INFLUENCE OF KINEMATIC VARIABLES OF DIFFERENT TRAJECTORIES ON RACING TIME AND VELOCITY IN ALPINE GIANT SLALOM

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INTRODUCTION: During the last five years, materials and techniques used in alpine giant slalom have changed drastically and influenced the trajectories chosen by the racers. Different trajectories influence racing time and velocity (NACHBAUER AND RAUCH, 1991) and mathematical models describe optimal trajectories (REINISCH, 1991). The aim of this study was to determine the influence of different trajectories on racing time and velocity in field measurements.

METHODS: five racers (2 f, 3 m, european cup level) took part in this study. One gate was set up on a slope which was in inclination and preparation equal to ec conditions. The start of the inrun was fixed to secure a constant initial velocity. The beginning and the end of the turn were marked and 4 different trajectories (in/out: wide/wide, wide/close, close/close, close/wide) were given by course markers. Total time obtained was determined using photocells. Each racer performed up to 3 trials on each trajectory (training trials not included). The trial order was randomized. The trials were recorded with 3 video cameras (50 hz) and the field was calibrated geodetically to obtain 3-dimensional coordinates a simi system and dlt-transformation (DRENK, 1994) were used according to literature the front binding of the outer ski was used to define the trajectory (NACHBAUER, 1991). the fastest trial of each racer for each trajectory was chosen for digitization, thus giving 5 trials analyzed for each trajectory. The trajectory was approximated with polynomial functions to calculate curve length (*l*). The angles between the fall line and the trajectory were calculated at the beginning of the turn (α) and at the end of the curve (γ). To describe the situation close to the gate the horizontal distance of the trajectory to the gate at the horizontal level of the gate ($\Delta\gamma$) and the maximum horizontal distance to the gate throughout the trajectory (Δy_{max}) were calculated.

RESULTS: The entrance angle α showed no significant changes (p=0.70) thus indicating that the initial conditions were equal for all 4 trajectories, whereas the curve length was significantly different (p=0.00). Δy showed significant differences (p=0.00) as well as the exit angle γ (p=0.04). A correlation could be found between exit angle γ and exit velocity.

Table 1. Mean and Standard Dev. of the horizontal distance at the gate (Δy) and exit angle (γ).

	wide/close		Wide/wide		close/close		Close/wide	
	m	sd	m	sd	m	sd	m	sd
L [m]	37.86	2.33	41.03	3.21	34.30	4.87	38.99	3.56
Δy [m]	1.13	0.48	2.40	0.45	1.28	0.31	1.36	0.42
γ[°]	-36.75	3.46	-39.49	8.38	-31.03	8.16	-25.08	9.38

DISCUSSION AND CONCLUSION: From the presented data it can be said that the trajectories showed statistical significant changes and the exit angle showed influence on the exit speed. As the exit speed coincides with the initial speed for the next gate without changing total time needed this can be seen as practically important result.

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