# The Use of Bigfoots Reduces State Anxiety in Novice Skiers

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Novice skiers' learning and performance is often hampered by the anxiety of falling. We investigated if the use of Bigfoot (i.e., short skis) for the first 4 of 10 days of a skiing course reduces anxiety. We surveyed state anxiety at the beginning and on the ninth day of the skiing course. Compared to a control group, which completed the course on normal skis, the Bigfoot group showed significantly reduced state anxiety on the ninth day, even though they had been performing on normal skis for the last 5 days.

The teaching system in skiing for beginners has changed. In the 1980's, lessons for beginners were characterized by the snowplow turn. With the arrival of the modern carving skis, a direct start with parallel skis has been favored. Lessons usually begin on gently inclined broad slopes, where the learners bend their knees and shift them laterally to the right or the left. This movement engages the skis' edges and causes a curved run. The change from one turn to the next is a critical phase in parallel turns—the turn initiation. Sooner or later, the body's center of mass (COM) has to move over the skis in the downhill direction. The student has to "throw" his or her upper body forward downhill, and has to rely on the physics that make the skis overtake the COM and intercept the upper body's downhill movement. The problem with this movement is that it is against all intuition. The "normal" and intuitive behavior is to lean uphill which minimizes the falling distance. The steeper the slope, the more dominant is the intuitive behavior; but the more necessary the downhill movement of the COM becomes.

It is the ski instructor's task to make her or his student overcome this intuitive behavior. Most ski instructors would agree that this is easier with courageous students, who venture to overcome intuitive fears, than with anxious persons, who will not give up the security that leaning towards the hill seemingly offers. Therefore, for anxious students, the snowplow turn has two advantages that make it indispensable in the daily use of ski instructor's methods: First, it always allows the scholar to leave the COM between the two skis, enabling a stable position. Second, it enables the scholar to slow down and stop on gently inclined slopes whenever she or he feels like it. This certainly enhances the controllability of speed and direction for the beginner. But there is an important disadvantage: It is unlikely that the control of the snowplow turn movement can be transferred to the control of the goal movement, the carved parallel turn (for a discussion of transfer in motor control see Schmidt & Young, 1987).

A solution to this problem is to start with the direct parallel ski method but to use shorter skis, so called *skiboards* or *Bigfoots* (i.e., short skis) around 65 cm in length (and painted toes

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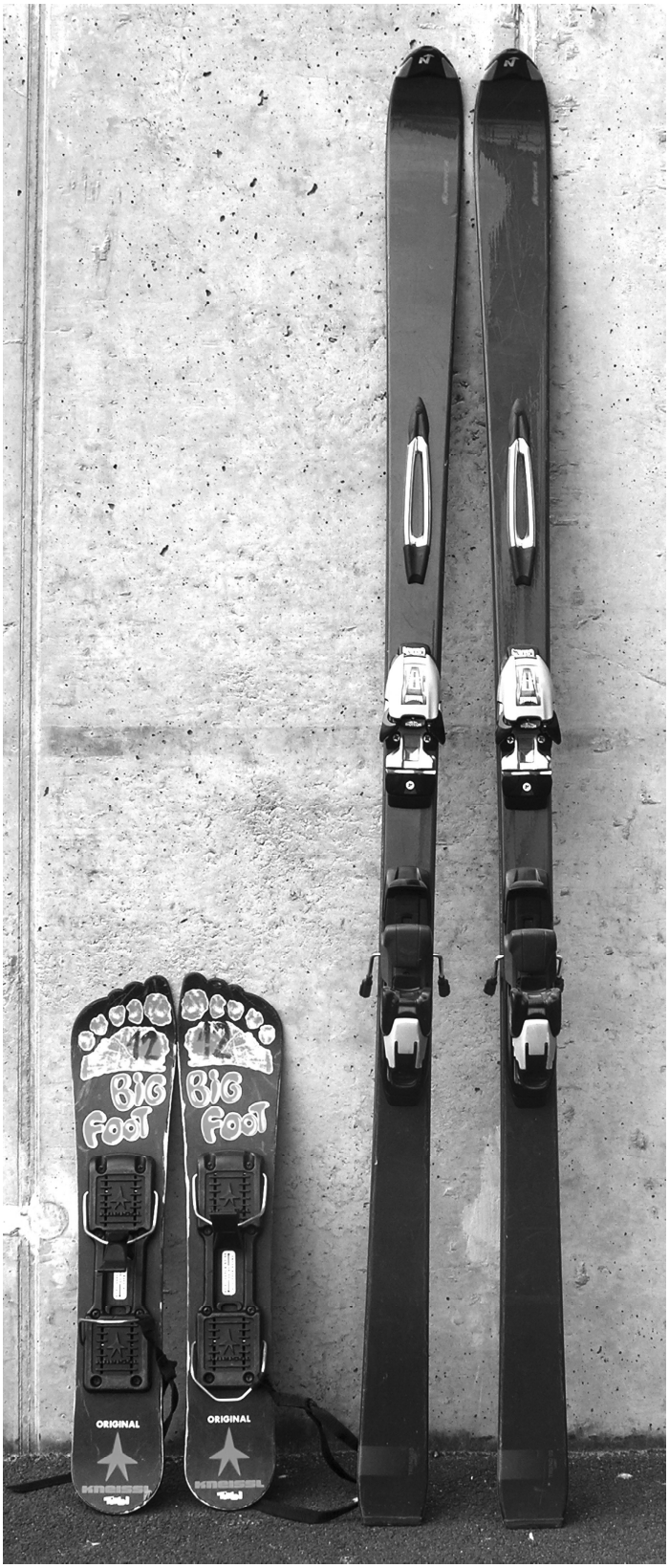


Figure 1. Bigfoots (left) compared to usual carving skis (right).

on the nose, hence the name, see Figure 1). Bigfoots can easily be turned in any direction. By using Bigfoots novices are able to change direction and stop with movements similar to those already known from blading or ice skating. For these reasons it can be assumed that the use of Bigfoots reduces state anxiety.

The idea to use shorter skis for beginners was originally invented by Clif Taylor (Jenson, 1970; Taylor, 1973). It never became widely accepted, presumably because it was too expensive to buy multiple skis at different lengths. Nevertheless, a handful of ski schools in the Alps reestablished this teaching method with the construction of Bigfoots and skiboards by the ski industry (for a review see Lund, 2002).

The coherence of state anxiety and performance in the process of motor learning is not the favored object of investigation in sport psychology. The focus of research has been on competitive anxiety in already learned high-level performance (for a review, see Woodman & Hardy, 2001). Older studies investigated the effect of anxiety on motor learning by analyzing learning curves of a pursuit rotor task (Marteniuk & Wenger, 1970; Sage & Bennett, 1973) or a stabilometer task (Carron & Morford, 1968), while stressing participants with electric shocks. They found facilitating effects of the fear of shocks for the pursuit rotor task, but no effect for the stabilometer task.

With rising ethical standards, electric shocks were replaced by failure instructions (Pemberton & Cox, 1981), where no stress effects on the pursuit rotor learning task could be demonstrated. Moreover, facilitation effects could not be demonstrated for the learning of more complex skills. In a ball-tossing task, Hutchinson and Cotten (1973) found a debilitative performance effect of stress induced by a male audience on highly anxious college women, but no impact on the learning score. Zajonc (1965) demonstrated that evaluative stress hampers performance in poorly learned complex tasks. In a more recent study, Burton and Naylor (1997), following the stress model of Lazarus (1991), argued that anxiety leads to detrimental performance if there is a goal of high relevance at stake combined with poor coping potential. Pijpers and colleagues showed that performance decreases in anxious novices (Pijpers, Oudejans, Holsheimer, & Bakker, 2003; Pijpers, Oudejans, & Bakker, 2005).

Carpenter, Frank, Adkin, Paton, and Allum (2004) examined the effects of anxiety on reactive mechanisms to unexpected balance perturbations. They reported an increased amplitude in balance correction responses, decreased onset latency of deltoid responses, reduced angular displacements, and a reduced magnitude of COM displacements with increased postural anxiety. Their experimental setting is roughly comparable to the situation of a novice skier. Moreover anxiety in high risk sports may lead to avoidance strategies (Robazza, Bortoli, Carraro, & Bertollo, 2006). These two findings seem to be of particular importance for the present study. Ski instructors often observe that anxious pupils simply avoid moving the COM in a downhill direction. It can be taken for granted that no learning can occur if the pupils refuse to execute the exercise.

Summarizing these considerations for teaching, it can strongly be recommended to reduce the fear of loss of control over the skis and, concomitantly, the fear of falling. This is particularly advisable when using the direct parallel skiing method because of the unstable, but indispensable turn initiation phase. The question addressed here is, can the use of Bigfoots actually reduce this fear under field conditions?

## METHOD

### Participants

Forty pupils of the Ulrich-von-Hutten School in Schlüchtern, Germany took part in the study. They were selected from a population of 101 pupils that went on a 10-day school trip

to the Alps. Before the trip, the pupils had been rated for their inline skating skills. The 20 worst performers were selected for the Bigfoot group (11 female, 9 male, *M* age = 16.3; *SD* = 0.72). For educational reasons it was intended to offer these pupils an easier access to skiing. The other 81 pupils were rated on the first day for their skiing skills on a gently inclined slope. The 20 worst performers of the 81 were taken as control group (9 female, 11 male; *M* age = 16.7; *SD* = 0.61).

Ski courses were given by four teachers who had passed an advanced exam as school ski instructors. Two of them had longtime professional experience, the two others were teachers on probation. The Bigfoot group and the control group were each divided into two classes, each class counting 10 pupils. Classes were instructed independently by either an experienced teacher or a teacher on probation. Overall, there were two groups (Bigfoot and control) in four classes, class $B_e$ (Bigfoot, experienced teacher), class $B_p$ (Bigfoot, teacher on probation), $C_e$ (control, experienced teacher) and $C_p$ (Control, teacher on probation).

## Measures

### *State Anxiety Inventory*

The focus in applied sport psychology concerning anxiety in sport is on competitive state anxiety. Therefore, sport related questionnaires typically concentrate on investigating emotions before or during competition. In this study, however, the source of state anxiety is not predominantly the threat of the consequences of failing in a competition, but the fear of loss of postural control and physical pain. Consequently, state anxiety was measured using the form X-1 of a proven German version (Laux, Glanzmann, Schaffner, & Spielberger, 1981) of Spielberger's 1970 State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970). Participants responded to 20 items on a 4-point Likert scale ranging from 1 to 4, which were recoded so that higher scores indicate higher state anxiety. The form X-1 demonstrated adequate internal consistency in the present investigation with an alpha value of .85 in the pretest and .91 in the posttest.

### *Trait Anxiety Inventory*

Trait anxiety was measured using the German form X-2 of the State-Trait Anxiety Inventory consisting of 20 items. Participants responded to each item on a 4-point Likert scale ranging from 1 to 4, again recoded so that higher scores indicate higher trait anxiety. The X-2 form exhibited good internal consistency in this study (alpha = .88). The purpose of measuring trait anxiety was to demonstrate that there were no significant differences between the two groups, so that differences in state anxiety after skiing were not biased by differences in trait anxiety.

### *Verbal Reports*

In addition to the quantitative data, all teachers were instructed to pay attention to signs of fear or anxiety during the ski lessons and to report them. They were informed of the signs and symptoms of increased stress and anxiety such as profuse sweating, negative self-talk, increased muscle tension, and the like (Weinberg & Gould, 1999).

## Procedure

State anxiety was measured twice. The first measurement was at the bottom of the slope immediately after the first downhill experience on Bigfoots for the Bigfoot group and immediately after the second downhill experience on carving skis for the control group (they had their first experience in the rating procedure). All pupils performed on the same slope. They were still wearing their ski boots and their ski clothing while filling out the form. The

test also was administered on the last ski day immediately after a more demanding descent, in line with the pupils' current skill level. Both groups performed on carving skis and used the same slope. Again, pupils were still wearing their ski boots and their ski clothes.

Trait anxiety was measured after dinner on the 5th day, in the middle of the ski excursion, roughly at an equal distance to the first and the second measurement of state anxiety. Each evening, the teachers made short notes of their impressions of the anxiety of their ski classes.

### Teaching Protocols

The Bigfoot classes had 3 days of lessons and 1 day of guided free riding on Bigfoots, then 4 days of lessons and 1 day of guided free riding on carving skis. The control classes had 3 days of lessons, 1 day of guided free riding, then 4 days lessons and another day of guided free riding, all on carving skis. Class content was predetermined as briefly described below.

#### *Bigfoot Group*

The Bigfoot group began the course on Bigfoots for the first 3 days. The first day began with familiarization to the Bigfoots, followed by using Bigfoots as a slide device. On the second day pupils were instructed in braking, turning, and load changes on Bigfoots. On the third day schuss (a straight downhill run at relatively high speed) and skiing on Bigfoots over undulations in the slope was taught.

The fifth day started with the transition from Bigfoots to carving skis by skiing on one ski and one Bigfoot. For the next 3 days skiing on two carving skis was taught focusing on the up-down-movement of the body and parallel turns close to the fall line.

#### *Control Group*

The control group had 7 days of classes on carving skis. They were taught the classical way: Familiarization and first experiences on skis were made without locomotion, followed by first skiing experiences in the flat and on a gentle slope the next day. On the third day, the snowplow was introduced. Pupils learned to slow down and stop. Snowplow turns and side slipping were the content of the fourth day. The following 3 days, the transition from the snowplow to parallel-open skis was taught by diminishing the snowplow angle in turns close to the fall line and the demanding up-down-movement of the body.

## RESULTS

### State-Trait Anxiety Inventory

The mean state anxiety scores from the first administration of the questionnaires for the Bigfoot classes were 44.80 ($SD = 7.74$) for $B_e$ and 49.90 ($SD = 8.01$) for $B_p$, the group mean was 47.25 ($SD = 8.10$). For the control group classes, state anxiety means were 54.10 ($SD = 4.46$) for $C_e$ and 50.6 ($SD = 6.17$) for $C_p$ with a group mean of 52.35 ($SD = 5.54$). At the end of the school trip, immediately after the last descent, the mean state anxiety score was 30.30 ($SD = 8.94$) for $B_{e,}$ 27.80 ($SD = 5.16$) for $B_p$, 45.20 ($SD = 5.04$) for $C_e$, and 44.90 ($SD = 4.98$) for $C_p$. On average, it was 29.05 ($SD = 7.22$) for the Bigfoot group and 45.05 ($SD = 3.46$) for the control group, respectively (see Figure 2). The trait anxiety inventory showed larger values for the Bigfoot group ($M = 43.9$, $SD = 6.82$) than for the control group ($M = 37.8$, $SD = 9.59$), but the difference was not significant ($t(38) = 1.94$, $p = 0.06$).

An analysis of variance (ANOVA) with the between-subjects factor *Group* (Bigfoot, Control) and the within-subject factor *Time* (1st, 2nd measurement) revealed significant main

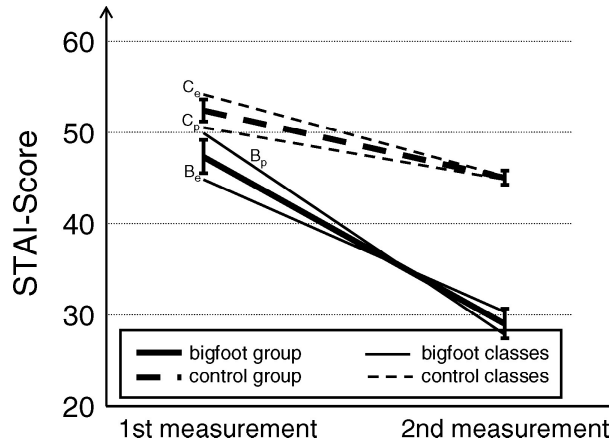


Figure 2. Mean scores and standard error for the groups on form X-1 of the State Trait Anxiety Inventory, measuring state anxiety of the groups (bold lines) and the several classes (thin lines). The minimal score is 20, representing a minimal state anxiety; the maximal score is 80, representing a maximal state anxiety.

effects for Time, $F(38, 1) = 178.34$, $p < .001$, part. $\eta^2 = .82$, and Group, $F(38,1) = 35.67$, $p < .001$, part. $\eta^2 = .48$. The interaction between the two factors, $F\ (38,1) = 32.93$, $p < .001$, part. $\eta^2 = .46$, also was significant. A-priori contrasts of the differences between pre- and posttest for each Bigfoot class and each control class were computed. Both Bigfoot classes had a higher reduction of state anxiety compared to each control group class, with significance ranging from $p = 0.27$ for the contrast between $B_e$ and $C_p$ to $p$ equal or less than 0.001 for the other contrasts.

## Teachers' Observations

Teachers of the control group indicated that pupils showed signs of anxiety. Especially on the first days on skis they reported motor reactions that were clear signs of anxiety, such as a cramped posture even on gently inclined slopes, which led to additional difficulties in controlling the skis. Most pupils were able to overcome these deficits as time passed. The teachers assumed that for pupils who did not improve their skiing skills, diminishing self esteem resulted in additional social anxiety. One girl was reported to be extremely anxious. In spite of low physical effort she sweated and looked pale and shaky. Once during the course she started crying hysterically and screamed "I want to learn it, but I'm afraid!" One usually brave boy was afraid of using the t-bar lift. Despite preparatory exercises on the day before, he acted anxiously entering the lift track and then sat on the t-bar instead of letting it pull him uphill. He forgot all the instructions and reported a "blackout."

Pupils of the Bigfoot group showed similar behavior as the control group. Teachers reported that their signs of anxiety declined faster, but that they showed more indications of anxiety during schuss. With the transfer to carving skis on the fifth day, short-term relapses to the previous shown anxious behavior were reported. Most of them were abolished in the course of the day. Overall, the teachers reported similar indications of anxiety in both groups, but pupils in the control group were reported as feeling safer sooner on their gliding devices.

## DISCUSSION

The purpose of this study was to see if short carving skis with a length of about 65 cm, called Bigfoots, could diminish the anxiety in ski lessons in fearful children. We were able to show, that right at the beginning, during the first experiences on their gliding devices, pupils on Bigfoots showed less state anxiety than pupils on carving skis. This is especially convincing because the pupils on Bigfoots were selected by rating their skills on inline skaters to be the potentially worse performers. Moreover they showed somewhat higher trait anxiety than the control group, which indicates that pupils in the Bigfoot group on average had a predisposition to perceive circumstances more or at least equally threatening than the control group.

The difference in state anxiety on the slopes becomes even bigger in the course of learning. The reduction of state anxiety in the Bigfoot group was significantly higher than in the control group, although the Bigfoot group changed to carving skis on the fourth day of lessons. It is improbable that the reduction of anxiety was due to the teachers' specific characteristics, because both Bigfoot classes outperformed both control classes significantly. Together with the verbal reports of the teachers, which point in the same direction, it can be clearly established that starting a ski course with Bigfoots efficaciously diminishes the state anxiety level on the slopes.

It is particularly noteworthy that the anxiety reduction was not limited to the first 3 days of the ski classes in which the Bigfoot group used equipment less intimidating than the carving skis. We clearly found that the lower level of state anxiety was substantiated after an additional 4-day time period in which both groups, the Bigfoot group and the control group, had classes on normal carving skis. This reveals that the use of Bigfoots with novice skiers reduces state anxiety on the slopes.

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