Gnar Country: A Peak Performance Aging Pilot Study

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Overview

The aim of this pilot study was to explore the relationship between human peak performance and aging, which is uncharted territory in the scientific literature. Its purpose was to investigate how, as we age, learning can be enhanced by novel pedagogical approaches that emphasize creativity, dynamic play, and the experience of flow. More specifically, the study examined how age-positive mindset priming, self-regulating challenge-skills balance, and group flow dynamics in a low-stakes cooperative environment would improve the learning of eight novel motions and increase flow while skiing and snowboarding. Central to this methodology was an embodied cognitive approach that considers certain aspects of cognition, such as learning, memory, and creativity, grounded in action and movement.

In this study, the independent variable was the introduction of eight novel motions (switch riding, jumping, shifty, grind, 360, 180, slash, crouch) which subjects voluntarily put into action while skiing and snowboarding. The dependent variables were:

- The subject's voluntary participation in the Flow Short Scale during each session.
- Independent video reviews that scored athletes' progression from their first session to their last session.
- Qualitative exit interviews conducted with subjects upon study completion.

The pilot study took place outside the lab. The location was the Sierra Nevada mountains; more precisely, the resorts Northstar and Palisades Tahoe. Before our first day in the field, subjects were introduced to the full motion suite, but they were told to focus on only two motions per learning session. Instructors were asked to minimize their verbal instruction. Instead, subjects were told to observe one of these new motions being put into action by an experienced skier or snowboarder. They were then invited to rehearse these novel motions in a game of "follow the leader," where they were asked to regulate their own challenge-skills balance, focusing on slow, steady and safe progression.

As the pilot study was exploratory, we allowed subjects to self-select from the motion suite, choosing which motions to rehearse and when to implement these new motions in their ski/snowboard runs. They also self-selected their groupings for their game of "follow the leader," based on how fast they wanted to travel down the mountain, and the overall "vibe" they felt for the day. These expressions of autonomy led to accelerated learning cycles, resulting in subjects going beyond their perceived skill sets faster than either they or the researchers had anticipated. *"I mean seriously, on that last run, those two 180s were so comfortable compared to the first day when my heartbeat was going [subject gestures to racing heartbeat by pounding their fist on their chest] just thinking about even trying it. Now it is like, I know it's okay,"* said a 57-year-old male subject on the third day of the study.

The primary conclusion of this study suggests that adult learning, particularly motor skill acquisition, is enhanced by dynamic play, especially when done in social contexts. We also found a 5.6% increase in flow short-scale responses between the first and last training sessions, suggesting that this dynamic play approach also increases flow-proneness. For these enhanced learning outcomes, both the autonomy to self-select peer groups to learn with for the day and the autonomy for subjects to tune their own challenge-skills ratio (again with a focus on slow and steady progression) seemed to be the crucial factors. *"As I age, there's something about being in settings where everyone wants to come together to challenge themselves, learn, and have those things come together naturally...There were moments when I realized I was just playing. I think this is flow. I guess how to get into flow will mean something different for everyone, I found my flow when I was playing,"* said a 42-year-old female subject during her exit interview.

Despite the observed and reported accelerations in learning, creativity, and play, this study was largely reliant on self-reporting and subjective assessment. These findings are open to questions of significance considering the prevalence of self-editing and the Dunning-Kruger Effect. Still, the preliminary results suggest learning and creativity can be enhanced throughout the lifespan, and that peak performance does not (and should not) necessarily decline as we age. We believe this study opens the door for a plethora of future research at the intersection of flow, aging, and cognition.

Early Outcomes

We're still analyzing the data but here are some interesting findings thus far.

- Overall, we saw a 5.6% increase in flow over the course of the experimental protocol, which we believe is a significant finding considering subjects were engaged in one of their favorite activities, which already produced high, self-reported, levels of flow.

- Over the course of the learning protocol, participants reported a 35% decrease in the perceived task challenge relative to their perceived skill level. In other words, during the experiment, subjects were able to close their challenge-skills gap and create a more balanced ratio.

- Related to this, we saw a 14% increase in the confidence levels the subject experienced while engaged in these high-risk motor learning tasks.

- Participants subjectively rated the overall learning experience as positive: "I've made a huge, huge amount of progression in the four weeks I've been up here," said a 56-year-old male subject.

- Athletes saw an average 26.5% increase in video review scoring on progression, amplitude, variety, execution, and difficulty, as recorded by three qualified judges.

Materials and Methods

Participants

Twenty-three subjects, ages 29 years old to 74 years old, were approached using a cold call method followed by a recruitment email that summarized the intent of the experimental pilot study, the fitness and skill requirements necessary, and the logistics required to participate. Of these, seventeen subjects, ages 29 years old to 68 years old, confirmed they were strong enough to ski fifteen laps in a day and accepted the invitation to participate. The six non-commits could not attend all of the learning sessions at the ski resorts, which made them ineligible to participate. This sample size included four females and twelve males. The recruitment period was from January 2023 - February 2023.

Procedure and Data Analysis

Leading up to the skiing and snowboarding, digital intake forms were sent on February 28, 2022, and collected through March 2, 2022. In these documents, subjects received details about voluntary participation in this pilot study and could choose whether or not to include their data in the pilot study. Also included in these forms were the following questionnaires:

- Demographics
- Skiing/snowboarding experience
- Goals and mindset about C/S Balance in sport
- Flow Short Scale
- Lifestyle Questions
- Flow Proneness
- Stress Mindset
- Growth Mindset
- Gratitude
- Pittsburgh Sleep Quality Index

In addition to these questionnaires, twelve subjects joined researchers, Steven Kotler and Ryan Wickes, in a video conference call prior to time spent on the mountain. On this same

video conference call, as part of the study's approach, subjects were primed with age-positive research in physiology, psychology, and neuroscience to help them prepare for the physical and psychological risks associated with forthcoming challenges (learning eight novel motions). Those subjects who were not able to attend received a recording of the call.

The five days (four scheduled and one make-up) at Northstar and Palisades Tahoe followed a general schedule. Each day, skiers and snowboarders warmed up with 3 laps down beginner or intermediate slopes, followed by 10-12 terrain park laps. On a typical morning, the group would ski 7 laps before breaking for lunch at 11:00 AM PST.

During this 30min-45min break, researchers sent a 'field questionnaire' to subjects' mobile devices to be completed before class resumed. The questionnaire included the Flow Short Scale and a Likert self-assessment of performance. After lunch, there was a second learning session, during which subjects, researchers, and coaches completed an additional 8 laps. At the end of each day, a follow-up questionnaire was sent to subjects. They were asked to complete it that same day. In this form, subjects answered long-form questions on their ability to tune the challenge skills balance. They also set clear goals for the next learning session, and answered questions about their recovery protocol.

Since the pilot study aimed to investigate motor pattern learning, subjects were also filmed during the first and fourth sessions. Each participant's last lap through the terrain park was reviewed for skill progression by three judges. The judges used an adapted version of the International Ski Federation's Freeski judging protocol, which scores riders on progression, amplitude, variety, execution, and trick difficulty. then averaged and calculated to determine overall progression.

Following the completion of the fourth learning session, researcher Ryan Wickes interviewed subjects to further contextualize the quantitative data. Interviews lasted between 30 and 60 min. Upon completion of the final interview, data processing began.