Effort Minimization and the Built Environment: Public Health Implication

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Please cite as: Cheval, B., Maltagliati, S., Owen, N. (2025). Effort Minimization and the Built Environment: Public Health Implication. *SportRxiv*.

Abstract

Promoting physical activity represents a major public health opportunity due to its significant impact on physical and mental health. Despite ongoing efforts, public health interventions often struggle to achieve sustainable behavioural changes. Instead of explicitly or implicitly attributing such failures to a lack of individual motivation, it is essential to consider the characteristics of contemporary environments that promote physical inactivity. We propose an explanatory framework that integrates the theory of effort minimization in physical activity (TEMPA) with the postulates of the ecological model of physical activity behaviour. According to TEMPA, humans have an innate tendency to avoid physical effort, making it difficult to adopt an active lifestyle in environments where opportunities to minimize effort are pervasive. Complementarily, the ecological model emphasizes the key role of built environment in providing behaviour settings – those social and physical situations that can promote and sometimes demand certain actions and discourage or prohibit others. Building from TEMPA, we suggest that redesigning the built environment so that being active is the default behavioural option, while ensuring that it elicits positive affective responses, could be a decisive strategy. Such an approach could not only increase physical activity levels across the population but also help to reduce gender differentials and socio-spatial inequalities in participation.

Keywords: effort, psychology, nudges, environment, interventions, public health.

Introduction

Physical inactivity is one of the major global public health challenges. Despite widespread awareness of the benefits of regular physical activity, global levels of physical inactivity remain alarming and continue to rise. In 2022, 31.3% of the global population was physically inactive, compared to 23.4% in 2000 and 26.4% in 2010 (Strain et al., 2024). Adolescents (aged 11–17) are particularly affected, with 80% failing to meet the recommendation of 60 minutes of moderate-to-vigorous physical activity per day (Guthold et al., 2020). Socio-spatial and gender disparities further exacerbate this issue. For instance, adolescents from lower socio-economic backgrounds and girls exhibit higher levels of physical inactivity (Chalabaev et al., 2022; Guthold et al., 2020; Ricardo et al., 2022; Van der Ploeg et al., 2014). In France, for example, a report published in September 2024 by Santé Publique France highlights that physical activity levels remain insufficient, particularly among women, children and adolescents, and socio-economically disadvantaged populations (Saint-Maurice, 2024). Physical inactivity remains responsible for 4 to 5 million deaths annually worldwide – equivalent to one life lost every six to eight seconds (World Health Organization, 2024).

To combat what has been characterized as a “global pandemic” of physical inactivity (Kohl et al., 2012) and to meet the World Health Organization’s target of a 15% reduction in inactivity by 2030 (World Health Organization, 2019), it is crucial to better understand the multiple determinants of physical activity. This understanding is essential for designing targeted and effective interventions to promote the adoption of an active lifestyle across the population.

We explore how characteristics of the contemporary environment contribute to low levels of physical inactivity and high levels of sedentary behaviour, also highlighting disparities observed within specific population segments. By combining the theory of effort minimization in physical activity (TEMPA) (Cheval & Boisgontier, 2021; Cheval & Boisgontier, 2023) with the ecological model of physical activity and sedentary behaviour (Owen et al., 2011; Sallis et al., 2015), we propose an integrative explanatory framework to better understand the psychological mechanisms underlying our behaviors in modern environments. Specifically, TEMPA posits the existence of a human tendency to minimize physical effort – an evolutionarily adaptive trait that now poses a significant barrier to engaging in physical activity. This article emphasizes the importance of integrating this natural tendency into the design of environmentally focused public health programs and policies aimed at promoting more active lifestyles. This integration can offer practical and tailored public health recommendations by accounting for human behaviors related to effort minimization in different life settings, thereby guiding strategies to enhance adherence to physical activity and reduce sedentary behaviors.

Physical activity is any bodily movement produced by skeletal muscles that results in energy expenditure above resting metabolic levels (Caspersen et al., 1985). Sedentary behaviour, on the other hand, is any waking behaviour characterized by sitting, reclining, or lying down that requires an energy expenditure of 1.5 metabolic equivalents or lower (Sedentary Behavior Research Network, 2012). A central aspect of our approach involves examining the various "behaviour settings" of daily life where individuals may be more active, less active or sedentary: within the home, during leisure time, during transportation, or in the workplace. This integrative perspective aims to better understand the determinants and implications of physical activity and sedentary behaviour across diverse life contexts, thereby identifying relevant environmental and policy levers to promote a more active lifestyle. We argue that an integrative approach building on TEMPA and encompassing multi-context (i.e., behaviour settings) and multi-level (i.e., different socio-cultural, interpersonal and individual) dimensions, potentially can help to identify unique approaches to the global problem of physical inactivity. Figure 1 offers a graphical illustration of our proposed approach.

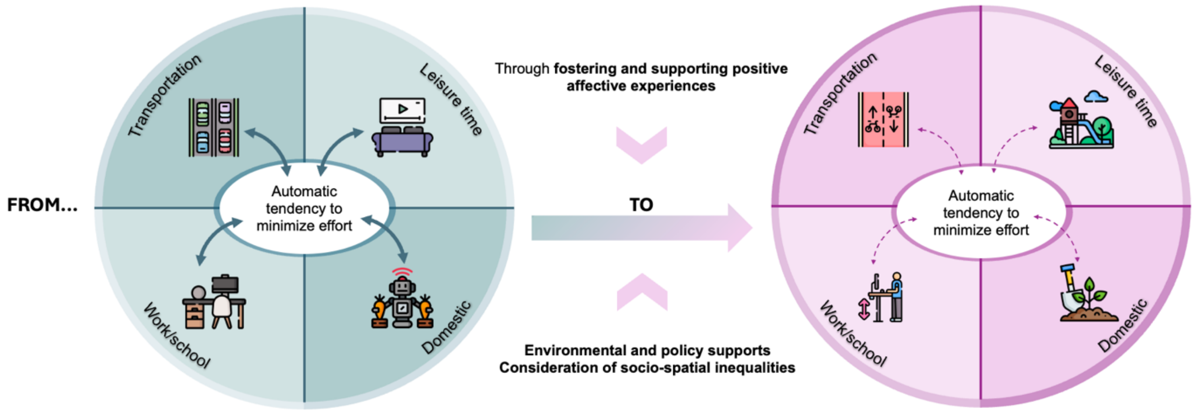

Figure 1. A multi-context and multi-level approach integrating the theory of effort minimisation in physical activity with the ecological model.

1. The role of environmental and social factors in the prevalence of physical inactivity and sedentary behaviours.

The ecological model posits that physical activity behaviours results from a combination of influences at multiple levels, ranging from individual characteristics to public policies (Sallis et al., 2015). Thus, in accordance with the work of Kurt Lewin (1951), this approach asserts that behaviour is shaped by both the individual and their environment. In other words, from this perspective, it is impossible to predict human behaviour without knowing the environmental structure or social conditions in which the individual is situated. This perspective aligns with Gibson's ecological model (Gibson, 2014). More specifically, Gibson introduced the concept of "affordances," which refers to the functional and relational properties of an environment. The modern ecological model, often attributed to Bronfenbrenner (1979), refined this idea by proposing that different environmental levels influence individual behaviour. This model includes five concentric levels: the intrapersonal level (individual factors such as age and cognitive processes), the interpersonal level (relationships with others), the organizational level (schools, sports associations), the community level (community structures and environment), and the policy level (local to national public policies).

A central element of this approach, the ecological model posits that these different levels of influence interact to shape behaviors (Ding & Gebel, 2012; Ding et al., 2012; Perez et al., 2017; Sallis et al., 2015; Sniehotta et al., 2017). Environmental factors can either support or hinder individual motivations (Giles-Corti & Donovan, 2002; Owen et al., 2014; Rhodes et al., 2019). For example, a person motivated to cycle to work might give up if they perceive cycling infrastructure as insufficiently safe, while another might hesitate to join a swimming club if the nearest pool requires more than a 15-minute drive. One study also revealed that older adults living in neighbourhoods lacking accessible services were nonetheless more active if they had high cognitive capacities (Cheval et al., 2019), suggesting that such capacities can compensate for less favourable environments. The interaction between individual characteristics and environmental conditions is central to understanding and influencing physical activity and sedentary behaviors.

Research applying this model to physical activity has primarily focused on built environments. Literature reviews highlight that elements such as mixed land use (residential, commercial, recreational), street connectivity, infrastructure quality, and neighbourhood aesthetics influence PA levels (Araújo et al., 2019; Ferdinand et al., 2012; McCormack et al., 2013; Van Holle et al., 2012; Van Hoye et al., 2022). For example, well-designed neighbourhoods with infrastructure like bike lanes, sidewalks, or green spaces are associated with higher levels of physical activity. However, the measured effect sizes remain small, with sometimes inconsistent results across studies (Rhodes et al., 2019).

Social and cultural factors (such as gender norms or the family environment) also play a key role in shaping opportunities for physical activity and sedentary behaviours. For example, affluent neighbourhoods, often equipped with well-maintained parks and accessible sports facilities, provide favourable conditions for physical activity. Conversely, in disadvantaged neighbourhoods, deteriorating infrastructure and a sense of insecurity pose major barriers to physical activity, particularly for women, children, and older adults (Harrison et al., 2007). These inequalities also extend to geographic disparities between rural and urban areas. While rural areas often offer natural spaces, the lack of specific infrastructure (sports fields, adapted tracks) and the significant distances required to access them limit PA opportunities. In France, for example, rural residents face challenges accessing specific facilities, such as indoor swimming pools and tennis courts, due to the considerable distances involved. This reflects disparities in access to sports amenities (INSEE, 2021).

Finally, at the individual level, demographic factors, health status, and personal motivation also influence PA behaviors. Specifically, regarding motivation, numerous psychological theories aim to identify the variables that explain sustained engagement in PA (Biddle et al., 2023; Biddle et al., 2007). While a comprehensive review of these theories is beyond the scope of this article, it is evident that these psychological theories share a common limitation: their weak integration with the other layers of the ecological model. In other words, although the ecological model posits an interaction of influences across individual, social, cultural, and environmental layers, the underlying mechanisms linking these layers are rarely explored. By focusing on a recent psychological theory and examining its connections with environmental and social layers, this article aims to address this gap.

2. The Theory of Effort Minimization in Physical Activity (TEMPA)

TEMPA is based on the proposition that humans naturally tend to minimize physical effort in all aspects of daily life (Cheval & Boisgontier, 2021; Cheval & Boisgontier, 2023). This tendency aligns with the principle of least effort (Hull, 1943; Zipf, 1949), which suggests that individuals systematically seek to exert the least effort possible to achieve a given goal. This mechanism spontaneously promotes the selection of actions perceived as less effortful (Hagura et al., 2017). In modern environments, where opportunities to minimize physical effort are abundant, this tendency represents a highly significant barrier to PA (Cheval et al., 2017; Owen et al., 2010).

Several disciplines confirm the ubiquity of this tendency to minimize effort. In biomechanics, for example, studies have shown that humans spontaneously adjust their stride length and walking speed to minimize energy expenditure during locomotion (Abram et al., 2019; Selinger et al., 2015). In neuroscience, it has been demonstrated that the brain perceives physical effort as a cost and an aversive experience (Bernacer et al., 2019; Hagura et al., 2017; Klein-Flügge et al., 2016; Prévost et al., 2010). In psychology, research has highlighted that avoiding sedentary behaviors requires the activation of inhibitory processes, thereby necessitating cognitive resources to resist the temptation to minimize physical effort (Cheval, Bacelar, et al., 2020; Cheval et al., 2018). These findings align with large-scale observational data showing a positive effect of cognitive functions on PA participation (Best et al., 2014; Cheval, Orsholits, et al., 2020; Cheval et al., 2023; McAuley et al., 2011; Sabia et al., 2017). Conversely, it has been suggested that developing a positive relationship with PA, fostered by repeated positive affective experiences, could weaken the pull toward effort minimization and reduce reliance on cognitive resources to engage in PA behaviors (Cheval et al., 2024). These converging findings illustrate the human tendency to minimize physical effort whenever possible and emphasize that overcoming this tendency requires the activation of cortical resources.

This tendency to minimize physical effort influences physical activity and sedentary behaviours across all life contexts in which individuals operate. In the leisure domain, it manifests as an increased preference for sedentary activities (Maltagliati et al., under review), such as watching television, browsing the internet, playing board games, or reading. Within the household setting, technological advancements have significantly reduced the physical effort required for domestic management. The rise of automated household appliances and technologies has minimized energy expenditure at home by simplifying daily tasks. Moreover, entertainment technologies heavily promote sedentary activities, potentially increasing time spent in sedentary behaviours at the expense of physical activity (Owen et al., 2010). Even when physical activity is planned, such as going for a walk, engaging in sports, or attending a gym session, this tendency can hinder the execution of intentions. For instance, leaving a comfortable position on the couch to start physical activity can feel particularly challenging. Studies confirm that this inclination to avoid physical effort can impede the translation of intentions into concrete actions (Cheval et al., 2015; Maltagliati et al., 2024).

To move from one place to another, the omnipresence of automated transportation options encourages the choice of sedentary modes of travel, even for short distances, to the detriment of walking or cycling, which are perceived as requiring more effort. This tendency is particularly pronounced when weather conditions are unfavourable, such as during cold or rainy weather (Maltagliati et al., 2021). Similarly, even when individuals choose an active mode of transportation like walking, they may spontaneously favour options that minimize energy expenditure, such as using escalators or elevators instead of stairs. Observational studies indeed show that a majority of individuals will opt for escalators rather than stairs (Andersen, 2006). This behaviour is amplified by the number of escalators available. For example, one study found that 64.8% of individuals chose the escalator when only one was available, compared to 81.8% when two escalators were offered (Faskunger et al., 2003). These results perfectly illustrate the influence of the built environment's characteristics on spontaneous PA behaviors.

Finally, in the context of work, studies have revealed that adult office workers spend a significant portion of their time sitting during work hours (Kurita et al., 2019; Owen et al., 2011; Ryan et al., 2011; Ten Broeke et al., 2020). The accumulation of sitting time at work can largely be explained by the general design of the workspace, including shared offices, the placement of trash bins, and the layout of work areas (Koohsari et al., 2022). These findings corroborate those of larger studies that show how workplace characteristics can influence prolonged sitting behaviours among workers (Hadgraft et al., 2018; Rietveld, 2016; Sallis et al., 2015).

The tendency to minimize physical effort has been argued to have evolutionary origins. In an ancestral environment characterized by limited and uncertain resources, conserving energy was crucial for survival. This adaptive strategy, aimed at accomplishing essential tasks with minimal effort, allowed for better management of energy resources, thereby increasing chances of survival and reproduction (Bramble & Lieberman, 2004; Gerber et al., 2025). While this propensity to minimize effort likely played a crucial role in human evolution, it is now partly maladaptive in our modern environment, where opportunities for sedentarism are ubiquitous, leading to significant consequences for the physical and mental health of the population (Owen et al., 2010).

3. Integrating the human tendency to minimize effort into the design of public health interventions to promote physical activity and reduce sedentary time

The TEMPA framework offers an innovative approach for informing public health interventions aimed at promoting physical activity and reducing sedentary behaviours. Building on an understanding of the human tendency to minimize effort, it enables the identification of strategic levers to modify the environment in ways that should promote physical activity.

One strategy would be to enhance individuals' cognitive abilities by equipping them with resources to overcome the perceived cost of effort. However, limiting interventions to this approach presents significant weaknesses. Indeed, the mobilization of executive functions is vulnerable to factors such as fatigue, stress, or lack of motivation (Hofmann et al., 2009; Metcalfe & Mischel, 1999; Strack & Deutsch, 2004). This fragility is particularly pronounced in certain populations, such as children, adolescents, or older adults, whose executive functions are either still developing or in decline (Park & Reuter-Lorenz, 2009; Salthouse, 2009; Singh-Manoux et al., 2012). Although interventions aimed at improving these capacities have been proposed (Gerber et al., 2025), their effectiveness in sustainably transforming behaviors remains limited (Friese et al., 2017). Consequently, relying exclusively on executive functions to counter the natural tendency to minimize effort increases the risk of self-regulation failures.

To promote sustained engagement in physical activity, we propose a dual strategy: make physical activity the default alternative and associate this activity with positive affective experiences. The principle of default choice is based on the idea that individuals generally favour the option that requires the least decision-making effort. For example, subscription services with automatic renewal capitalize on this tendency to maintain the initial choice. In the case of physical activity, studies show that the presence of passive options, such as escalators, reduces the likelihood of choosing an active alternative (Faskunger et al., 2003). Drawing on TEMPA, we suggest that a public health focus on reducing access to passive options and promoting active alternatives could increase engagement in physical activity behaviors. However, making physical activity the default option is not enough to ensure its long-term maintenance. It is crucial to strengthen motivation by making the activity rewarding as soon as it is performed. Affective mechanisms, such as pleasure and intrinsic motivation, play a central role in increasing the perceived value of physical activity while reducing the effort felt (Maltagliati et al., 2022). These mechanisms can be enhanced through targeted interventions, such as adjusting the intensity of effort (endogenous factors) or incorporating music and natural environments (exogenous factors) (Jones & Zenko, 2021). For example, well-maintained green spaces foster more positive experiences than environments perceived as hostile. Approaches inspired by the principles of nudging (Thaler & Sunstein, 2008), such as making active behaviors more attractive or enjoyable (e.g., piano stairs), combined with default choice strategies, offer promising solutions. By aligning environmental characteristics with the principles of the TEMPA framework, it becomes possible to make physical activity more engaging, thereby increasing the chances of sustainable behavioural change.

The effectiveness of these interventions relies on a multi-contextual analysis that considers the specificities of each moment in daily life. By targeting varied contexts, it is possible to increase opportunities for physical activity while meeting the specific needs of each situation. This approach would help overcome the natural tendency to minimize effort by making physical activity more accessible, enjoyable, and better integrated into daily routines. Finally, socio-spatial inequalities must be considered, as access to leisure and physical activity infrastructure varies depending on socio-economic status and geographical location. Vulnerable populations living in disadvantaged neighbourhoods may have limited access to spaces conducive to physical activity. A public health approach must therefore integrate these inequalities to design interventions accessible to all.

In summary, according to TEMPA, public health approaches to physical activity and sedentary behaviours will be more effective if they: 1) create environments in which active choices become the default option; and 2) make physical activity more enjoyable and rewarding to encourage its long-term maintenance. These strategies are crucial to fostering engagement in physical activity and reducing sedentary behaviours, particularly among vulnerable populations.

4. Conclusion

The theory of effort minimization in physical activity (TEMPA), combined with an ecological model of physical activity and sedentary behaviours, provides an integrative explanatory framework for analysing behaviors related to physical inactivity in a modern world dominated by the omnipresence of opportunities to avoid physical effort. Highlighting the natural attraction of individuals to avoid effort in various life contexts, while emphasizing the role of executive functions and positive affective associations to overcome this tendency, allows for a better understanding of the limitations of current interventions. This framework encourages a rethinking of behaviour-environment relationships to reintroduce opportunities for physical effort in all contexts of daily life. By identifying the relevant strategic levers, TEMPA in combination with an ecological model provides a solid foundation for developing more effective approaches to promoting physical activity and reducing sedentary behaviours, thus contributing to the sustainable improvement of public health.

Author contributions: B.C.: conceptualization, writing – original draft; S.M.: conceptualization, writing – original draft. N.O.: conceptualization, writing – original draft

Funding: BC is supported by the Rennes Métropole Research Chair (23C0909).

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