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Systematization of the Types of Adaptations Requested in Pedestrian Routes: Human Strategies in Sport, Tourism and other Critical Situations

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ABSTRACT

The aim of this work is to create a structure of knowledge that allows to understand and explain different adaptations requested in pedestrian routes to individuals. We establish the conceptual framework in which this study fits and define its application to two types of frequent adaptations in these activities: uneven terrain and sloped terrain (downhill), establishing which variables to consider and how they interrelate in order to establish decision trees that allow us to make choices and set up strategies consciously and intentionally. We also try to highlight some particularities in the application of these instruments to situations in the field of sport and tourism.

Keywords: Adaptation; Systematization; Uneven Terrain; Sloped Terrain

Introduction

Man moves, using the same instruments and strategies and even the same models of action, adapting to the different problems faced in different journeys. It is always the same man and, of course, the same individuality.

It is the 'self', its identity, that is called into question, a 'self' that has adapted itself in its evolutionary process, where it has been transformed and built (in its morphology, in its physiology, in its psyche, etc.) gaining functionality in the actions it undertakes, see Gordon Childe (1947) in his work, already a classic, of "Man makes himself". They may seem to be mere one-off arrangements (we only see what we are capable of perceiving) but it is, permanently, the expression of a whole that we must try to understand and not lose the details (important, no doubt, but which it is essential to situate) that hide the overall vision and the ability to relate, namely by the "tunnel effect", and the ability to relate (let's not forget what culture it is, today, the ability to find bridges and relationships in a world of dialectics). Thus, for example, a pedestrian route can be considered a mere muscular exercise, a simple activation of cardiopulmonary function, going in search of new smells or (more or less) spectacular views, a form of socialization with a group, a subjection to local or more universal fash-

ions and customs, an occasion to take photographs, to review stories (or even history), ..., and so many other things and pretexts that, being there, we can (consciously or unconsciously) have the opportunity to live or that may not even serve for more than 'telling friends' on nights of pleasant talks or bragging about 'adventures'.

However, to enjoy circumstances is always to build culture (the possibility of understanding and exercising relationships) which, paradoxically, always passes through the capacity of the 'culture' that we already possess (a virtuous circle) that enriches (more or less, according to the cultural tool we have) the experiences and amplifies (more or less) the value obtained from what is experienced. In this way, we can situate a pedestrian route as a privileged situation where we leave the habits and vices of everyday life, which, due to the change of context, the rhythm and hurry of 'normal' life and the vulgar conditioning where we are integrated. A situation, therefore, that disposes (it may even predispose, if we are capable) to reflection and that sharpens sensitivity (it is known that a repeated stimulus loses the ability to generate sensations), creating development potentials for those who experience it.

To understand the Pedestrian Route

The transition from an understanding/explanation mode, which we have tried to frame above in an accessible way , to an operational mode, implies making choices and options in order to select the variables and parameters that can be more efficient in a cost/benefit relation according to the resources and intentions in question. We must also not forget that when we move from the orientation of an activity, whatever it may be, sport, tourist, etc., to a structure in which the simple transmission of techniques considered useful and based on experience, fundamentally by imitation, is made to the management of existing functionalities, as we implicitly defend here, it is a profound structural rupture. This rupture that we propose consists in following, predominantly, a strategy in which we confront contradictory evolutionary tendencies in the search for the most favourable balances that we can, in an expeditious way, categorize as a passage from a casuistic empiricism to science, which it is not up to us to explain here, but has marked implications that we should not ignore. In this way, we will frame and explain the operational strategy, which we will later show how to operationalize through decision trees. The most common classifications of the difficulty of pedestrian routes, given the frame of reference on which they are based, are fundamentally on variables inherent to the context, such as distance, unevenness, altitude, duration, among other factors essentially focused on morphological, geographical and physical characteristics of the terrain itself [1-3].

This type of characterization is important, but it is not enough for it to be possible to integrate these variables into models that consider the characteristics of the individual who performs the activity and define the difficulty that the chosen route will have for the individual or choose the training/experience that best fits with his objectives. In a previous work, we proposed as a way to overcome this type of difficulties the characterization of pedestrian routes based on the adaptations they require from the individual who performs them [4]. The advantages of this type of characterization is that it makes it possible to broaden the understanding and explanation of the phenomenon, restructuring the frame of reference used in such a way that, in addition to the attributes of the context, it allows us to face the whole process that is triggered in the individual to achieve his or her path, that is, the cycle "aggression » reaction » adaptation » transformation (ARAT)" [5]. In this way, a change is made in the 'knowledge' tool used, giving new dimensions and increasing the possibilities of efficiency, and even the dimension of what we can achieve with the use of a more accurate and precise reference framework. In this line we will delve into some examples of adaptations, such as the uneven terrain and the sloping terrain (downhill), identifying in the context, in the situation, and in the individual, the main variables to be taken into account and, subsequently, how to frame them in a Sports or Tourism perspective.

Uneven Terrain

The terrain with irregularities, whether stones, vegetation, sinuosity's of the terrain or other types of obstacles, can prevent a regular displacement (which may have its advantages when we focus attention on the modification of the individual, on his training, but which will certainly have more costs in the displacement itself - a proof of the new capabilities of the new reference framework of the knowledge tool used) (Figure 1), modifying, in particular, the rhythm, the distance between steps, the cadence of the pace, the times of the pace, the direction of the route, among other variations that can be caused by these characteristics. There is a consensus in the literature that the variation in the gait pattern leads to an increase in the energy cost necessary to carry out a given route [6-9]. According to O'Connor, Xu, & Kuo [9] the energy cost increase is mainly due to two reasons, for one hand, active movement corrections require a muscular effect, on the other hand steps variability (width) is less energy-efficient. All these constraints will imply that the individual is permanently reading the terrain, making decisions about where to place the steps and the best strategy to carry it out, as well as the necessary motor adjustments to carry out the displacement.

Figure 1: Examples of irregularities that can be found in this type of terrain. A- Vegetation; B- Loose Stones and C- Larger Stones that may or may not be stable. Image taken from Darman (1999).

This constant adaptation has energy costs at the motor level, but also at the nervous level [7]. In these circumstances, it is important to identify the possibilities that arise to overcome the irregularities of the terrain in order to systematize not only the decisions that the individual can make, but also to understand what type of adjustments are possible to provoke (Figure 2), that is, the inherent demands. Concretizing the choices that are made at the time we move, if an irregularity is identified in the terrain in the place where we would naturally place the next step, it can be solved by: changing the direction of the step, deviating and/or bypassing it; change the pace length to overlap it (when the height of this irregularity does not disturb the normal pace height); change the height of the pace in order to vertically contour the irregularity; perform the step on the irregularity by adjusting the way the support is placed to the characteristics of the irregularity and the effects we expect it to have on it (we may have to increase the stability of the joints if the deformation of the tread is expected, we may have to adjust the direction of the force in order to maximize the compression force and minimize the slip force, If a decrease in friction is expected, we may have to change the characteristics such as direction, length, height, among other possibilities). The decisions to be made must be considered according to the conditions of the context, but also to the characteristics of each individual, in order to opt for that situation in which he is more proficient and consequently will have less change in his performance regarding the circumstances.

We highlight that in some situations we can have options that happen simultaneously, for example, the change in the direction of the step can happen together with the change in the length of the pace, thus "adding" the effects that each of these changes will have and, of course, understanding the interactions that can be established between the variables in question. As mentioned by Wong, Selinger & Donelan [6] several parameters can influence the gait "… it may not only have a different step frequency and speed but also a different step width, toe clearance, and maximum knee angle. In addition, at the muscle level, the new step may be accomplished with muscle and motor unit activity patterns that differ in many ways from the average step. Some of these changes to coordination, if performed in isolation, may increase energetic cost, while others may decrease it.". To define which are the most profitable options, it is necessary to consider how each one of them influences the cycle and rhythm of the pace, the path of the Center of Mass (CM), knowing that there may be options that have higher energy costs than others and that there are differentiated energy costs (with incidence at the nervous or motor level, but not only). In addition to the effects at the motor level, it is also important to understand that the energy sources used in movement (anaerobic alactic, lactic and aerobic system) have different regeneration timings and the decisions made can influence their alternations as well as the need to use each of them. It is also essential to understand the framework of this set of variables in the whole of the journey to be taken, since, depending on its total duration, the point where we are and the demands that are still expected, there are options that may be more appropriate than others taking into account the circumstances of the moment we are facing.

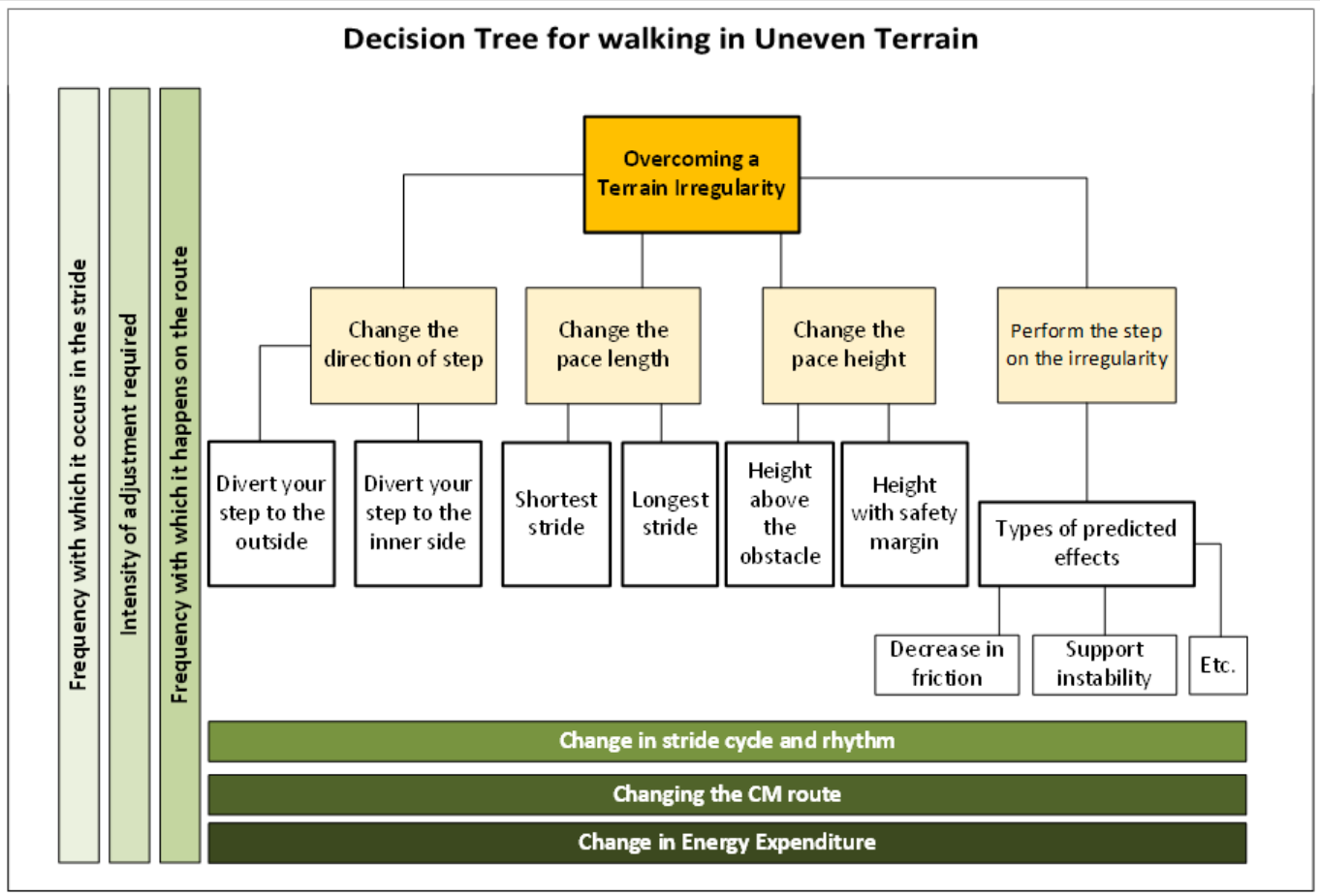

Figure 2: Decision tree relating to the various options that the individual may be faced with in a situation of overcoming irregularities and the factors inherent to them.

Sloped Terrain (Downhill)

Routes on sloping terrain, in the case of descents, allow a part of the force of gravity to be used to generate the movement of displacement itself. Knowing how to use this force in an efficient, systematic and less flawed way (as opposed to a more empirical process made up of mere experiential situations) implies understanding the variables inherent to movement, but also being able to operationalize the appropriate techniques so that the benefits are greater than the costs of their use in displacement. Several difficulties in moving downhill are mentioned, which often overlap with the search for energy efficiency that the descent of a slope can provide, namely, the constant braking of movement and impacts on joints [10-12] and the search for stability to the detriment of gravity [13]. The need to adapt to the context and situation is fundamental to achieve the desired objectives in a cost-effective way [11]. Thus, knowing how to consider the possible strategies for displacement and what are the expected implications in the decisions we make is essential to manage the activity. AS mentioned by Wong, Selinger, & Donelan [14] it is necessary to have a global notion of the problem and of the interactions that different variables establish between themselves "Furthermore, whether a particular change in coordination will gain an energetic benefit depends on the walking task: decreasing step frequency, for example, may be beneficial when walking downhill but not when walking on the level.

The task to be solved by the nervous system when initiating optimization is to determine which of these many candidate changes to coordination are responsible for sensed reductions in energetic cost and in which contexts.". Controlling the changes that a slope implies in the individual's displacement involves first of all, within the constraints of the context itself, making decisions by choosing the slope that we intend to face through the selected path (Figure 3). The path can be in the direction of the slope, thus subjecting us to the existing slope, or we can opt for an oblique path in relation to the slope, which the farther it is from the direction of the slope, the lower the slope will have (a relationship involving the effort - slope/space covered - similar to what happens in a lever in the relationship between the

dimensions of the force arms/force intensities). This choice of trajectory in relation to the slope has, of course, implications for the space that will need to be covered to get from one point to the other, and these two variables have contradictory evolutionary trends, and as such, the greater the slope, the smaller the space to be covered. The costs of each option depend not only on the strategy chosen (leading to the choice of the route), but also on the individual's ability and mastery of the technique used (the individual's potential and the way to use them).

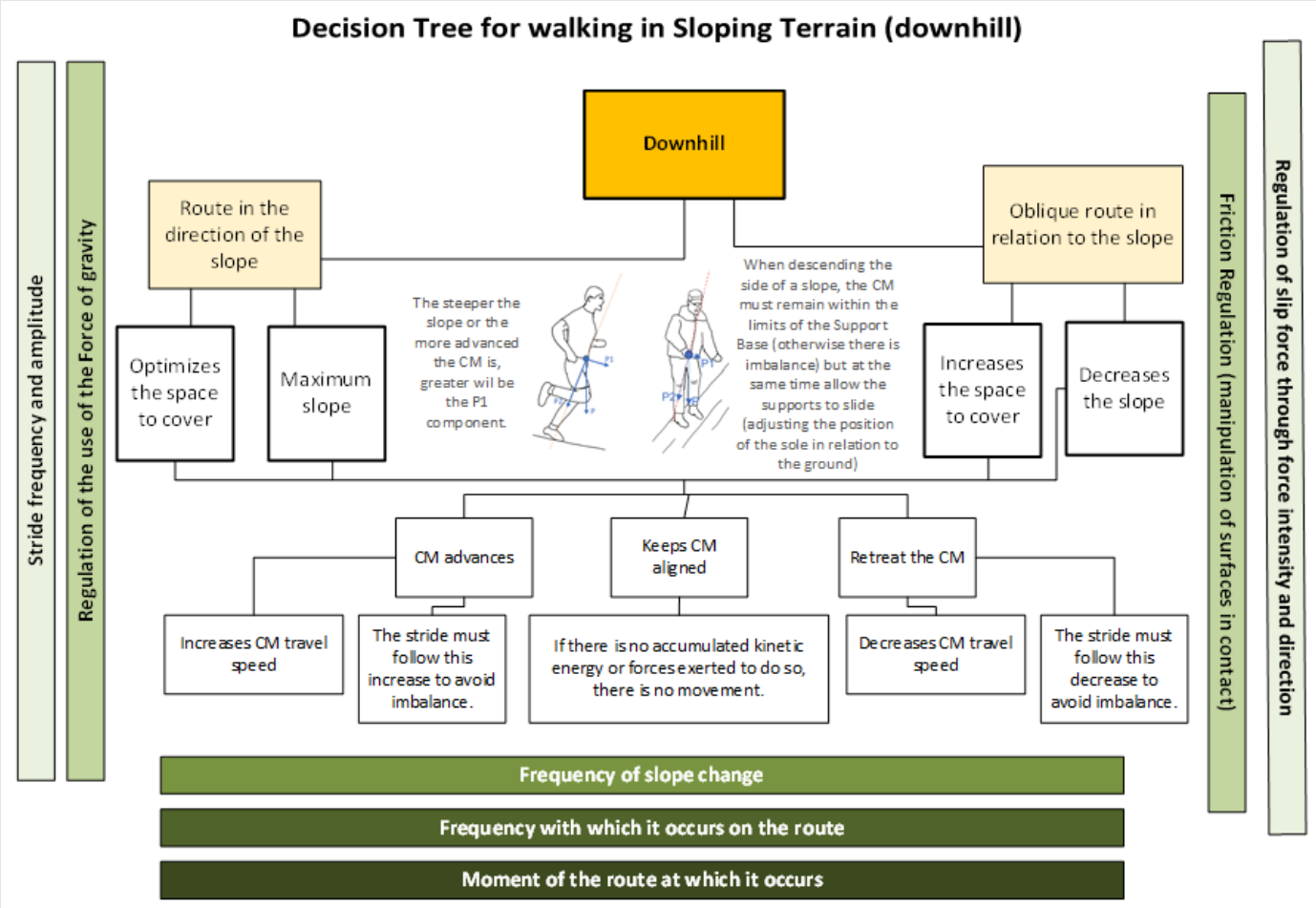

Figure 3: Decision tree regarding the various options with which the individual may be confronted when moving on sloping terrain (descent) and the inherent factors.

In the case of lateral sliding, usually used in terrain with little friction and deformable, such as snow, small stone or sand floors, the individual, in order to control the pressure exerted on the ground (ratio between the force exerted / area) regulates the position of the supports on the slope, by adjusting the dimension (in some cases using equipment that facilitates this type of strategy such as skis) in order to slide down the slope while maintaining the projection vertical of its Center of Mass within the boundaries of the Support Base. A sudden braking of the supports by not keeping them in the position that allows them to slide, will lead to the individual being projected (by the action of the existing inertia) towards the slope downwards. On the other hand, reactions such as fear, which are associated with a defensive strategy such as the retreat of the pelvis and/or the search for protective positions such as the approach of the body to the slope, lead to an increase in the weight component that acts on "the slip" and, consequently, to a reduction in the compressive force on the slope. This can result in an uncontrolled slippage where the very position of contact with the ground makes the situation difficult. The frontal progression (in addition to the slope of the terrain) also implies a control of the position of the Center of Mass, which must necessarily be balanced with the positioning of the steps in the pace (through the frequency of the steps and amplitude). When the individual cannot

keep up with the speed "that the CM gains" with his stride, which can result in losing balance, due to not being able to adjust the position of the CM in relation to the support base. The difficulties in regulating this set of variables can have repercussions on the joints or, conversely, if there is not a sufficient advance of the Center of Mass to enhance the use of the Force of gravity in the displacement, the energy expenditure of the descent can be equal to or greater than that of the ascent.

From Sport to Tourism

If in Sport the immediate objective is to maximize the performance of the athlete, in Tourism the challenge is to provide the best possible experience to the tourist, through the activity that is offered [12,13], being (and should be), however, the mediate objective, in both situations, the transformation of Man (that is, the same general objective through different means). To train and evolve, the individual has to approach his performance to his limits, without, however, exceeding them (which would cause injuries) because only in this way is it possible to transform himself (see ARAT), the management of contradictory evolutionary tendencies mentioned above. The same happens (should happen) in tourism, if only so that we don't have boring situations that don't motivate (whatever the purpose, immediate objective – take a picture, integrate into the group ... as we indicated before) and where there are still challenges to face (even if it's just to tell in friends talk nights...).

However, in the orientation of activities of this nature, where we focused on the displacement of man, there are specific differences between these two aspects. In sport, it becomes possible to plan continuously to provide a "training effect". In a "touristic activity" we must create motivations and 'ways of selling', also according to the intended objectives and in a personalized way, but where the imaginaries pursued by the customer follow, namely, other "models to imitate", in a different framework and with different time constraints. A reflection to be carried out, a debate to be held and the search for new answers, which, in order to be efficient, must integrate the new possibilities and resources that are available to us today. As we can see, as we stated at the beginning of this work, in order for this intervention to happen successfully, it is necessary not only to understand the stimuli we intend to provide, but also the processes of adaptation to these stimuli and the transformations that can result from them. We would also like to make a few notes in this regard. We must also consider that in the "sports training" facet, it usually happens that there is a continuity of contact between the coach and the athlete. This generates the possibility of an in-depth knowledge of the athlete, his personal characteristics, limitations and potentialities. A continuous work that is being permanently adjusted to the evolution of the athlete and to the stipulated goals.

On the other hand, in sports activities framed in Tourism, the contact between the advisor and the tourist is usually more fortuitous, and it is frequent that they only establish a first contact already in the activity. These circumstances mean that the diagnosis has to be much faster than in a "normal" training situation. Being able to interpret some indicators, even before the activity, is fundamental and essential to be able to have a quality intervention. Sometimes, looking at the equipment they use is enough to get a first impression of their mastery of the context, it is not uncommon to see people who present themselves with shoes that are totally inappropriate for the walk that awaits them, but we also have the opposite, such as people with an elite equipment, but too new not to denounce that it has never been used before. It is in this balance of indicators that the manager must seek to situate himself in order to prepare for orientation. Also, in terms of intervention, it is necessary to understand that in a tourism situation,

Where the individual is only expected to perform one activity, the prescription will have to be based on variables that we can act on and have almost immediate effects, that is, in a period compatible with that foreseen for our intervention with the individual. In a training context, the mentality has to be different, we can sometimes opt for prescription solutions that will only have effects in the medium/long term, but that may be more advantageous in the evolution of the individual. In short, in the same frames of reference, but in different contexts, it is necessary to break with the traditional ways of looking at these activities, so that the resources we have today (knowledge, equipment, communication facilities, conceptual, etc.) can be optimized. This implies structural, normative, methodological, and organizational changes, among others. It is not enough to make mere one-off arrangements, it is essential to find the new coherences, which are already possible today. Evolution, let us even say the enrichment of man, requires more, much more than simple changes in appearances and speeches.

Final Reflection

Understanding the movement of Man on a pedestrian route or in any other context is a complex process. It is necessary to have a comprehensive view not only of the motivations inherent to this activity, but also of the various conditionings that can influence this process. The strategies of action and the instruments used for displacement imply a global vision of the individual, conditioned by the evolutionary process of the human species itself and which involves the profitability of a set of structures (nervous, muscular, energetic, technical, psychological, cultural, etc.) and that it is necessary to understand this amplitude in order to be able to act. In this work, we sought to define a comprehensive and integrative frame of reference for the various aspects of human displacement, but at the same time, to exemplify through the decision trees presented, how it is possible to create models to understand the adaptations that are placed on the individual during a journey. We exemplified through two types of adaptations, Uneven Terrain and Sloped terrain (downhill) how it is possible to unfold some of the variables that we consider fundamental to understand this phenomenon, to structure future research, where several

options are quantified that allow us to understand the evolutionary trends of the variables and their interactions, but also to be able to act coherently with the intended objectives both in the sport and tourism.

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