Another Look at USST Skating Dogma
Aspects of Technique

Over the past 6-8 years the USST approach to skating technique has been widely presented and marketed to the US cross-country skiing public. Accompanied by genuine good will and high energy, a degree of centralized zeal also essentially closed off open discussion or analysis of skating movements and ultimately took on the role of rigorously defended dogma. That dogma has been spread and copied across the country, despite its lack of basis in modern movement research or biomechanics.

The positive contributions of widely attended international scholarship, native experience and athletic potential have been sacrificed in the process. Despite one Swedish researcher's presentations, there has been little critique of his conclusions, which he himself is wisely tentative about, or inquiry into other sources broadly available. Domestic review and discussion has been considered gratuitous at best. As a result, the very credibility of the USST's capacity to educate stands open to legitimate question. The discussion which follows is an attempt to finally expand the discussion and bears with it the hope that a more inclusive, thoughtful approach to technique can restore greater credibility to the USST's diligent efforts.

Facing straight up the track or toward the gliding ski.

My guess is this originated in response to excessive twisting in the early days of skating. Trimming excess in the interests of efficiency has always been wise, but in this case the trimming some branches took away the tree, defeated the basic movement. The flaw in the thinking can be seen in the 1986 skating study done at Penn State. First it is noted that poling forces applied parallel to ski displacement by the faster skiers accelerate the skis in the direction of ski glide angle. (p.11) Secondly, "A greater flexion of the trunk can perhaps generate greater poling thrust and greater stride length." (p. 48) Simple physics, and a review of other human movements, should have suggested that both of these factors are achieved by initially and rhythmically squaring the shoulders and pelvis to the direction of glide.

But then the flaw: "Since the path of the head closely follows the path of the CM [center of mass], the head position of the skier can be used to estimate the CM location when viewing skiers in the field. Perhaps instructions to the skier suggesting less lateral deviations of the head from the line of travel may assist in keeping the CM from deviating *unnecessarily* from the line of travel." And later: "The faster skiers had velocity vector angles directed more nearly up the track than did the slower skiers. Thus it is important that CM motion not be directed along the ski glide direction but rather aimed in the track dimension, *as much as possible*." (p. 48)

The PSIA Manual ultimately cast this idea in stone: Advanced skate skier move their core straight down the track as much as possible while skating from one ski to the other. A beginner tends to move the core from side to side with each skate. When analyzing the core of the skate skier, try watching from behind. If the core is moving from side to side, or 'waving' from one direction to the next, have the student concentrate on keeping the hips and torso *always* facing in a straight line." This became the basis for the so-called "neutral position."

The first flaws derive from the words “unnecessarily,” “as much as possible,” and “always.” The path of the CM was throughout observed to be in the shape of a corkscrew, and the faster skier did indeed also show less lateral deviation from the “line of travel.” First, that does not mean *no deviation.* Secondly, the mistaken assumption was: if you want to go faster, deviate less. The mistake lies in a confusion of cause with effect. The correct assumption is: if you go faster, your deviation from the line of travel will naturally be smaller. Speed begets position; simply putting yourself in the “speed position” does not beget speed. The movement in its environment (speed, terrain, snow type) determines the skier's motor options. He can no more simply set and maintain his positions beforehand any more than a sailor can set his sails. Since the path of the CM is corkscrew-like, the correct assumption which follows is: by the very nature of movement, it is necessary to deviate back and forward from the line of travel to propel yourself forward at all. That is the inherent back-and-forth nature of skating.

The same reasoning applies to “velocity vector angles directed more nearly up the track,” aside from the fact that vector analysis, even though it may apply somewhat to the movements of inanimate objects (like pool balls), has limited relevance for animate movements, which are drastically more active and complex trajectories, energy impulses, environmental responses. In a word, in human movement you have to move through all of the directions, span and length of all the vectors in order to produce movement. You cannot just split the middle of the vector with a “sum” or “neutral” position and think efficient movement will result. The 1989 Penn State Study by Gerald Smith has been re-published in recent years, and quoted in a coaching article even last November, despite the fact that as early as 1985 E.C. Frederick, a biomechanist with the Nike Sports Research Lab, had cautioned that “the excursion of the body center of mass might be a key factor, although this approach has its limitations. Point-mass models treat the body as if it were a single point mass located at its center of mass. These models have illuminated some of the factors affecting the work and energy relationship, but they suffer from the fundamental problem that kinetic energy is not a vector quality, and so tracking the body center of mass is not sufficient for estimation of the total kinetic energy of the body.”(p.46)

In his article in *Master Skier* two winters ago Jack Sassville described the results of working with the neutral position: “With increasing emphasis by many coaches and instructors on facing forward and not twisting, it has become harder for many skiers to skate with a complete weight shift. They are stuck between their skis and spend most of their time on two skis, one against the other. Skiing on one ski will make you a better skier.”

I have used the example of the fish in the stream: he does not simply lie straight into the current and push with his fins. His whole body moves back and forth in response to the flow of the water. If he wants to move ahead into the current or encounters faster water, he speeds up the back and forth and his deviation from his line of travel diminishes.

Poling:

Going back to the early Penn State study, whose *descriptions* are useful where its *prescriptions* are not, the observation that poling in the direction of ski glide is optimal has since been broadly echoed. A Norwegian study from 2001 notes: “The tendency among top-notch skiers is that the poles are more parallel today than earlier. This gives the skier a bigger chance to let the poles work in the speed direction.” (*Skisport*, “Central Principles of Skating,”,8, 2001)

Although the poles will not always appear perfectly parallel in V1 because of the angle of the movement, we have to ask what might aid their functioning as parallel as possible to the gliding ski? The answer lies in the natural trend of the pelvis and shoulders to move in the direction of optimal force application. The Norwegian study also recognized this: “The rotation of the pelvis is another important element that for a long time has been both underestimated and misunderstood. To say that the pelvis should be stabilized does not mean it should be in the same position through the whole cycle, but the pelvis should be turned naturally in correlation to the skis. The angling of the skis depends upon the skier's speed and will therefore vary in different terrain. The faster, the less angling in relation to the speed direction. That means that the pelvis must be turned more actively in the uphills.”

The Penn State study had observed a similar natural tendency, but for some reason ignored it: “The direction of the strong side....was faced by the shoulders and trunk through much of the cycle....[Another skier's] body orientation was directed primarily toward the strong side even during much of the weak side skating phase.”(p.11)

What has always been implicitly recognized , therefore, is that facing straight ahead with the core and shoulders compromises glide speed, not just because dynamic weight shift onto the gliding ski is less accomplished but because the “weak side” arm is essentially removed from effective poling activity. That has been considered a fundamental deficit in skating by, among others, Ansgar Schwirtz, the biomechanist researcher and co-author of the German Ski Association's coaching manual. Yet USST prescription for V1 poling, while no longer being quite so explicit about facing straight down the track, still warns against allowing the weak side arm from crossing toward the new gliding ski and observes that the main source of power will come from the “hang pole.” Not crossing with the weak side pole preserves the face-down-the-track position, but in doing so it asks the skier to settle for half poling power in V1. The weaker side need not be construed as an empty side, particularly when both-pole power, while not being equal in both poles, is substantially available if you simply “follow the ski” with shoulders and pelvis.

In fact, outside the US the prescription for the shoulders and pelvis to move facing parallel to the gliding ski, or *rechtwinklig zur Gleitrichtung* – at right angle to direction of glide – flowing rhythmically back and forth between the two skis, is universal. That is not astonishing; it simply reflects an understanding of modern motor theory and animate biomechanics. It is also a simple element of the basic grammar of human movement.

A brief review of current observations is compelling. Among my sources are all the available materials relating to the development of the German program, from 1996 to the present from IAT (The Institute for Applied Training Science), *Nordic Sports Magazin*, *Das grosse Buch vom Skilanglauf* by Hottenrott and Urban (2004), a comprehensive reference manual for the German program, and *Biomechanische Analysen von Skatingtechniken im Skilanglauf* by Stefan Lindinger (2006), a comprehensive study of the history and current state of skating research.

Nowhere have I encountered the suggestion of facing straight up the track, to the contrary; right angles to direction of glide runs throughout Lindinger's long study (300 pages) as well as throughout a series of technique presentations in *Nordic Sports Magazin* (German) in which Marco Selle, Head Coach of the Italian National Team critiques World Cup skiers. Looking at Tor Arne Hetland's V2, he notes “shoulders in the direction of the gliding skier support the pelvis movement and stabilize the

course of the movement. The weight transfer from one ski to the other is always harmonious, almost dancelike. He never loads both skis at the same time [Sasseville's point!], yet the movement is absolutely flowing..... Hetland always brings his body weight optimally over the ski. Thus his power can unfold optimally and glide cleanly."

Selle uses the term "direction of running," but it is clear he does not mean "line of travel" but rather the path the body takes, back and forth, with greater or less lateral movement depending on speed and terrain. We heard this before in the earlier Norwegian study.

Of Virpi Kuitunen he notes that her V1 is quite good: "High position, which allows the legs to operate closely together [contradicting USST's wide stance prescription]. The shoulders are parallel [facing] to the ski set on the snow. Different than her rivals, she is position to shift the shoulders and pelvis to the opposite ski not until the second push of the arms....which brings stability and efficiency."

Of Pietro Piller-Cottrer's V2 he says similar things: "He is always compact, with the limbs in a line, very high and narrow in his execution....His shoulders are always oriented toward the ski tips."

Of Kuitunen's V2 he notes: "Her V2 and V2 alternate on the flats (long glide phase) is not optimal. Even when she succeeds in having good ski directionality through her balance and good ankle work, one can see how she has problems with bringing the pelvis/hips into an axis with leg and upper body. This results in the knee rotating inward. Thus the shoulders and pelvis work parallel [facing] to the opposite ski rather than the ski on the snow. This results in several problems: it is not possible to reach a stable and relaxed position; also she is gliding on the inner edge of the ski. This makes the push-off less effective."

I have said on several occasions that these priorities represent elements of a general grammar of human movement. Modern systems-dynamic theorists call them "orders of coordination." If that is the case, similar prescriptions ought be found for other related movements. A top alpine coach confirmed my observation that modern skiers square, or even lead slightly, in the shoulders and pelvis to the line of glide. During the recent Olympics I heard Dan Jansen remarking how well Shani Davis moved his shoulders and pelvis parallel, or facing, the glide line of the skate. Intrigued, I went looking into speed skating biomechanics. I have more looking to do, but one suggestion has caught my eye already: "The placement of the new gliding skate close to the other leg is important so as to accelerate as much body mass as possible during push-off." Another from Van Ingen Schenau's book on speed skating makes a line drawing showing how CM follows the skate line until the push-off shifts it to the new gliding skate. This would seem to echo Selle's advice to "follow the ski." (In fact, diagrams of the dynamic interrelationship of CM to line of glide in speed skating and ski skating are quite similar.) Similar priorities, a top alpine coach explains, characterize alpine turning: shoulders and pelvis move toward the glide line of the ski. Certainly alpine skiers are the ones who have studies how to maximize glide.

This also sounds to me like Hetland having his weight all on one ski, so his power can unfold optimally, like Kuitunen whose V1 legs operate close together, Piller-Cottrer's limbs very high and narrow. These elements of technique are human movement responses to terrain, their own physical characteristics, and their urge and feel for speed. They are not complex, though they are varied and subtle, particularly with increasing speed. They are natural and need not be exaggerated or forced. If they are, movement patterns simply become more awkward and mechanical, less flowing and efficient. More starkly put, but obvious, American skiers are ill served with movement prescriptions which are

inconsistent with modern biomechanical approaches. Broader and substantial scholarly updating is the beginning.