SKISPORT by J. Novosad and J.Waser (Moscow, 1975)
The comprehensive system of research and practice
in Soviet Russia

The following are typed excerpts from *Skisport*, Novosad & Waser (Moscow, 1975). I came into this translation in late 1975, after Charles Dillman had visited Russia prior to the 1976 Olympics. Just how it got to me I cannot recall, but my guess it is one of very few copies in the US. It was quickly known in Europe, as *Skilanglauf Heute* (Munich, 1977) by Maier and Reiter (former German Head Coach) attests. *Skisport* is already present in its bibliography. Over the years I have repeatedly returned to it, both for refreshing my approach to technique and for the clear, scholarly process of its thinking. Part of that thinking is in research; a part just as important is the analysis of how earlier mistakes were made, by perfectly reasonable people, and how those same people went about correcting them.

Many years later reading and translating Jürgen Birklbauer's *Modelle der Motorik* (2006) not only further refreshed and deepened the bases for my approach to athletic movement, it gave me a broad historical perspective on the evolution of biomechanics in sport. Modern biomechanics, specifically animate biomechanics (as differentiated from inanimate), began with the results of system-dynamic research and theory of the Russian, Nikolai Bernstein, in 1975, and the ecological perceptual psychology of James Gibson (1979).

The coincidence of the dates of *Skisport* and Berstein's work struck me anew when I went back to *Skisport* and could recognized Bernstein's theoretical vocabulary. In other words, as early as 1975 the Russians were integrating modern human/animate biomechanics into their teaching, whereas even today those insights have not penetrated American Nordic ski science, which remains still cast in terms of Newtonian physics, inanimate mechanics. (USST, Gerald Smith et al.) and thus 30 years behind the rest of the world. Not surprisingly, on the other hand, system-dynamic vocabulary and theory is broadly in evidence in European and Scandinavian discussions.

Excerpts from *Skisport*

Ch. I

...it is not only enough to simply go fast; one must also go thriftily and economically.....Economically means....having the largest coefficient of useful movement.....economy is conditioned by the the use of laws of motion, in other words, rationality.

Finally, technique must also provide the reliability of a high result in any conditions...[and that] depends upon the athlete's ability to adapt his technique to changing conditions....With this flexibility of technique it is not easy to master its *adaptive variability* [Bernstein term].

The more technique is perfected, the more variation of means of movement there is and the more flexibly the skier adapts to external and internal conditions [system-dynamic/ecological terms].

p.3 There exist general bases of technique.....Basic demands create, as it were, a model, a known model toward which all skiers must strive.

The word “model” means “standard” is Greek and in English. It would seem that these are identical in those languages. But nowadays, and especially as applied to sport technique these are not only different but opposing notions. [Signals the break from Newtonian mechanics.]

“Standard-1” is an exact model (for example, meter or kilogram standards); until recently,

"standard-1" was used in sports. It was thought that the closer technique was to "standard-1" the better! But what should be used as the "standard-1" so that all can be pulled toward it and to wipe out differences? [Cf. Attempt to establish a single "American double-pole" movement.] It is clear from what has been written above that it is impossible and harmful to make everyone fit the same pattern, to seek an ideal, exact model for this.

"Standard-2" is another matter. It is understood as the establishment of requirements, but not absolutely exact, and within definite limits of divergence and tolerance. In these allowable limits divergences do not disturb the performance of tasks. On the contrary, these divergences are the same individual pecularities and the same adaptive changes, the necessity of which has been well established.

Thus technique is a method of deciding the moving problem [movement which does not return to a state of balance, as with inanimate mechanics, but is continuous] for attaining high sports results..... Requirements on technique are established in the form of "standard-2" standards with the determination of an allowable limit of tolerance. These tolerances are necessary for the adaptation of details of technique to the changing conditions in competition and to the individual peculiarities of the athlete. It is the very presence of such tolerances which creates good reliability in contemporary technique …. [Cf. Bernstein: predictable goal-movement not despite variability but by means of variability.]

More perfected technique opens a path for new tactical plans, new variants, which rest on the higher level of physical and technical possibilities. ["Variant" is a key notion. Cf. Recent research book entitled *Movement System Variability*.]

The Nature of Movement

p.6ff. Insufficient understanding of how complicated a racer's movements are only impedes the use of his capabilities. The simplification of ideas of the movements of man can directly bear on the unsure course of perfection. [Major problem with US ski science.]

The athlete performs each moving action, for example some sort of stride, doing a number of movements. He accomplishes them in many joints simultaneously—as groups of movements and sequentially—as a series of movements. All these individual movements are organized in a definite regular order. All of them are united with one another in a whole and form a system of movements. [Echoes Gestalt/whole-form priority] Systems of movements differ from an accidental selection in that they are strongly interconnected, forming composed parts and elements of the system of movement.

In order to study the system of movement, we must first separate it into component parts and establish the composition of the system.

Since all movements take place in space we can divide spatial elements. They are movements which a man makes in his various joints. The simplest <u>joint movements</u> are in one joint, around one bone, only in one direction. In sport technique such simple movements do not occur. Movements are always united into groups and series of movements.[Cf. The fallacy of emphasizing single movements of positions, ex. "American double-pole, pronounced shin angle.rt]

….....

Movements can also be divided by time, making up time elements, or phases. <u>Phases</u> are a series of sequential movements which are performed without significant changes of the movement task in the course of this phase.

What is it that unites movements into larger blocks and, finally, into an entire system? There are a great number of methods of uniting, of interdependence of elements. All these methods are called <u>structural</u>. …..Kinematic structures are methods of uniting of the corresponding movements in space

and time. In order to illuminate spatial structure, spatial characteristics are studied: a) the position of points and parts of the athlete's body; b) their changes (as a result of movement [movement as cause of position, not effect – central system-dynamic priority], and c) the trajectory of points of the body (their path and curve of trajectory)[Cf. Gestalt law of "good curve."]

Dynamic structures show the mechanics of movements, in other words, their reasons. If kinematics more describes movements, then dynamics more deeply explains them.

Finally, informational structures show the thought and meaning of all the interdependencies.... feeling/sensation, psychological, and command structures. Feeling structures are complexly connected with the so-called feeling of the snow, ski, speed, tempos, equilibrium, etc. From the multitude of single sensation signals are formed unified perceptions, according to which the skier controls his actions. (Cf. Bernstein: perception-action coupling]

Command structures are the thousands of commands, going in an organized manner from the skier's brain to his muscles. Of course, these are not always conscious. The great majority of them are automatic, outside consciousness. [Not yet to the point of understanding the full nature of spontaneous self-organization of movement responses, as Bernstein called it, the ambiguity of central and peripheral movement steering.]

Courses [of instruction] may differ: from small block to larger (analytical), or the entire structure is formed, and then details are gradually worked out in it (synthetic). There is no need to contrast them. Not infrequently and analytic-synthetic course is more useful, with alternation of task in dependence on the course of technique mastery. [Anticipates Schöllhorn's differential learning!]
….....

Then comes persistent work on the adaptation of the system of movements to the skier's individual peculiarities and to the changing conditions of movement, i.e., the individuation of the technique and its adaptive variability. …..It is the development of the internal structure as a means of interdependence between elements which causes the perfection of the outer structure as a means of interdependence of the system of movements itself with the surroundings. [Ecological basis for self-organization.]

Systems of movement are based on two tasks of perfection: the perfection of the support-movement apparatus (the development of his movement qualities); the perfection of the control of movements [Bernstein's and modern usage prefers "steering" rather than "control." Could be the Russian word contains both meanings.] (the formation of his movement habits). The first task is served chiefly by physical readiness, the second by technical readiness.

The Requirements of Technique

Technical preparation ….improved; if it earlier was closer to copying of given examples, today is has an empirical scientific base. ….. Earlier the technique of the best skier was used as a model; but even the best did not always have entirely perfect technique..... Often a model for technique was formed from separate odd elements, which according to one sign of the other were considered more rational (for example, as sharp an angle of leg push as possible, as long a thrust as possible, etc.). Finally, elements appeared as a model which had no other basis than personal taste.

[Later] it became possible to formulate contemporary requirements for contemporary technique

not as separate advice, but as a system of exact requirements. For skiers following this system, there is much less variation in technique, which depends only on objective reasons – personal peculiarities of skiers and changing conditions of action..... Interest in them has naturally raised, the more so since from these requirements for technique flows the construction of the methodology of the mastery of technique and the perfection of technical mastery.

The Technique of the Ski Racer

The entire gliding stride is divided into two periods: the gliding of the ski and the standing of the ski.

p.9. In the course of [gliding] the speed curve always descends since there are no moving forces in this phase, and the skier in no way pushes from support, while friction brakes gliding. However, for some skiers the curve does not descend much, and they lose little speed during free gliding. For other skiers speed decreases noticeably (as much as 3m/sec); the reason is an increase of leg pressure on the ski.

There are several mistakes which cause pressure increase:

- sharp loading of the ski at the beginning of the phase while planting the ski on the snow "with a blow."[Cf. USST: "forcing the ski down the track." rt]
- when the skier, tensing the muscles, slows lowering of the body; with this forces of inertia of parts of the body are directed down, pool with body weight, and increase ski pressure on the snow. Members of this group of mistakes are: a)gliding *with the shin inclined forwards,*[! cf. USST shin angle prescription. rt] when the knee is above the toe of the foot (back shin muscle) and the boot toe presses with force on the ski; b) "relief" with lowering of parts of the body at the hip joint, and also during lowering of the body at the hip joint of the support leg; these movements greatly soften the "blow" during ski loading, but as a result press the ski more strongly against the snow..... We must note that all of the cases of lowering of parts of the body lead in the final analysis to braking with the muscles and pressure increase.

p.12. In the period of standing of the ski slow straightening of the leg decreases the force of the push. That is why all phases are shorter for the fastest skiers; as a whole this appears as a higher stride frequency.

p. 15. Gradually, toward the end of phase II the skier straightens the support leg, which allows the stroking leg to pass by it more straightened. As a result of the stroke at the foot with the ski there will be great linear speed. [law of inertia] As the same time, having straightened the leg (having raised it), is is as if the skier "raises up/ brandishes" for faster and deeper squatting on the support leg. In these instants the force of gravity becomes equal not so much to the tension of the muscles as to the resistance of the bones of the almost straightened leg.

p.16. [The "kick"] The skier exerts pressure on the snow with the forward part of the foot, a "pillow" placed behind the toes of the foot; the knee must be moved back and that energetically, powerfully and shortly. Straightening of the foot at the knee is performed by the fastest skiers in .06 seconds. If the boot presses the ski to the snow well, the skier distinctly feels the push, directed along the thigh, applied to the pelvis. It is as if the push tosses his body up and forward, as they say, "for flight." As a result the body accomplishes movement at first forward and up, and then forward and down, along a trajectory, convex upwards. [clearly no applicability of vectors here, rt] This recalls a "hill" in flight,

during which the pilot and passengers in a plane experience partial weightlessness; their weight and pressure on the seats decreases.

p. 20. [The stroking forward leg] It us necessary to demand that the stroking leg be carried out before the foot, and not with the knee, beginning the stroke with a movement of the pelvis.....

[Stroking to kicking] The stroking leg performs the thrust longer; consequently the push will be longer and its speed slower; all this lowers the speed of the gliding stride.

p. 24. Stroking movements of the forward extended leg and arm are very important for pushing with the ski. The skier performs the latter movements not only at the hip and shoulder joints, but also with the participation of movements of the pelvis and humoral belt. All the described movements are much more extensive, with the participation of many muscle groups, and therefore are stronger than the simple pushes with the leg.

In the same manner pole pushing includes: trunk inclination forward with its bending; transmission of forces from the support pole to the gliding ski through the rigid arm-trunk-leg system, and stroking movements of the arm and leg to a certain extent; influencing tension of the arm muscle performing the push; straightening of the trunk with its bending in phase IV. Therefor pole pushing includes a wider circle of actions than only their part-arm pushing. [Clear echoes of Bernstein's system-dynamic movement theory and its relationhip to Gestalt perception theory. Rt]

p. 29. Unthinking copying of a standard, without deep understanding of the purpose and meaning of each element of it will not make it possible to basically raise the speed and economy of the stride.

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….....

Ch. IV <u>The Formation and Perfection of Technical Mastery</u>

p.1f. Our main rivals up until now, skiers from northern lands, solved the problem of initial instruction in their own ways. All school children ski from childhood, thus seeing numerous examples of the technique of highly qualified skiers. And even if they have little organized instruction, they acquire a rich experience from childhood on, being guided by the example of the best skiers. Along with this there is also a weak side to such unconscious imitation – the imitation of the mistakes of others.

We trainers in ski sections and teams run into young skiers who often have no schooling in ski technique. If they passed through beginning courses but are unqualified, they must be re-taught, and in this case it is better to simply begin the initial instruction on a correct basis than to spend time eliminating numbers of errors. The solution of questions in such a spirit has great value in principle. Should we begin from the beginning or “darn the holes?”

….....

p.3. Above all [mastery] is the problem of attainment of high movement speed on the basis of **easiness**, **swiftness**, and **power** of the stride.

The demand for <u>easiness</u> denotes the search for the means of the best use of moving forces, of the lowering of actions of braking forces, the use of elastic and inertial forces, and high economy in the use of one's muscle strength.

<u>Swiftness</u> refers to the character of covering distances at great speed without hesitation, as well

as to the peculiarities of movement, especially of stroking movements and the leg push.

The demand of the output of power of the stride reflects not only great ease and speed of movement, but also the application of great efforts and the performance of a large amount of work in a short space of time, giving the highest speeds.

….....

The demanded high movement speed is not only the result of highly rational contemporary technique, but also of the perfected ability to suitably change it depending on terrain conditions, friction and body condition.

….....

Work on the *adaptive variability* [my italics] of technique consists in studying to consciously adopt these changes. At the same time skiers succeed in mastering the adaptive changes so well that they are done automatically, by themselves, even when the skier does not think, but when they are necessary. [Here is the system-dynamic notion of "spontaneous self-organization.]

….....

p.6. Their first races are still a means of training and do not count in the competition period. In them they strive not for a win but for technical and tactical perfection.

….....

p. 8. The description is always accompanied by a demonstration. The trainer picks the best place for the demonstration, from which the group can best hear and see. There is no need doing the demonstration with a model, to deprive it of its naturalness, or to do the demonstration exercises overly exaggerating necessary features. It is better to do it several times, slightly changing insignificant details, but strictly and exactly performing the significant ones.

One must closely watch that the description and the demonstration attain their goals. They must provide understanding of the basis of the tasks and only then should finer aspects be disclosed. If the first instance is overloaded with details then afterwards it is only necessary to repeat. Overloading attention with details can seriously hinder the mastery of the basics, i.e. "unnecessary explanations only cloud what is said." [Echoes "whole determines the parts" basis of system-dynamic approach to movement.]

The trainer, in explaining new material, must clearly express his thoughts. He should not speak in a dry commanding tone. The athletes are the trainer's co-participants in the pedagogical search; they must be interested and fascinated, not coerced.
