *et al.*, 1989; Eagly and Chaiken, 1993; Aarts, 1996). Firstly, subjectively reporting on the frequency of past behaviour may yield less accurate responses than one would wish (Pearson *et al.*, 1992). That is, to the extent that habitual behaviours are performed automatically and may, therefore, constitute non-salient events, memories of having performed the behaviour in question may be difficult to evoke (except maybe by presenting the very goals that instigated the behaviour). Additionally, subjects' estimates of frequency may be biased by heuristics such as availability or representativeness (Tversky and Kahneman, 1974). Further research on habitual behaviour should therefore develop and validate alternative measures of habit that do not rely on subjects' ability to remember frequency of past behaviour. For example, response time paradigms may be employed, in which subjects are briefly presented or 'primed' with a sample of representative situations (behavioural goals), eliciting a specific behaviour (e.g. physical exercise, travel behaviour). Next, for each situation they are required to respond as quickly as possible with the behavioural alternative that comes first to mind (e.g. going to work may evoke bicycle use). The speed of retrieving a specific action in response to the presented situations may then be indicative of the strength of the habit of performing that behaviour (i.e. association strength among situation, goal and behaviour). In addition, the frequency of responding with a particular behavioural alternative may reflect the extent to which the habit of choosing that alternative is generalized (Verplanken *et al.*, 1994). Such measures do not rely on self-reports of the past and, moreover, may capture the element of goal-directed automaticity, which is an essential characteristic of the habit concept.

Another important point concerning the operationalization of habit by using self-reported frequency of past behaviour is that 'Repeated

occurrence is necessary for the formation of habit, but it is *not* habit itself' (Mittal, 1988, p. 997, italics added). Obviously, as argued before, habit formation is strongly linked to frequency of past behaviour. However, prior and later behaviour may correlate because other, not measured, determinants than habit may operate on both occasions (Ronis *et al.*, 1989; Eagly and Chaiken, 1993). However, whereas the observed unique shared variance between past and later behaviour does not provide conclusive evidence for the role of habit, studies that investigate an interaction between measures of habit and intention in the prediction of later behaviour may reveal the role of habit more clearly, i.e. deliberate intentions are less predictive of behaviour as habit increases in strength (Triandis, 1980).

Furthermore, most research on habitual behaviours is concerned with the measurement of attitudes, intentions, habit and later behaviour. Conclusions on causality tend to be based on the observed statistical relations between the measured constructs. Unfortunately, in such studies the processes mediating the relations between antecedent conditions and the resulting behaviour remain hidden. In other words, little empirical attention is given to the cognitive *processes* underlying habitual behaviours. In recent experiments Verplanken *et al.* (1997) and Aarts (1996) investigated the effects of habit on predecisional information use (information about the trip, e.g. distance, weather conditions, and about attributes of options, e.g. travel time, comfort) in the domain of a travel mode choice. Results showed that habit attenuates the process of information search and use preceding choices of mode of transport, which corroborates the idea that habitual choices tend to follow cognitive shortcuts. Of course, the cognitive processes underlying habitual choices require further study in other behavioural domains, in which for instance the decisional process is operationalized in terms of information search behaviour.

Finally, despite that many health-related behaviours are repeatedly and routinely executed, for some reason the role of habit is largely neglected in the field of health education. Perhaps this is consequent on the observation that healthy habits are rather difficult to establish or, once unhealthy habits have been formed, are hard to break. It is hoped that the present analyses on habitual physical exercise may encourage researchers and practitioners to take new pathways to be explored as to the understanding and promotion of health habits in general, and in particular physical activity habits.

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