

INVESTIGATING THE DIFFERENCES BETWEEN BEGINNERS AND ADVANCED CLIMBERS

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The aim of this study is to identify the differences in the movement patterns of beginners and advanced climbers, according to quantitative parameters. In order to do so, climbers (n=17) of a variety of skill levels were analyzed as they climbed up the test routes. From this, the following conclusions were drawn: beginner climbers (n=11) require very much the aid of tactic and visual information to elaborate their responses, whereas more experienced climbers (n=6) are able to anticipate their response only with the aid of visual information. This characteristic was conveyed through the greater amount of hand movements performed by the beginners, as well as a longer period of time required to ascend the test routes.

KEYWORDS: climbing, biomechanics, sportive initiation.

INTRODUCTION:

In sport climbing, knowledge of the specific techniques, the correct use of material, the proper employment of safety systems and the environment are crucial to the climber, and a fundamental aspect of their responsibility. A beginner is faced with a wide range of complex situations, all of which require the highest degree of safety awareness. In this context, the instructor's role becomes essential, seen as it is extremely dangerous to be self-taught.

When teaching, instructors rely a great deal on informal analysis, mainly through visual observation, in order to improve or correct their students' technique. However, to elaborate advices and recommendations, they must be educated in the anatomic and mechanic principals so as to formulate their instructions. Even though the desired results are well known, the specific standards that contribute to their accomplishment are seldom known.

Many elements must be observed simultaneously while the climber ascends and, in spite of the fact that there is scarce available information, a few points are well documented, such as: the need to maintain one's centre of gravity close to the wall in vertical and negative ways, and the bodyweight must be supported primarily by the lower limbs, while the hands counteract the backwards imbalance – especially on vertical ways (Quaine *et al*, 1997; Mermier *et al*, 1997; Werner *et al*, 2000; Noé, 2006). Nonetheless, qualitative analysis demands sophisticated equipment and experience, and naked-eye observations are limited and very complicated, even more due to the array of scenarios one is faced with.

This study justifies itself because: a) most investigations of this nature are carried out with elite athletes, who's objective is high-end performance; very few researches focus in studying beginners or recreational climbers; b) movement pattern analysis usually rely on advanced technological resources that are much too difficult to apply to everyday teaching, so it is important for instructors to have other resources available to them (e.g.: quantitative parameters that are more easily observed, such as elapsed time, number of movements and amount of holds used) to enrich their analysis; c) there are few available studies that consider the time factor and limbs' movements.

The aim of this study is to identify the differences in movement patterns between beginners and advanced climbers using quantitative parameters.

METHOD:

Data Collection: Seventeen climbers (8 male, 9 female) volunteered and signed informed consent to participate as subjects for the study. Descriptive characteristics of the subjects are presented in table 1.

The range of personal best abilities of the subjects varied from 3rd to 8th degree in the Brazilian difficulty scale. The participants were assigned into two groups: eleven beginners (performance level below or equal to 4th grade) and six advanced climbers (performance level above the 4th grade)

Both routes of the present study were set on a ten meters vertical wall. Route A was designed to produce a difficulty level of a 3rd grade and route B rated at 4th superior grade.

All trials for each subject were performed on the same day. Initially, subjects answered a questionnaire regarding their personal rock-climbing experience, such as: how long they have been climbers, frequency of climbing sessions and performance level (auto declared). Anthropometric measurements were taken, including body mass, stature, wingspan and ape-index (wingspan/height).

The individuals performed a five minute warm up including stretching and easy climbing. The participant then performed two climbs, route A and B (random choice), one attempt in each, with a five minutes break between the two. In case a climber fell, the test was interrupted and the subject was eliminated.

The climbs were registered by two videotaping cameras for posterior analysis. The cameras were located in front for the wall (frontal plan), one on ground level and the other five meters above.

Through the images, the following observations were made: total time of ascent (T), number of holds used for hand support (HH), total number of hand movements (HM), number of holds used for feet support (FH), total number of feet movements (FM), total number of holds (NH), total number of movements (NM) and the number of feet movements/ hand movements ratio (RFH). The information was extracted by counting (except for elapsed time) with the aid of an analysis instrument.

The value T of each attempt was entered from the moment that the climber assumed the starting position, supporting their hands and feet in the indicated holds. The T count finished the moment the climber reached the last hold at the top of the wall.

NM was independent of NH. NM was resultant of simply adding the number of movements for each climber (HM + FM). NH was obtained by the sum of different holds used, not counting the repeated use of a same hold or its segment. RFH was established as the ratio between the total number of hands and feet movements.

Data analysis: The observed variables were grouped so as to differentiate the participants with regards to their performance level. Those deemed most relevant were regressed in a logistic model to determine their influence when evaluating the difference between beginners and advanced climbers.

RESULTS:

The average age, body mass, stature, wingspan and ape-index for the beginners and advanced climbers are presented in table 1.

Table 1 – Anthropometric profile of the individuals

Level	N	Age (years)	BM (kg)	ST(cm)	WS(cm)	APE
Beginners	11 (5m/6f)	21,9 (2,36)	65,2 (9,36)	169,6 (8,87)	173,5 (9,74)	1,02 (0,018)
Advanced	6 (3m/3f)	21,9 (3,13)	61,2 (14,63)	172,3 (10,68)	173,4 (10,3)	1,02 (0,019)

After analyzing the data (table 2), T, HM and RFH were initially selected as the main variables capable of differentiating the beginners from the advanced climbers, as they

presented the biggest correlations with the performance level. T and HM were entered for a logistic regression model. RFH was excluded from the model for presenting high correlation with HM.

Table 2 – Observed variables

Level	Route	T (s)	HH	HM	FH	FM	NH	NM	RFH
Beginners	A	93,2* (23,89)	26,8 (4,19)	26,4* (3,72)	22,5 (3,59)	20,7 (3,17)	38,5 (5,57)	47,4 (6,28)	0,78* (0,098)
	B	161,5* (50,00)	21,5 (1,86)	25,6* (3,47)	17,5 (2,58)	18,8 (4,98)	25,4 (1,12)	44,5 (7,22)	0,73* (0,181)
	total	127,4* (51,83)	24,2 (4,16)	26,1* (3,55)	20,00 (4,01)	19,8 (4,19)	31,9 (7,76)	45,9 (6,77)	0,76* (0,144)
Advanced	A	61,6* (15,90)	23,7 (4,55)	22,5* (4,76)	22,8 (2,93)	21,2 (2,93)	38,0 (5,66)	43,7 (5,85)	0,97* (0,223)
	B	91,3* (20,07)	20,2 (1,72)	20,8* (1,27)	17,8 (2,23)	18,0 (2,28)	25,5 (1,22)	38,8 (2,79)	0,87* (0,137)
	total	76,5* (23,14)	21,9 (3,75)	21,7* (3,52)	20,3 (3,60)	19,6 (3,00)	31,8 (7,61)	41,3 (5,05)	0,92* (0,185)

* variables regressed in the logistic model.

DISCUSSION:

In the present study, all types of limbs displacements have been computed as movement, including those of an exploratory nature. In other words, when an individual grabbed a hold (with their hand or foot) with the intent of examining it better, even if they did not effectively use it to progress in the way, this gesture was computed as movement. Bigger values of HM were observed for beginners, suggesting that they had greater need to analyze and/or test the positions before making a decision.

This finding is in accordance of those observed by Handy *et al* (2006). The authors had investigated the activity in the cerebral cortex while the individuals manipulated known and unknown objects. This result suggests that the level of cerebral activity is negatively related to the previous experience with the object in question. That is, experienced individuals rely less on the conscientious analysis to elaborate their responses.

This phenomenon also can be associated to the fact, when learning new motor skills, all individuals seem to go through different stages. These periods of training integrate one continuum: on one end, the total unfamiliarity to the movement, and on the other, the movement becomes absolutely natural (Magill, 2000). The grouping analysis did not display differences in FM between the two groups, however, in all cases the values for HM surpassed the combined values for FM. This indicates that all climbers performed more movements with their hands than with their feet in order to progress in the routes.

Several authors recognize the importance of feet movements in climbing (Long, 1994; Beck, 1995). It is important to point out that the fact that FM values were similar in both groups does not indicate that they worked their feet in the same way. Possibly, advanced climbers had more adequate technique than beginners; however, this study's objective did include an evaluation of the quality of the movement techniques.

Time is a crucial factor in sport climbing. In this study, a trend was observed in the time of ascent (T): more experienced climbers took less time to complete the routes than beginners. This response is in agreement with the results found by Doran and Grace (2000), Mermier *et al* (1997) and Ferguson *et al* (2000). Time is a limiting factor in sport climbing, therefore it is directly associated with the fatigue mechanism and, consequently, with the fall.

CONCLUSION:

Our results suggest that beginner climbers require very much the aid of tactic and visual information to elaborate their responses, whereas more experienced climbers are able to anticipate their response only with the aid of visual information. This characteristic was conveyed through the greater amount of hand movements performed by the beginners, as well as a longer period of time required to ascend the test routes. Based on the findings of the present study, some important points must be observed by instructors when teaching: a) the “previous reading” of the route is very important! Climbers must be stimulated to premeditate all movements to prevent and/or to delay the fatigue - reducing isometric contraction as well as the amount of unnecessary movements; b) the less time expense to ascent the routes is one of the pointers of performance, as well as, the lower perceived exertion.

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