Dynamics of balance during carving turns

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Introduction
Finding of a dominant structure of systems keeping well balance state plays a key role in human motorics. It is especially important at top level sport performances, where the system is working on the level of maximal possibilities. Carving turns or direction changes in downhill skiing represent a very complicated motoric system which is based on activity of a certain amount of elements with different influence level. Three main systems are needed for optimal function during carving turn: management, motoric and mechanical systems.

Methods
Five high performance skiers were tested and their carving turns were recorded by video. Results have been analysed. The best results were quite similar, so we are able to create some ideal model. Two ways of carving turns are possible which represent two basic models.

Results
Achieved results offer some differences but the most of well done carving turns are common for each ski competitor. The optimal way of this ski task is presented by different types of model which can explain physical parameters during this ski maneuver. For better imagination are two icon models enclosed. Figure 1 shows the first way of doing carving turn. It is based on balance disturbance which means that the center of gravity is replacing to the other place by using the smooth movement in curve trajectory pointed to the centre of carving turn (across the skier movement). This leads to the ski edging and all forces are entering into the process. The sum of forces equals zero and by this d'Alembert principle the final dynamic balance is garanteed.

![Fig. 1: Icon model of doing carving turn by moving the center of gravity into the center of turn](image1.png)

![Fig. 2: Icon model of doing carving turn by moving the axis of lower extremities out of turn](image2.png)

The second way of how to do the correct carving turn is based on the movement of lower extremities out of turn. This is seen on the second icon model (figure 2).

Conclusion/Discussion
Both icon models shown in figures 1 and 2 represent the ideal solution of dynamic balance of a certain way of carving turn. These models are diffused in sport praxis and these systems work in synergy. This allows to realize the optimal solution of keeping the balance in such complicated movement like carving turn is.

References