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Part 1
Optimizing Figure Skating Performance

As the current Chair of the PSA Sport Science Committee I am dedicated to providing our readership with research that can enhance our coaching practices. We coaches can think of ourselves as lifelong learners who seek to elevate our sport to new levels not seen before. To do so, we must challenge existing beliefs, be open to new ideas, and integrate what we learn into an organized, yet constantly evolving, set of core principles that inform our coaching methodologies. One theory that greatly enhanced my own coaching practices is the OPTIMAL theory for motor learning. The OPTIMAL theory was conceived by professors Gabriele Wulf and Rebecca Lewthwaite. I had the opportunity to meet them both at a Neurorehabilitation Conference in Boston several years ago. I am happy to share with you an article I co-authored with Gabriele, which presents the OPTIMAL theory and applies its core principles to figure skating practice. Gabriele is a distinguished professor whose research has been cited more than 30,000 times. The OPTIMAL theory has greatly influenced physical therapy and athlete development domains. You can learn more about OPTIMAL theory through the extensive references we provide in the article.
~ Garrett Lucash

Theories have important functions in their respective fields. They explain certain phenomena (e.g., motor skill learning) and make predictions that can be tested in experiments. In addition, theories often have important practical implications. As Kerlinger (1973) remarked: "Nothing is as practical as a good theory."

A few years ago, Rebecca Lewthwaite and I (Wulf & Lewthwaite, 2016) published a new motor learning theory, the OPTIMAL theory (Optimizing Performance Through Intrinsic Motivation and Attention for Learning). The theory integrates research findings from recent years and describes factors or conditions that are essential for motor learning. It explains how these conditions directly influence the execution of movements (motor performance) and, in the longer term, the learning of motor skills. I (Garrett Lucash) read Gabriele and Rebecca's work in numerous textbooks, book chapters, and research journals and attended one of their presentations at a recent neurorehabilitation conference. The OPTIMAL theory has influenced my coaching practices tremendously.

Here, we provide an overview of the OPTIMAL theory and its implications for skating practice. Two motivational factors, *enhanced expectancies* for one's own future performance and learner *autonomy*, and an attention-related factor, an *external focus*, are central to the theory (see Figure 1). All three factors are important for the production of economic and fluid movements that are necessary for the achievement of the movement goal.

Enhanced expectancies

As studies have shown, conditions that increase learners' expectations of their future performance not only increase their self-efficacy beliefs, but they also have a positive impact on learning. Confidence in one's own performance can be promoted in different ways. Positive feedback plays an important role in this regard. In several studies, the effectiveness of feedback after "good" versus "poor" performances was examined (e.g., Chviacowsky & Wulf, 2007). It turned out that feedback after relatively successful performances led to better learning (i.e., performance in delayed retention or transfer tests). One reason why this is interesting is that in practical settings instructors often underestimate the need to highlight successful movement executions. In contrast, the importance of corrections is often overestimated.

The above point that learners tend to prefer positive feedback has implications for effective coaching practices and there are different ways coaches can share feedback after positive trials. I (Garrett Lucash) developed a feedback method called positive bandwidth feedback, which is inspired by a traditional method — bandwidth feedback (Schmidt, Lee, Winstein, Wulf, & Zelaznik, 2019) — and Wulf and Lewthwaite's research. Positive bandwidth feedback involves feedback provision only after the athlete completes positive trials of a skill. This involves several steps. First, select the target skill. Then define success for the task. Finally, clearly explain these parameters to the athlete so they know the coach will provide feedback

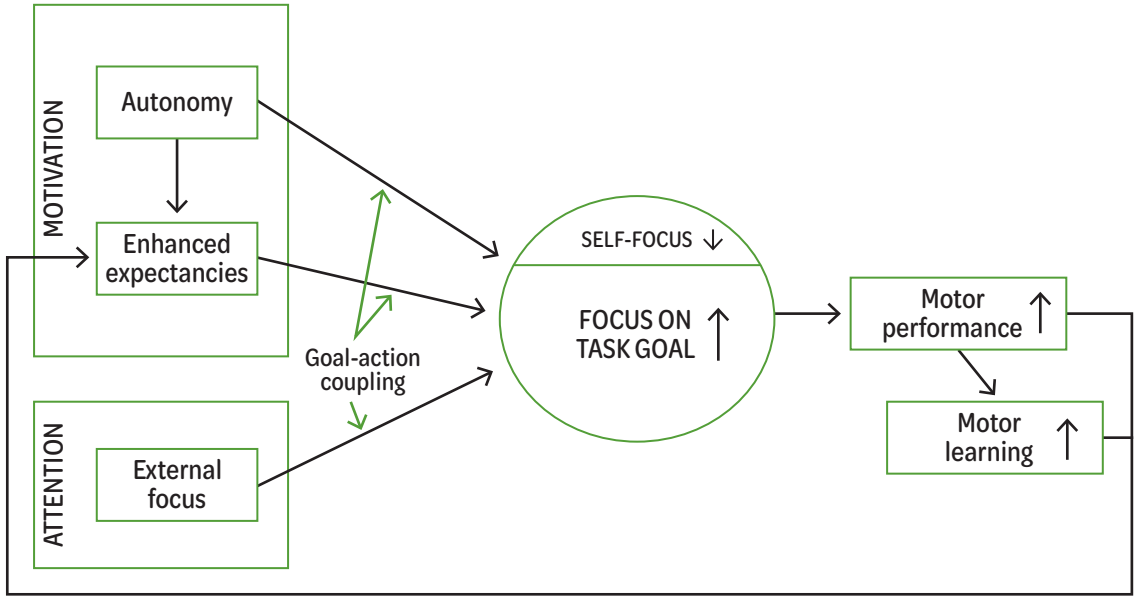

Figure 1. Schematic of the OPTIMAL theory

only when the athlete achieves success. Then the athlete engages practice. Let's say, for example, the target skill is an Axel and the athlete can land the jump somewhat consistently but the quality needs to be improved. The athlete has difficulty stepping over their skating hip from the back edge. The coach can define success as "an improved step over the skating hip" (notice how we did not define success as "landing the jump" – more on that later). As the athlete practices, the coach need not comment if the athlete errs — the athlete will already know they have not achieved success yet. Each time the coach observes an improvement in the athlete's step from the back edge, they let the athlete know through encouraging feedback (e.g. "Yes, that is better!"). In this way, the coach provides feedback after successful completion of the target task.

Also, conditions that make a task appear less difficult can increase performance expectations. For example, a coach can define movement success in such a way that it is relatively easy to achieve (e.g., Palmer, Chiviacowsky, & Wulf, 2016; Trempe, Sabourin, & Proteau, 2012). In a study by Palmer et al. (2016), in which a golf putting task was used, two concentric circles of different sizes were placed around the target point. A control group was informed that all balls that came to rest within the larger circle were "good" attempts. For another group, the smaller circle was used as a criterion for successful attempts. As expected, the first group had more success (22% "good" attempts) than the second group (8%) during the practice phase. Importantly, the group with more success experience showed better learning outcomes. In retention and transfer tests the next day, with the circles removed, that group still showed greater putting accuracy.

If we apply the above approach to figure skating practice, success can be defined in different ways. Success can mean landing a jump with a positive grade of execution (GOE). Success can mean to land the jump regardless of quality. Success can also be defined as an improvement in the execution of the jump (e.g., step over the skating hip on the Axel) regardless of whether or not the athlete landed it. To help determine how to make a task appear less difficult, coaches can assess each context. How new is the skill to this particular athlete? How are the athlete's mechanics? What are the athlete's current emotional and motivational states? By identifying such parameters, coaches can adapt the practice goals to facilitate the likelihood of context-specific success for their athletes.

Even simple encouraging remarks that remind a learner of their movement-related experience — thereby making a new task seem less daunting — can work wonders. For example, in one study a group of participants who were about to learn a new balance task was informed that "active people, with their experience" are usually relatively quick to master the task (Wulf, Chiviacowsky, & Lewthwaite, 2012). Compared to a control group, this group not only made more progress during practice; on another day, they demonstrated more effective task performance (i.e., learning) — due to a single sentence uttered before they began practicing the task. Below are

some figure skating specific examples:

- Skaters who work on their basic skills the way you do improve their jumps more rapidly than skaters who do not.
- Since you landed your double Axel off the ice first, you will learn it quicker on the ice.
- Skaters who take regular strength and conditioning classes tend to develop their spin positions faster.
- Skaters who prepare a pre-competition routine the way you do tend to perform better.

Even simple suggestions that a task is "learnable" can enhance individuals' expectations and facilitate learning (e.g., Drews, Chiviacowsky, & Wulf, 2013). That is, instructions or feedback that promote a "growth" mindset (Dweck, 2006) can alleviate learners' concerns about their abilities and reduce or at least prevent a detrimental self-focus. As a result, movements are performed more fluidly and effectively (Wulf & Lewthwaite, 2009). Also, as Cimpian, Arce, Markman, and Dweck (2007) have demonstrated, simple differences in the wording of instructions can influence performers' conceptions of ability and have an important influence on individuals' motivation and continued interest in a task.

Why are enhanced expectancies so important? Positive expectations or experiences lead to the activation of dopamine neurons. The release of dopamine not only improves immediate performance, but is also essential for consolidating what has been learned (Trempe, Sabourin, & Proteau, 2012). The *combination* of challenging practice conditions and success is particularly effective. Occasional failures temporarily lower dopamine levels, but the positive effect of subsequent success is even greater (Schultz, 2013).

In Part 2, we will present the other two factors — autonomy and external focus of attention — central to the OPTIMAL theory and its implications for figure skating practice. ❖

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