Transfer of Training in Sports

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Translated from the Russian by

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About the Author

Anatoliy Bondarchuk

Dr. Anatoly Bondarchuk is renowned as an athlete (1972 Olympic Champion and European Champion in the hammer throw as well as a former World Record Holder) and Mr. Bondarchuk's coaching credentials are virtually unprecedented in the sport of Athletics.

Dr. Bondarchuk is a Doctor of Pedagogical Science (University of Kiev) and his research into technique and high-performance training methods formed the basis for many of the common techniques and practices used by the world's top athletes today. Mr. Bondarchuk developed the USSR National Team throws program from 1976 to 1992 from which he produced numerous World and Olympic Champions in the Hammer, Discus and Shot Put. He has authored 11 books and 195 articles in his areas of expertise. A common focus is training to maintain performance and technique. Since 1992 he has been coaching for Portugal and Kuwait.

Mr. Bondarchuk's athletes, while members of the USSR National Team, broke 12 World Records, and still hold the current world record in the hammer throw. His athletes won all hammer throw medals in 4 consecutive non-boycotted Olympic Games.

About the Translator

Dr. Michael Yessis

Dr. Michael Yessis received his Ph.D. from the University of Southern California and his B.S. and M.S. from City University of New York. He is president of Sports Training, Inc., a diverse sports and fitness company. Dr. Yessis is also Professor Emeritus at California State University, Fullerton, where he is a multi-sports specialist in biomechanics (technique analysis) and sports conditioning and training.

In his work, Dr. Yessis has developed many unique specialized strength and speed-strength (explosive) training programs. He has served as training and technique consultant to several Olympic and professional sports teams, including the L.A. Rams and L.A. Raiders football clubs, Natadore Diving Team, and the U.S. Men's Volleyball Team. He has also successfully trained many athletes in different sports.

Dr. Yessis has written 16 books including *Kinesiology of Exercise, Explosive Running, Build A Better Athlete, and Sports: Is It All B.S.?* He has also written more than 2,000 articles on fitness and sports training that have appeared in magazines such as Muscle and Fitness, Shape, Scholastic Coach, Fitness Management, and the National Strength and Conditioning Association Journal. In addition, he has completed four videos; Exercise Mastery, Developing a Quarterback's Arm and Strength, Specialized Strength and Explosive Exercises for Baseball and Specialized Strength and Explosive Exercises for Softball.

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Preface

On the contemporary stage of track and field development, many pertinent problems are being resolved. This is made possible only by using what is known in the theory and methods of physical education to reveal the essence of training transfer. Many different aspects of sports improvement are touched upon---such as more effective means and methods of developing physical abilities, learning and mastering technical skills and revealing the relationships between them in separate training sessions in the micro-, meso- and macro- cycles of sports training. These interrelationships can have a positive or negative effect on improvement of sports results in the competitive events. In individual cases, the training may not show either a positive or negative effect on improving performance.

When examining the process of training transfer, it follows to remember that transfer is realized only during the cycles of sports form development. Because of this, at the end of these cycles, the athletes should enter a state of sports form in the exercises (events) in which he is involved. At this time there is a change in the level of sports achievement (an increase in stabilization) appearing as a result of the effects received from the training system used. In view of the direction of training transfer, body reactions are formed not at that moment, but during the time of moving into the sports form state during each training session in the developmental cycle.

Consequently, an increase in sports achievement at the end of these cycles ensures not only the effectiveness of the training system used (means and methods of training, their combinations, the dynamic changes in volume, etc.) but also the ways of constructing them. The latter serve as short time processes at the beginning and later, as long term adaptational restructuring in correspondence with the micro- and macro- systems of the body. As a result of these changes, the sports form state becomes evident as well as the direction of the transfer of training.

Correctly understanding the organic inter-relationships between these short and long term processes is very important. Many specialists in the theory and methods of physical education have proposed different means of dealing with adaptation which appears as the basic survival form of living things. They give recommendations for the organization of the transfer of training without distinguishing the significance of short term and long term adaptational restructuring. But how is it possible to come out against adaptation and witness the flow of different levels of adaptational changes?

In sports practice, specialists give outstanding recommendations on the organization of the training systems for separate training sessions (means and methods of training, their combinations, volume and intensity of training loads and others). They reveal a decrease in effectiveness by changing single complexes of exercises with others in short periods of time. This leads to not finishing single adaptational restructurings in specific body systems without which there cannot be any discussion of sports achievement improvement. As a consequence, we "restructure" other systems that dissect the transfer of training. This switching not only significantly detracts from entering the state of sports form, but prevents the transfer of training to take a specific direction, not withstanding the creation of unfavorable conditions for the functional systems of the body.

In putting together contemporary notions of training transfer, we face significant problems. In the theory and methods of physical education there is little written on this topic. In most cases, they touch on various aspects of training transfer but hardly any of the factors that make possible the flow of this process. Over the last two decades, we have systematically collected small increments of experimental material related to the positive and negative relationships from the practical exercises used in all the individual track and field events. More than 7,000 athletes having different sports qualifications were examined. Collection of such a large amount of factual material was made possible over several decades when the author was with the competitive USSR team. For 8-10 months on a daily basis I was with the learning-training groups which included not only native, but foreign athletes specializing in different track and field events.

In this book, training transfer is looked at from the point of view of training systems without the use of steroids. When using steroid preparations during the cycles of sports form development, at the moment of entering this state, results are increased in all the exercises used and in those that were not used in the training. The explanation for this regarding the mutual influence of one exercise on other, is practically impossible. An increase in sports results takes place in all used methods of training and with any system of training effects. When training systems without steroids are used, sports results at the moment of entering a higher state of sports form do not increase and even decrease. But they always improve with the use of steroids. The observed increase in sports results is always significant.

We didn't make this finding by chance since the picture of training transfer in the exercises when using the two systems mentioned above are distinguishable from each other in their roots. Because of this, before making definite conclusions regarding the direction of training transfer, it is necessary to take into consideration only experimental material received in the training without the use of steroid preparations. Only in this case can we talk of the true laws of training transfer.

The author sincerely thanks those athletes and coaches who kindly dealt with them in their own training but also helped in the collection of experimental material over the duration of almost two decades.

Glossary

Term	Definition
Block method	The block method of constructing cycles of sports form development is alternated to resolve physical ability development and technical mastery. According to Y.V. Verkhoshansky [49, 50] specialized physical preparation should always take into consideration work on the technical and preparing the base for technical improvement. He recommends division of the cycles of sports form into blocks of physical and technical preparation. Each of the blocks should end at the moment of entry into the state of sports form in the complex of exercises used and maintained.
Block-complex method	This method of constructing cycles of sports form development uses a definite complex of general developmental and specialized-preparatory exercises over the duration of the first block and specialized developmental and competitive exercises over the second.
Block complex-variation method	This method, used over the duration of the physical preparation block, uses a definite complex of general developmental and specialized-preparatory exercises while the athlete has still not entered into the state of sports form. At the beginning of the technical preparation block these means of training are excluded from the training and specialized-developmental and competitive exercises are introduced.
Block-variation method	In the blocks of physical and technical preparation the same system of exercises is used as in the blocks-complex method.
Block variation-combined	Construction of these cycles of sports form development are distinguished from the previous ones by the fact that in these blocks, physical preparation does not use the same complex of general

method	developmental and specialized-preparatory exercises and their schematic changes every 2-4 weeks. The complex method of constructing cycles of sports form development does not take into account the use of the different stages, blocks. At the beginning a definite complex of general developmental, specialized-preparatory and specialized developmental and competitive exercises are introduced. They are used until the athlete enters into the state of sports form. Corresponding means of training depend upon the qualifications of the athletes, individual essentials and tasks to be resolved on specific stages of sports improvement.
Block variation-complex method	In this method, when used in the physical preparation block, general developmental and specialized-preparatory exercises change every 2-4 weeks. During the block of technical preparation a definite complex of specialized developmental and competitive exercises is used.
Complex-combined block method	In this block of constructing sports form development cycles there is a division in the second block in the stage of specialized preparation and development of sports form. In the first stage only specialized-developmental exercises are used and in the second, competitive and specialized-developmental. At the beginning of the physical preparation block a definite complex of general developmental and specialized-preparatory exercises are introduced. They are used while the athlete still has not entered into the state of sports form.
Combined method	When using the combined method of development of sports form, the cycles are broken into stages of specialized preparation and development of sports form. Over the duration of the first of these, general preparatory, specialized preparatory and specialized-developmental exercises are used. In the second---specialized-developmental and competitive.
Competitive Exercises	In the theory and methods of physical education, the acting definition or understanding is "sport event", in which the athlete participates in competition. The exercises are executed in the process of competition

	as well as in training. In the latter case they can model (repeat) the competitive conditions in easier or more difficult conditions.
Complex-variation method	This method of constructing sports form development cycles uses a definite complex of specialized-developmental and competitive-exercises. These exercises do not change unless the athlete does not enter into the state of sports form. At that time, over the duration of the sports form development cycle, there is a change in the complex of general preparatory and specialized-preparatory exercises.
Direction of Training Transfer	This usually refers to whether the transfer tends to be or is moving in a manner more positive, negative or indifferent. In other words, by doing a particular type of training the transfer becomes more positive negative or neutral.
Exercise	The definition of this term is standard and typically means the activity in which the person engages. It can refer to a specific strength or endurance exercise and it can also refer to the competitive event, as for example, the competitive exercise.
General Exercises	General exercises typically refer to those exercises that are used for conditioning but do not have a direct correlation to improvement of the sports skill or sports event (except for low level athletes).
General Preparatory Exercises (often synonymous with general exercises)	When executed, these exercises do not repeat the competitive actions as a whole or their separate parts. Other muscle groups take part in the work being done. The functional systems of the body are activated but do not ensure an increase in results in the competitive exercise. General preparatory exercises (also known as general physical preparation (GPP) appear as a means of all-round development of the individual, and have a positive influence on increasing the general level of work ability and coordination. At the same time, their use with other forms of exercises serve the flow of the restorative processes (active rest).
High Start Standing Start	These terms are used interchangeably. They refer to running start positions.

Indice **Result**	Indice usually refers to the number of the recorded result of a particular exercise. It may also refer to results in the exercise, results in the competition, etc.
Level of Athlete **Qualifications of Athlete**	These terms are used interchangeably. They refer to an athlete's level of ability, i.e., whether he or she is in the elite (world or professional level), high, average or low (novice) class. The categories are very distinct.
Means and Methods	Means refers to the type of training being done, as for example, strength, endurance, or specialized training. Methods refer to the programs used in each of the means. For example, strength training is the means and concentric, eccentric, interval, explosive, maximum strength training etc. are the methods. In the U.S., these terms are most often used interchangeably.
Motor Analyzer	This is a unique term that has no analogy in the English language. Typically, analyzer refers to the area of the brain that controls a particular function or functions. For example, the motor analyzer usually refers to the area of the brain (cortex) which is responsible for movement in the body. It is in this area that the brain analyzes the incoming information and then responds by sending out the proper signals to guide the motor activity.
Period **Stage**	These terms are interchangeably. Stage of training is synonymous with period of training. At times, stage of training may also refer to level of training.
Physical Education	This term is used to denote the pure discipline. The physical education discipline is more highly developed and scientific in the Russian literature than in the U.S.
Qualifications of Athlete **Level of Athlete**	These terms are used interchangeably. They refer to an athlete's level of ability, i.e. whether he or she is in the elite (world or professional level), high, average or low (novice) class. The categories are very distinct.

Result **Indice**	Indice usually refers to the number of the recorded result of a particular exercise. It may also refer to results in the exercise, results in the competition, etc.
Specialized Exercises	Specialized exercises have a direct correlation to the sports event. They have specific criteria and must duplicate various aspects of the competitive event, as for example, the biomechanical structure, energy source, range of motion in which strength is displayed, etc. Also known as specialized physical preparation (SPP).
Specialized-dcvelopmental exercises	These exercises repeat the competitive exercise in its separate parts. In executing them, one and the same muscle groups participate, together with activation of similar systems and organs. They not only repeat the muscle work regime and other systems of the body which ensure further increases in the competitive exercise, but also supersede them. The specialized-developmental exercises more or less recreate all the elements of the competitive activity, and in so doing, make it possible to more effectively and sclectively have an effect on improving or developing the same or other physical abilities. The levels achieved in these exercises are realized in further execution of the competitive exercises. They serve for entry into the state of sports form.
Specialized-preparatory exercises	These exercises as the general preparatory exercises, do not repeat the competitive actions as a whole or in their separate parts. However, they use similar muscle groups in their execution. The training work serves to activate the functions and body systems from which an increase in sports results in the main movements depend. Identical or close to identical regimes of muscle work and different functions of other systems are involved.
Sports Form	This term typically refers to when the athlete attains all that is possible from the specific training done over a specific period of time. For example, entering sports form after working on a particular exercise and mastering it, means that the athlete has attained full mastery of the

	exercise and full development of the physical quality. There are various stages of sports form development culminating in the sports form needed for competition. This is analogous to peaking at which time the athlete achieves technical and physical perfection.
Stage **Period**	These terms are interchangeably. Stage of training is synonymous with period of training. At times, stage of training may also refer to level of training.
Stage-complex method	This method of constructing a sports form development cycle uses a specific complex of general developmental and specialized-preparatory exercises over the duration of the general preparatory stage (GPP). At the beginning of the stage of specialized preparation, specialized-developmental and competitive exercises are introduced. Excluded are general preparatory exercises. There is also a change in the specialized preparatory exercises over the duration of the specialized preparation stages which once again use a definite complex of specialized-preparatory, specialized-developmental and competitive exercises.
Stage complex-combined method	This method is used on the stage of general preparation which uses a definite complex of general developmental and specialized-preparatory exercises. At the beginning of the stage of specialized preparation, a new complex of specialized preparatory and specialized-developmental exercises are introduced. The competitive exercises are used only during the stage of sports form development.
Stage-complex-variation method	This method uses the same system of exercises as the ones above. The only difference is that over the duration of the general preparatory stage, a specific complex of general developmental and specialized-preparatory exercises are used. The stage of specialized preparation begins with the introduction of a complex of specialized-preparatory, specialized-developmental and competitive exercises. These methods of training change every 2-4 weeks.
Stage-	This method of constructing cycles of sports form development uses

variation method	the same system of exercises which is used over the duration of the stage-complex method. The difference is that every 2-4 weeks there is a change in the exercises used over the duration of the general and specialized preparation stages. The first stage is basically the same as the second and ends at the moment of entering the state of sports form in the exercises being used.
Stage variation-combined method	This method of constructing sports form development cycles is distinguished from the stages of the complex-combined methods only in that over the duration of the general preparatory stage, there are changes in the exercises every 2-4 weeks.
Stage variation-complex method	This method calls for a change in the means of training (general preparatory and specialized-preparatory exercises) over the duration of the general preparatory stages and uses a standard complex of specialized-preparatory, specialized-developmental and competitive exercises during the following stages of specialized preparation.
Standing Start **High Start**	These terms are used interchangeably. They refer to running start positions.
Variation method	This method of constructing sports form development cycles is distinguished from the complex because it calls for a change in the methods of training used every 2-6 weeks. In sports practice it most frequently consists of 4 different (according to name and content) stages. The latter of them, which oversees entry into the state of sports form, is called the stage of development of sports form. There must be a session between the exercises used over the duration of these cycles. Resolution of each following task should come from each of the previous. The corresponding means of training can change on each stage and depend upon various factors.

Metric System Conversions

To convert kilograms (kg) to pounds (lbs) multiply lbs by 2.2.

To convert meters (m) to feet (ft), multiply by 3.28.

To convert feet (ft) to meters (m), multiply by 0.3048

To convert pounds (lbs) to kilograms (kg), multiply by .4563

Chapter 1

A Brief Overview of Training Transfer

The transfer of training is one of the central problems in the theory and practice of physical education. The reason for this is that it is in the transfer of training that the learning and improvement of technique and likewise the development of the related, or other physical qualities (abilities) take place. However, we also come up against the interactions of the training means used at this time. This has a place even when using ordinary training sessions with only one exercise. The exercise can leave traces, as for example, after executing the first training session in a specific manner, it has an influence on execution of the second (next) session. Dynamic changes take place in all systems of the body in order to ensure the sports activity. This shows up mainly on the functioning of the central nervous and heart-circulatory systems.

Even in the first decades of the 20th century, specialists in many scientific areas (classical and sports physiology, classical and sports psychology, neurophysiology, biomechanics, theory and methods of physical education, and others) began to carry out experiments to determine situations in which the acquisition of an earlier learned skill in one exercise had a positive influence on the learning of another exercise later on. Or, in cases where an increase in the level of sports results, as for example in exercise A, makes it possible to improve results in exercise B.

In further studies, it was shown that the transfer of training not only can be positive, but negative. In many cases, as for example an increase in strength capabilities in exercise A, there is no positive or negative affect on exercise B.

In the theory and methods of physical education, the process of training transfer is subdivided into the transfer of skills and the transfer of physical abilities. Each of these problems is looked at separately. In this chapter, the essence of the three basic theories of transfer are looked at. Those siding with the first of these we conditionally call "specifists", second, "generalists" and third, "holistics".

The Specifists Viewpoint on the Theory of Training Transfer

One of those who established the base for specificity was E. L. Torndyke [223]. She called it the theory of identical elements. In agreement with her, the transfer of training is seen when in two types of activities, there is some kind of concurrence (identicalness) of elements. Their absence does not make it possible to have transfer. This appearance is completely specific according to its essence.

The transfer of training takes place by using earlier acquired associated ties [284, 287, 288, 294, 304]. Between them there must be identical elements in a definite order. The theory of identical elements was criticized by many native specialists in the area of classical and sports physiology and psychology. They quoted the learning's of I. P. Pavlov and believed that naturally formed conditioned reflexes lie in the activity of the central nervous system. They do not negate the significance of old associations in the systemic activity of the higher segments of the brain.

The influence of the coinciding "working" elements in the process of forming functional systems was noted by P.K. Anokhin [7]. According to him, the functional systems are only as great as displayed in the existing exercise. In execution of most exercises, similar muscle groups participate. Besides this, any activity ensures the functioning of one or another body system in the process of adaptation that takes place in response to the external or internal effect.

Similar muscular groups appear to work in the formation of simple as well as complex, physical exercises (according to their coordinational make-up) [25, 26, 79]. This allowed several authors to speak of the multi-sided structure of physical exercises [50, 128, 143].

Physical exercises possess multi-functional and multi-system properties. The multi-functionality ensures activation of similar organs and body systems [94, 126, 140, 267].

As a result, this produces definite adaptational changes which serve to increase the level of their functionality. These changes can then also be seen in execution of other exercises.

Multi-system actions appear in the formation of complex coordinational movements. The latter can be composed of definite "selections" of simple local movements, each of which is used in many track and field events. For example, active extension and flexion of the legs occurs in many sprint events, in the hurdles, jumps and throws. Local movements can be improved outside the structure of some complex coordinational exercise, and later used as a "building block" for learning movements having multi-links [265].

The Generalists Viewpoint on the Theory of Training Transfer

The viewpoints of the generalists are distinguished from the specifists according to their formulation of training transfer. Generalists recommend several general and specialized pedagogical principles which give special attention to harmonious, all-round development of the athletes in the process of sports improvement. The essence of this viewpoint is in the principle of unity of general and specialized preparation. Separately, each cannot resolve the problems presented before it. General preparation creates the prerequisites for increasing sports achievements in the specialized area. Note that all-round development of the athlete is determined by the laws of formation and improvement of motor skills. The basic idea of general preparation somehow appears to be realized in the process of sports improvement with a transfer of training from the general to the specialized preparation [18, 153, 212].

In the theory and methods of physical education, it is recommended that coaches use the unity of general and specialized preparation when constructing the multi-year process of sports improvement, as well as during separate cycles (periods) of sports form development. Thus, on the base stage of preparation, which lasts from four to six years, it is believed that with the use of general preparation, it is possible to lay down a full value foundation for future movements, ensure all-round harmonious development of the body, increase the general level of the body's functional capabilities, create a rich fund of differently formed movement skills and abilities, and form beginning basic sports mastery [154]. They believe that the achievement of sports results on a given stage does not influence the next stage or objective. This is realized later on the stage of maximum realization of sports capabilities.

Generalists recommend that cycles of sports form development be broken up into general and specialized preparatory stages, where naturally, a base is created at the beginning with the use of a large number of general preparation means and later, on the stage of

specialized preparation, realization of them. This idea is maintained and used in different ways in constructing cycles of sports form development which can consist not only of two stages, but of three, four, or more.

Of course, striving for harmonious and all-round development of the person as a valuable foundation for future sports results is very commendable and gratifying. In this case, it is used when the task is physical normalization, not achievement of high sports results.

The views of the generalists were formed during the years from 1940-1960. Their views were a major contribution to the understanding of the process of sports improvement. However, with time, it has been shown that the general preparation means create a base, a foundation, only in the training of low level athletes [34, 57, 182]. What is pertinent to an increase in sports mastery of high level athletes is the transfer of training to the competitive event that can take place only with specialized preparation means [34, 57].

With the advent of a greater number of research studies illuminating the specificity of training transfer, those on the side of unity of general and special preparation began to gradually "specialize" the means of general preparation. In so doing, they brought out that the specialization of general preparation allows for fuller use of the positive training transfer effect. The idea behind specializing the means of general preparation led to beginning training with the use of a certain number of specialized-preparatory exercises in the general preparatory stage cycles in the development of sports form. If, at the beginning the correlation between the time spent on general and specialized preparation was expressed in a 3:1 ratio, it later changed in favor of an increased number of specialized preparation means.

An impression is created that by ignoring the idea that it is necessary to specialize general preparation for the sake of more effective use of positive training transfer, many specialists do not want to admit the error of their views. They cover it up with various word combinations or as best as possible, combine opposite meaning terms of "specialized" and "general" preparation to get away from the agony of the dreamed up

principle of the "unity of general and specialized preparation". If we move away from multi-structure, multi-function and multi-system physical exercises, it becomes clear that even in the 1960-1970's, general preparation means were practically not used in the training of athletes having different sports qualifications.

In order to not make unsubstantiated statements we will present several examples. In the training of jumpers and throwers, short distance runs were relegated to general preparation means. But this is a specialized-preparatory exercise, in as much as their execution develops the speed-strength abilities of the leg flexor and extensor muscles that are actively involved in all throws and jumps. Regardless of this, short distance runs are repeated in jumps as they are one of the structural components of the competitive event as for example, in the long jump. Also, in the training of sprinters, jumpers and throwers how is it possible to execute a barbell clean or half squat with the barbell as a means of general preparation if these muscle groups participate in executing the competitive exercise? The discussion here is related to the flexors and extensors of the legs.

Even more surprising is the classification of middle and long distance running which has an aerobic effect, as a means of general preparation. In execution of the workloads coordinated body systems (the nerve-muscle, respiratory, heart-circulatory, and other systems) participate even without taking into consideration running technique.

No matter how we "specialize" the means of general preparation, no one and nowhere in sports practice is it possible to escape the negative effects when there is development of unnecessary muscle groups in one or another sports discipline, especially in speed-strength events. Specialists in the sprints, jumps and throws know that extreme development of speed-strength abilities of the leg flexor muscles shows up negatively on the physical ability of the leg extensors.

This finding is related to the technique of executing the competitive exercise. Also, extreme development of arm strength in the training of a hammer thrower leads to a

decrease in the amplitude of movement of the implement and interferes with the needed consecutive inclusion of the basic body links in the work being done.

The Holistics Viewpoint on the Theory of Training Transfer

According to the holistics, the body appears as a single unit and any internal or external action affects all of it's systems to a certain degree. From here it follows that development of single abilities cannot take place without the involvement of others. In this, their inter-relationships and consequently their inter-effects always exist. On the one hand, a certain exercise has an influence on the development of another or other physical abilities, and on the other hand, ensures the functioning of the entire body as a whole. Thus, it is not possible to agree with the conclusions of the holistics.

However, we are interested in significant research on non-specific reactions by the body systems with which it is possible to influence the development of specific physical abilities of athletes, who specialize in different track and field events or other sports. The discussion here is about the multi-functional properties of specific or other exercises which bring about similar reactions of the blood vessels, heart-circulatory and respiratory systems and allow for an increase in sports results mainly in the cyclic disciplines, beginning with the sprints and ending with middle, long, and super-long distances.

Many studies in the theory and methods of physical education substantiate that on the higher levels, the above named body systems do not function in the same manner in all types of sport. This is especially true where an increase in achievement depends on a definite level of development of speed or specialized endurance. For example, the functional capabilities of the blood vessels, heart-circulatory and respiratory systems can be increased equally well, as for example, in training middle distance runners, with the use of specialized means or by using exercises from other sports (rowing, cycling, swimming, sports games, and so on).

At the present time the positive influence of cyclical sports on increasing the functional capabilities of the body systems is generally acknowledged. However, using other

cyclical sports in cyclical track and field events is limited because of the difficulty of transferring them to the main competitive activity. They also have a negative influence on technique of executing the competitive exercise.

For example, in using exercises from cycling or ice skating in the training of sprinters or middle distance runners, non-specific muscular groups are developed which can then hold back an increase in sports results in the given track and field event. In this case, we come up against both positive and negative transfer of training.

Non-specific reactions of the body systems appear not only in the process of developing endurance with the use of different natural but also with non-natural means, in relation to the sports event. However, the single direction of the vegetative functions is fixed in developing speed [63, 188]. Similar to this is the display of endurance and when using different regimes of muscle work (dynamic and static).

In classic and sports physiology there are many studies that substantiate the fact that in the process of developing conditioned reflex reactions, there arises a hotbed of excitation in certain nerve centers of the brain that can spread out over "close" and "far" areas [15, 47, 119, 170]. In the first, "close" instance, nerve impulses appear as some kind of separate analyzers as for example, the motor analyzer [motor movement area] and spread out. In the second, "far" instance, there is inter-analyzational displacement.

It is completely natural that active "close" and "far" areas, which appear as a consequence of a generalized distribution or spread of the excitatory-inhibitory impulses, appear in a definite form to improve the functional ability of a body system due to non-specific adaptational changes.

Knowing the regularity of the "breaks" in activeness in the working nerve centers on the non-working areas can explain many questions about the transfer of training in the speed-strength events in track and field and other sports. Their expression will be accompanied

with great changes in the understanding of the principles not only of training transfer, but the very method of training. All of this is in the future.

Now, we should take note of a major deficiency in the theory of the holistics in that they indirectly call for the use of one method of training for increasing the functional capabilities of the blood vessels, cardio-vascular and respiratory systems, in order to get corresponding adaptational changes in the neuro-muscular system. This leads to disharmony, as the athlete enters the highest training state in non-specific exercises at the start and only after this, after several weeks, enters a state of sports form in the specific exercises. It would be possible to ignore this if the functional levels achieved in non-specific exercises were maintained while the athlete was still achieving corresponding increases in his physical preparation in the specific training means. However, the level of trainedness decreases long before entering the state of sports form in the specialized exercises.

In the track and field jumps and throws and likewise in the hurdles, there is agreement with the holistics that is necessary to first develop the physical capabilities and only after this, perfect technical mastery. Thus the "block" method of constructing cycles of sports form development oversees the separate preparatory periods in the blocks of physical and technical preparation [49]. Those in agreement with this concept do not believe that simultaneously introducing means of technical preparation into the training process develops the physical abilities together with improvement of technique.

In these instances, there is a theoretical and practical error working at the base of the artificial division of form and content since they are united in all of their displays. In the theory and methods of physical education this unity is expressed in the principle of conjugated training effects. This was proposed in the 1960's by head coach and scientist V.M. Dyachkov [81]. The essence of this method will be looked at further on since it provides answers to many questions that require a straight forward understanding of the training transfer process.

The Principle of Conjugated Training Effects

The use of training means for developing physical abilities and improving technical mastery is in accord with this principle. These two factors should coincide and correspond to the competitive exercise according to their basic characteristics. Later on, this principle was modified by other specialists who called it dynamic correspondence and the principle of resolving motor actions. [157]. According to U.V. Menkhin [157] the conjugate principle should affect not only the competitive event, but all the specialized activity as a whole.

Using the sport of gymnastics as an example, Menkhin showed that the best form of conjugation appears when the physical preparation ensures five main components of preparation for technical improvement or for learning technique:

- Development of the motor qualities that are necessary for a specific activity that is sufficiently localized in the muscle groups;
- A high level of motor qualities that define the demands of the biodynamic structure of gymnastic elements;
- Suitability for realizing the motor potential in the most common forms of motor activity, that characterize the potential physical preparation needed for mastering technique;
- Suitability for fulfilling long duration work in specific events in all-round competition that guarantees the gymnasts motor activity reliability [repeat ability];
- Suitability for realizing the motor potential in competitive combinations [routines] which is the main objective of the gymnast.

We will not purposely end on the main components proposed by U.V. Menkhin in gymnastics as we believe that it can be used in the technical disciplines of track and field.

The conjugate principle of training effects was used by us in working out the principle of all-round specialized preparation [265]. Over many years, it envisioned sports improvement through the use of primarily specialized preparation means. General preparation means were used to a lesser extent and only for general warm ups and during the time of using restorative measures. Special-preparatory and special-developmental exercises create the "base", "the foundation", for improving sports results in a competitive event on each level in the cycle of developing sports form that produced the greatest sports improvement.

The number of special-preparatory and special-developmental exercises used in each consecutive cycle (period) of developing sports form depends on the tasks to be accomplished. They should be sufficient for resolution of the tasks. Here, the transfer effect depends not only on the number of special-preparatory and special-developmental exercises used, but on their "newness" and the strength of their effect which should be greater in each consecutive cycle of sports form development. This makes it possible to achieve a new level of adaptation, which serves to increase the sports result and naturally, the transfer of training.

Types of Training Transfer

There are three types of training transfer: positive, negative, and neutral. In the specialized literature it is also possible to find "indifferent" transfer.

Positive transfer of training means that there is a positive effect of one exercise on another. In other words, with an increase in the sports result in one exercise, a parallel increase takes place in another exercise.

In *negative transfer of training* there is always a negative interaction between the exercises being used. Here, with increased preparation in one exercise, there is a simultaneous decrease in other exercises.

In *neutral transfer of training* there is no increase or decrease in sports achievement. The training does not show any affect on another training.

In addition to these three noted forms of training transfer we more rarely meet with indifferent transfer. This is especially so when training high level athletes who use a whole complex of different exercises, and depends on their coordination structure and strength of their influence. At the present time, the interrelationships between the exercises are complex and unpredictable, and they may have a double effect on one another. For example, there may be a positive affect on increasing the functional capabilities of the body systems and a negative effect on the technique an exercise [92]. In track and field, there is a noticeable worsening of technique in some throws with the use of heavier implements [18, 152]. In these cases, with an increase in strength, there is a negative change in the process of executing separate elements as well the entire movement as a whole [152].

The double effect of certain exercises on others (indifferent transfer) is most frequently explained by the use of exercises which, from the beginning, interfere with the unity between form and content. Examples of indifferent transfer can be in the systems of

training as for example, by athletes specializing in different walking events. Included here is the use of a high volume of aerobic and anaerobic running for long periods of time, as in the general preparatory stage. In this training there is a noted improvement in the functional abilities of the heart-circulatory, respiratory and blood vessel systems and a worsening of walking technique [94].

There are similar inter-effects that come up in other sports. In walking it is possible to get away from the negative influence by using mainly specialized-developmental and competitive exercises. In certain running events, hurdles and throws, it is possible to maneuver between "good" and "poor" in selecting exercises, so that there would be more good ones rather than poor ones. This makes it possible to eliminate the negative influence on technique in several weekly cycles.

Transfer Factors

The theory of training transfer oversees the study of many carry-over factors, beginning with the interaction between separate exercises and physical abilities to their mutual influence in simple or complex movements. We will address some of these basic carry-over factors. Foremost is the transfer of physical abilities and motor skills when using different, according to form and content, means of training. First is the influence of general developmental exercises on specialized-preparatory, specialized-developmental, or competitive exercises. Second, is the effect of specialized-preparatory exercises on specialized-developmental and competitive exercises. Third are training questions on the effect of specialized-developmental exercises on the competitive event.

Thus it is necessary to know how the general-preparatory, specialized-preparatory and specialized-developmental exercises have an effect on the competitive exercise and which form of the latter exercises has an influence on the general-preparatory, specialized-preparatory and specialized-developmental exercises.

The transfer of training, within the limits of one exercise, is basically the same when using simple or complex (according to their coordinational structure) exercises. For example, training the leg extensor muscles at one joint angle has a positive effect on strength in other joint angles [95]. We come up with similar effects in the process of using the bench press, the angle of the body and others. In the training of throwers, when using the entire throw, we simultaneously get an increase in sports results when throwing from place. In training long jumpers, when using jumps with a full or short run up, there is a positive effect on the development of speed in the 30 or 60 meter run.

Throwing, as for example the standard weight in any track and field throw event, can have a positive or negative influence on results when throwing a lighter or heavier weight (implement).

Transfer of training is also realized within the confines of whole motor actions. The specific system of training, as for example, with 800 meter runners, has an effect on results in the 400 and 1500 meter runs.

In the theory and methods of physical education, there are many studies devoted to learning about the influence of single physical capabilities (strength, speed, endurance), acquired in certain motor actions on other actions [40, 91, 92, 94, 124]. Looked at were the inter-influences of differently composed identical or other physical abilities. Thus in development of strength, what kinds of physical exercises and muscle work regimes serve to develop absolute strength, speed-strength, or explosive muscle properties and likewise strength endurance. In the track and field sprints, in studying speed development, specialists are interested in the influence of these or other means of training for developing simple and complex motor reactions, speed and special endurance.

In studying endurance, the mutual relationship not only between specific physical qualities such as general and speed endurance are looked at, but also factors such as the energy that ensures work, functional power, functional economy (maximum utilization of oxygen--max O2 uptake--during the time of work, the time limits possible when working at maximum oxygen uptake, anaerobic threshold--AT, concentration of lactic acid and oxygen debt).

The Mechanisms of Training Transfer

In dealing with construction of sports form development cycles, specialists are in agreement that the level of physical, technical, psychological and other abilities, as well as definite functional results in each of the previous stages, the training block, should create the "base", "foundation" for increasing sports achievements in the following exercises to be used. However, none of the specialists make note of when and how the earlier achieved level is transferred. In one case, transfer can take place at the beginning, middle or end of each following stage or block. In the second case, there is no explanation of the essence of these changes. It is known that transfer can influence the time of entering into the state of sports form as well as the beginning and ending level of results in the training used over the duration of the following stages, blocks.

It is not necessary to be reminded of what takes place with the achieved level of results from the end of each previous stage, block, to the middle or end of each of the following stages. Know that it can remain unchanged, be decreased or increased.

Explaining these problems, which are organically tied in with one another, has major significance. Without knowing the mechanisms of training transfer on the duration of each consecutive stage, block, our actions can be in error in selecting the system of exercises to be used in relation to the means of constructing the cycles of sports form development.

In sports practice, one can encounter three different situations depending upon which, the use of an effective system of exercises for the duration of the following stages, blocks is based.

The first situation—the transfer of the achieved level of results at the end of each previous stage, block, takes place at the beginning of each following stage, block. In this case we are not interested in what takes place with the achieved level of sports results at the end of the previous stage, block. It can decrease, increase or remain unchanged by

fulfilling its role in creating the "base", "foundation" for the means of training used over the duration of each of the following stages. If this is so, then the earlier used exercises can be excluded from the training process.

The second situation—is distinguished from the first by the fact that *the transfer of training can take place in the middle of each following stage, block.* In this case, we are not indifferent to the level of results achieved. Its decrease is not allowed or the effect of the transfer will be absent or it will not reach the maximum amounts possible. Consequently, for the duration of the following stages, blocks, we should use a system of exercises that allows us to maintain the earlier achieved level of sports results at the end of the previous stages, blocks, and to experience an increase in those exercises which are used during the following stages.

The third situation—occurs if the process of training transfer takes place at the end of each of the following stages, blocks. In this case, it is necessary to maintain the achieved level of sports achievement at the end of each stage, block.

Up to this time, only one method of maintaining the achieved levels of sports results is known. It is a schematic in which the exercises are used for the duration of a specific segment of time. Thus, in using *the complex stage method* of constructing cycles of sports form development (Figure 1), we should not exclude general preparation means for the duration of the specialized preparation stages. Instead we should carry out the schematic at the beginning and in the middle using the exercises with significantly less volume.

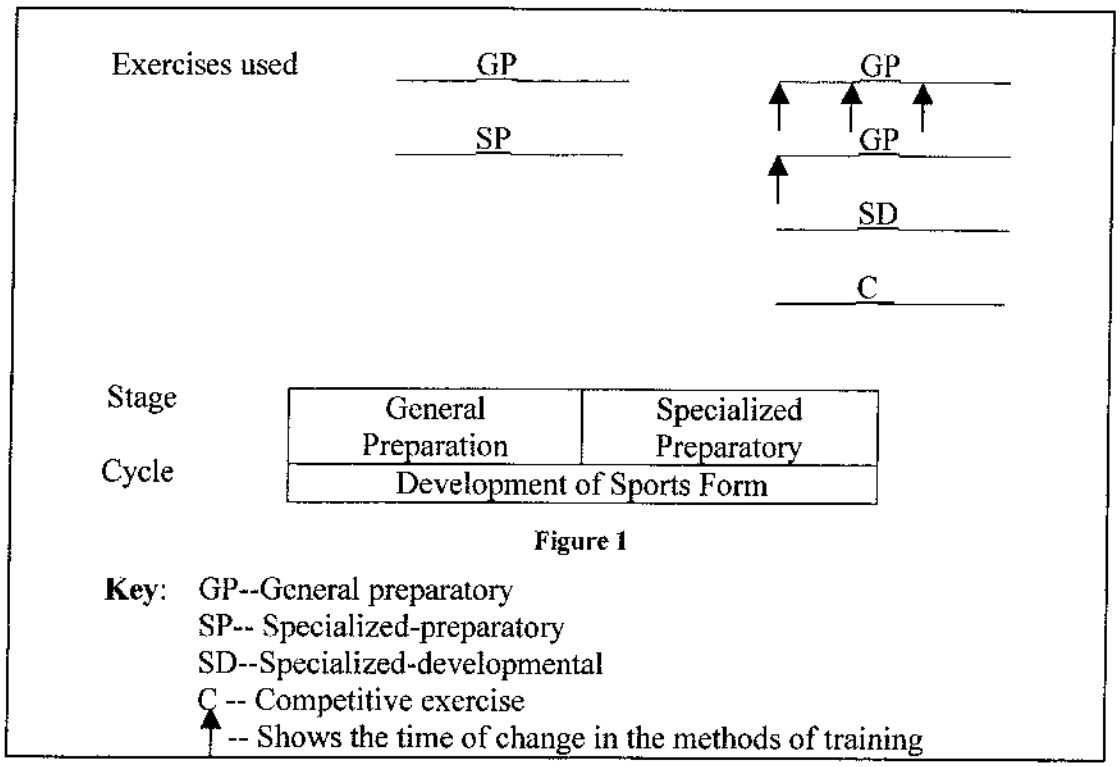

Figure 1: System of exercises that allows for maintaining the level of results in the general preparatory exercises toward the end of the development of the sports form cycle with use of the stage-complex method of construction.

In studying the mechanisms of training transfer when using stages, blocks, combinations, variants and complex methods of constructing sports form development cycles, we came to the conclusion that the transfer of the achieved level of physical and other capabilities at the end of each of the previous stage, block, takes place not at the beginning, middle or end of each of the following stages, blocks, but over the duration of them. It serves to establish a new level of adaptation in the means of training used for the duration of the following stages, blocks.

Here it becomes clear that the transfer of training can occur only in those situations in which, over the duration of the entire stages, blocks, a succession is observed in the methods of training used. The exercises used appear to be those that over the duration of the previous stages, blocks, lengthen or shorten the time of entering into a state of sports form in the competitive exercise (event). These are mainly specialized-developmental

exercises. If a succession in the use of the exercises does not exist, then transfer is not observed. It can exist only in situations where these exercises are used simultaneously with specialized-developmental and competitive exercises. Here general preparatory and specialized-preparatory exercises can have an indirect influence that accounts for the mechanisms of dispersing the activity onto the "neighbors".

It was also noted that excluding specialized-developmental and competitive exercises for the duration as for example, the third or fourth stage, block, lasting more than 3-4 weeks with use of the variational method of constructing the development of sports form cycles, it leads to a loss in the achieved level of physical and other abilities.

The Dependence of Training Transfer on the Duration of Different Stages, Blocks of Sports Form Development Cycles

At the present time, after the regularities regarding development, maintenance and lose of sports form have been studied, it becomes clear that the duration of the stages, blocks, of sports form development cycles, as proposed by various authors, can serve to reveal the mechanisms of training transfer, or to create conditions that do not allow for transfer. In the latter instance, we have in mind situations in which the idea of creating the "base", "foundation", remains only an idea. The reason for this is that the work carried out in each of the previous stages, blocks, does not show an influence on increasing achievements in the training used over the duration of each successive stage.

In life the idea is realized only when at the end of each previous stage, block, the athlete resolves the tasks put before him that allows him to enter the state of sports form in the training that is used for the duration of the work. For this to happen it is necessary that the duration of the stages, blocks, correspond to the duration of the cycles of sports form development for each individual athlete. From the literature it is known that most frequently, athletes, after the period of rest (transitional period), enter into the state of sports form over 2-3 months. But there are also athletes whose individual cycles of sports form development take 4-7 and even 8 months.

Practically, only when using the same yearly cycles of training with the duration of the general preparatory stage on the average, three months, athletes who enter the state of sports form in the exercises used over 2-3 months, can realize creation of a "base", "foundation", for the training used during specialized preparation stage. When using two and three cycles in the yearly cycle of training, the athletes, at the end of the general preparation stages, do not have time to enter into full sports form in the exercises used. We remind the reader that when using the two cycle schematic of the yearly cycle, the

duration of the second stage of general preparation (the second preparatory period) varies from 4-6 weeks, and in the three cycle plan, it is even less—2-3 weeks.

For example, we will look at one of the schematics of constructing the sports form development cycle used by a group of sprinters and hurdlers. This schematic oversees the following alternation of stages: 1) development of general endurance—2) development of general strength—3) development of speed and speed endurance— and 4) entry into the state of sports form. The duration of the first stage is ten days, second, 15 days, third, 6-8 weeks and the fourth, 2-3 weeks.

Practically, because of such short periods of time (10-15days) it is impossible to resolve, the tasks of developing general endurance and general strength. At the present time, not knowing the regularities for shortening the limits of entering into the state of sports form, in 10-15 days it is possible to resolve only the task of preparing the body for the forthcoming work in the speed and speed endurance development stage. The stages of developing general endurance and general strength should be called "followers" (tag alongs) but in no way "developmental", capable of creating the "base", "foundation", for the means of training used during the following stage.

Note that when using this construction scheme for the development of sports form cycles, the athletes enter into this state at the end of the fourth stage. The reason for this is that sports form begins to develop at the beginning of the stage of speed and speed endurance development.

Consequently, it is possible to conclude that only when using stages, blocks, stage-variants and block-variant means of constructing cycles of sports form development, that we can in reality, resolve the task of creating a "base" "foundation", over the duration of the first stages, blocks. Achieved at the end of these stages or blocks, the level of sports results can be realized only at the end of the following stages or blocks.

The practical discussion here is of the presence of long term transfer of training, that is beginning with the duration of the stages of general preparation or blocks of physical preparation, we create the "base", "foundation" and achieve the planned for level of sports results in the exercises being used. Only later do we address the development of sports form in the specialized-preparatory, specialized-developmental and competitive exercises, believing that it will serve to increase achievement in the specific sports event.

With this logic it follows that an increase in sports results at the moment of entering into the state of sports form in the competitive exercise (event) takes place because of the level achieved with general preparation means. Specialized-preparatory, specialized-developmental and competitive exercises in this case fulfill a secondary role, only for entry into the state of sports form.

It is possible to go along with this presentation if the concept of general and specialized preparation unity is upheld in the future and if the created "base", "foundation" during each of the previous stages, blocks, shows a positive influence on increasing the level of achievement in the training used during the following trainings. In this case, it can be said that the means of general and specialized preparation, or the physical and technical preparation exercises, used during the stages of specialized preparation and blocks of technical preparation, have a specific relationship to one another. They have a mutual influence on increasing sports results at the moment of entering the state of sports form.

When using other schematics of constructing sports form cycles in which the training means are set up for 1-2 or 2-3 weeks, the transfer of training, due to the created "base", "foundation", cannot be practically realized. It is possible only when there is a succession in the exercises used over the entire cycle of sports form development that is, over the duration of all the cycles, stages, put together in a specific conformity to general and specialized preparation means. The portion of general and specialized exercises can change from stage to stage, but they must be used in each of them. In such cycle construction, the athletes can simultaneously enter into the state of sports form in the general developmental, specialized-preparatory, specialized-developmental and

competitive exercises. As a result, there will be a definite level of sports achievement attained at the end of the last stage.

We call this view of training transfer, current (flowing), not distant. It is most frequently observed when using the variational, combinational, complex and also some mixed means of constructing development of sports form cycles.

Current transfer of training is observed on stages of general preparation and in blocks of physical preparation when using the stage and block methods of constructing cycles of sports form development. The exercises used have an effect on one another and serve to achieve a definite level of sports results at the end of their use.

Such an understanding of training transfer is also seen when using the complex method of constructing cycles of sports form development. Here, the level of sports form is determined by the complex of exercises that are used in the given cycles of sports form development.

Model Characteristics of the Preparation of Athletes Having Different Sports Qualifications

In the 1970's the "something" that created the "base", "foundation" of which we spoke earlier, began to acquire "some kind of" content. Its essence was expressed in the athlete's definite level of physical preparation achieved at the end of the general preparation phase.

Such an understanding of the mechanisms of training transfer came from the presentations of L.P. Matveev on the concept of general and specialized preparation unity. At that time, it was considered the base preparatory principle of sports training in the Soviet scientific school of thought. The inseparability of general and specialized preparation, as one of the important and necessary sides in the process of sports training, was fully inculcated in the stage method of constructing cycles of sports form development.

With changes in the ways of looking at the system of using exercises during the general preparatory stages of sports form development cycles, there was a natural change in the means of training used in the stages of general preparation. At the beginning, specialists worked out model characteristics as the basis for general preparation (general preparatory exercises). As other methods of constructing preparatory periods were introduced into practice they began to appear in the means of specialized preparation. Several of them, having a direct relationship to training in most disciplines of track and field, are presented in tables 1-34.

TABLE 1

Model characteristics of the Competitive Activity of 100m Runners [52]

Distance segments, m	Results in the 100m run, sec.				
	10.00-10.20	10.20-10.40	10.40-10.60	10.60-10.80	10.80-11.00
10	1.90-1.95	1.95-2.00	2.00-2.05	2.05-2.10	2.10-2.20
20	2.95-3.00	3.00-3.05	3.05-3.10	3.10-3.20	3.20-3.30
30	3.90-4.00	3.95-4.05	4.05-4.10	4.10-4.20	4.20-4.30
40	4.80-4.90	4.85-4.95	4.90-5.00	5.00-5.10	5.10-5.20
50	5.70-5.80	5.70-5.80	5.80-5.90	5.90-6.00	6.00-6.10
60	6.55-6.65	6.60-6.75	6.75-6.85	6.85-6.95	6.95-7.05
80	8.30-8.40	8.40-8.50	8.50-8.60	8.60-8.70	8.70-8.80
30-60	2.60-2.70	2.65-2.75	2.75-2.80	2.80-2.90	2.90-3.00
60-80	4.40-4.50	4.45-4.55	4.45-4.65	4.65-4.75	4.75-4.90
50-100	4.30-4.40	4.50-4.60	4.60-4.70	4.70-4.80	4.80-4.90
80-100	1.70-1.80	1.80-1.90	1.90-2.00	2.00-2.10	2.10-2.20

TABLE 2

Model Characteristics of Speed-Strength Preparation of 100m Runners [52]

Exercise	Sports Results in the 100m run, sec.				
	10.00-10.20	10.20-10.40	10.40-10.60	10.60-10.80	10.80-11.00
Standing Long Jump, m	3.10-3.30	3.00-3.20	2.90-3.10	2.80-3.00	2.70-2.90
Triple jump from place, m	9.50-10.00	9.50-10.00	9.20-9.60	9.00-9.20	8.60-9.00
5-fold jump from place, m	16.50-17.50	16.00-17.00	15.50-16.50	15.50-16.00	15.00-15.50
10-fold jump from place, m	35.00-36.00	35.00-36.00	34.00-35.00	33.00-34.00	33.00-34.00
Jumps on one leg for 30m, sec.	4.0-4.1	4.0-4.2	4.2-4.3	4.3-4.4	4.4-4.6
Jumps from leg to leg 30m, sec.	3.8-3.9	3.9-4.0	4.0-4.1	4.1-4.3	4.3-4.5
Jumps from leg to leg 50m, sec.	5.8-5.9	5.9-6.0	6.0-6.2	6.2-6.4	6.4-6.6

TABLE 3

Model Characteristics of Speed Preparation of 100m Runners of Various Qualifications [52]

Exercise	Results in the 100m run, sec.				
	10.00-10.20	10.20-10.40	10.40-10.60	10.60-10.80	10.80-11.00
30m run with a flying start, sec.	2.60-2.70	2.70-2.80	2.80-2.90	2.90-3.00	3.00-3.10
30m run with a start, sec.	3.80-3.90	3.90-4.00	4.00-4.10	4.10-4.20	4.20-4.30
40m run from a start, sec.	4.80-4.90	4.85-4.95	4.95-5.05	5.05-5.15	5.15-5.25
50m run with a start, sec.	5.70-5.80	5.75-5.85	5.85-5.95	5.90-6.00	6.00-6.10
60m run with a start, sec.	6.55-6.65	6.65-6.70	6.70-6.80	6.80-6.90	6.90-7.00
70m run with a flying start, sec.	6.20-6.30	6.30-6.40	6.40-6.50	6.50-6.60	6.60-6.70
80m run with a start, sec.	8.35-8.45	8.40-8.50	8.50-8.70	8.70-8.90	8.90-9.10
60m run with a flying start, sec.	4.40-4.50	4.50-4.60	4.60-4.70	4.70-4.80	4.80-5.00

TABLE 4

Model Characteristics of the Competitive Activity of 200m Runners [52]

Distance segments, m	Result in the 200m run, sec.				
	20.00-20.40	20.40-20.80	20.80-21.20	21.20-21.60	21.60-22.00
50	5.90-6.00	6.00-6.10	6.10-6.20	6.10-6.20	6.20-6.30
100	10.50-10.60	10.60-10.70	10.70-10.80	10.80-11.00	11.00-11.20
50-100	4.60-4.70	4.60-4.70	4.70-4.80	4.70-4.80	4.80-4.90
100-150	4.60-4.70	4.70-4.80	4.80-5.00	5.00-5.10	5.10-5.20
150	15.10-15.40	15.40-15.60	15.60-15.80	15.80-16.00	16.00-16.40
150-200	5.00-5.10	5.10-5.30	5.30-5.40	5.40-5.50	5.50-5.60
100-200	9.60-9.80	9.80-10.10	10.10-10.40	10.40-10.60	10.60-10.80
100(1)-100(2), sec*	0.60-0.90	0.50-0.80	0.40-0.70	0.20-0.40	0.20-0.40

*The difference in time of running the first and second halves of the 200m distance.

TABLE 5
Model Characteristics of Speed Preparation of 200m Runners of Various Qualifications [52]

Exercise	Results in the 200m run, sec.				
	20.00-20.40	20.40-20.80	20.80-21.20	21.20-21.60	21.60-22.00
30m run from a flying start, sec.	2.70-2.80	2.75-2.85	2.85-2.95	2.95-3.00	3.00-3.10
30m run with a start, sec.	3.90-4.00	4.00-4.10	4.10-4.20	4.15-4.25	4.25-4.35
50m run with a start, sec.	5.90-6.00	6.00-6.10	6.10-6.20	6.20-6.30	6.30-6.40
60m run with a start, sec.	6.70-6.80	6.80-6.90	6.90-7.00	7.00-7.10	7.00-7.20
70m run from a flying start, sec.	6.20-6.30	6.30-6.40	6.40-6.50	6.50-6.60	6.60-6.80
80m run with a start, sec.	8.40-8.50	8.50-8.60	8.60-8.80	8.80-9.00	9.00-9.20
100m run with a start, sec.	10.10-10.30	10.30-10.50	10.50-10.70	10.70-10.90	10.90-11.10
Maximum running speed, m sec^{-1}	10.9-10.7	10.7-10.4	10.4-10.1	10.1-9.8	9.8-9.5

TABLE 6
Model Characteristics for Women 100m Hurdle Runners [74]

Exercise	Result
100m hurdle run, sec.	12.40-12.45
Results after the 2^{nd} hurdle, sec.	3.52-3.54
Results between the 3^{rd} and 8^{th} hurdle, sec.	0.95-0.96
Result after the 10^{th} hurdle, sec.	11.35-11.38
30m run from a low start, sec.	4.18-4.20
30m run from a flying start, sec.	3.15-3.17
150m run with a high start (hand time), sec.	16.20-16.40
Triple jump from place, m	8.40-8.60
10 fold jump from place, m	29.50-30.00
Throwing the shot (4kg) forward, m	15.50-16.00

TABLE 7

Relationship between Results in the 400m Run (Men and Women) from the Level of Sports Achievements in the 100 and 200m Runs with a Low Start [75]

Exercise	Results, sec.							
Men								
400m run	43.5-45.0	45.1-46.0	46.1-47.0	47.1-48.0	48.1-49.0	49.1-50.0	50.1-52.0	52.1-54.0
100m run	10.2-10.4	10.4-10.5	10.5-10.7	10.7-10.9	10.9-11.1	11.2-11.3	11.3-11.4	11.4-11.5
200m run	20.0-20.6	20.7-21.3	21.3-21.5	21.5-21.8	21.8-22.2	22.3-22.6	22.6-23.3	23.4-24.0
Women								
400m run	47.5-48.5	48.6-49.6	49.7-51.0	51.1-52.0	52.1-53.0	53.1-54.5	54.6-56.0	56.1-57.5
100m run	10.8-11.2	11.2-11.4	11.4-11.6	11.6-11.7	11.7-11.8	11.8-12.1	12.1-12.3	12.4-12.7
200m run	21.7-22.5	22.6-22.9	23.0-23.4	23.4-23.8	23.8-24.2	24.2-24.6	24.6-25.0	25.0-25.5

TABLE 8

Several Individual Indices of Preparation of Men and Women Runners in the 400m Run [75], Sec.

Athletes	Result in the run for		Repeated results in the 200m	Results in the 400m	The difference between the repeated results in the 200 and 400m run	Speed Reserve
	100m	200m				
Men						
L. Evans	10.2	20.3	40.6	43.86	3.26	0.765
B. Cameroon	10.4	20.74	41.48	44.58	3.1	0.745
T. Smith	10.2	19.9	39.8	44.1	4.3	0.825
D. Smith	10.3	20.6	41.2	44.5	3.3	0.825
T. Lewis	10.5	21.0	42.0	45.2	3.2	0.800
V. Markin	10.4	21.1	42.2	44.60	2.4	0.750
A. Juanterena	10.4	21.1	42.2	44.26	2.06	0.665
M. Larabee	10.5	20.6	41.2	44.9	3.7	0.725
M. Connelly	10.4	20.9	41.8	45.9	4.1	1.075
D. Carr	10.4	21.0	42.0	46.2	4.2	1.150
D. Istmen	10.5	21.2	42.4	46.4	4.0	1.100
T. Tomov	10.7	21.30	42.60	45.86	3.26	0.765
N. Popov	10.7	21.60	43.20	46.65	3.45	0.960
M. Kharizanov	10.88	21.19	42.38	45.92	3.54	0.600
E. Velchev	10.8	21.5	43.0	47.3	4.3	1.025
D. Rangelov	---	21.28	42.56	45.91	3.35	---
Women						
M. Cox	10.83	21.71	43.42	47.60	4.18	1.070
O. Vladikina	11.20	22.46	44.96	48.27	3.31	0.867
L. Muller	11.00	22.14	44.28	49.79	5.51	1.447
R. Stamenova	11.3	23.64	47.28	50.82	3.54	1.405
L. Tomova	11.27	23.17	46.34	51.27	4.53	1.547
I. Venkova	12.2	24.1	48.2	50.82	2.8	0.550
P. Pavlova	11.30	22.68	45.36	51.40	6.04	1.550
S. Damyanova	11.92	23.90	47.80	51.63	3.83	0.987

TABLE 9

Some Individual Indices of Preparation of 400m Hurdle Runners [41]

Athlete	Results				Sec.
	100m	200m	400m	400m hurdle run	
S. Morale	10.6	21.4	47.6	49.2	1.6
V. Skomarokhov	10.6	21.6	47.4	49.1	1.7
H. Yantse	10.6	21.6	47.8	49.9	2.1
V. Anisimov	10.6	21.5	47.3	49.5	2.2
I. Kushmen	10.4	20.9	47.4	49.6	2.2
R. Howard	10.5	21.3	47.5	49.7	2.2

TABLE 10

Model Characteristics of the Level of Preparation of 400m Runners Having Different Ages over the Duration of the 1st Preparatory Period [75]

Exercise	Stage of General Preparation			Stage of Specialized Preparation		
	15-16	17-18	19 & older	15-16	17-18	19 & older
30m run from a low start, sec.	---	---	---	4.6-4.5	4.4-4.2	4.1-4.0
30m run with a flying start, sec.	---	---	---	3.6-3.4	3.4-3.2	3.1-3.0
300m run with a high start, sec.	45.5-41.5	41.0-40.0	37.0-36.0	43.5-39.5	39.5-38.5	35.7-34.5
600m run with a high start, sec.	1:39.0-1:35.0	1:33.0-1:31.0	1:28.5-1:27.5	1:38.0-1:33.0	1:32.5-1:29.0	1:23.0-1:21.5
Triple jump from place, m.	7.40-7.50	7.70-7.90	8.10-8.90	7.50-7.60	7.80-8.10	8.30-9.00
10-fold jump from place, m	23-24	25-27	28-29	24-25	25-28	29-30

TABLE 11

Model Characteristics of the Level of Preparation of 400m Runners of Different Ages during the 2nd Preparatory Period [75]

Exercise	Stage of General Preparation			Stage of Specialized Preparation		
	15-16	17-18	19 & older	15-16	17-18	19 & older
30m run from a low start, sec.	---	---	---	4.5-4.4	4.3-4.0	4.0-3.9
30m run with a flying start, sec.	---	---	---	3.5-3.3	3.2-3.1	3.0-2.9
300m run with a high start, sec.	42.0-40.5	38.5-36.5	35.5-34.0	41.0-38.5	37.7-35.7	33.8-32.8
600m run with a high start, sec.	1.36.0-1.34.0	1.30.0-1.26.0	1.24.5-1.23.0	1.33.0-1.30.0	1.29.0-1.24.0	1.19.5-1.17.5
Triple jump from place, m.	7.40-7.70	7.60-8.10	8.40-8.90	7.50-7.80	7.90-8.40	8.50-9.10
10-fold jump from place, m	24-25	27-29	30-31	25-27	28-30	31-32

TABLE 12

Model Characteristics of the Level of Preparation of 400m Runners of Different Ages during the 1st and 2nd Competitive Period [75]

Exercise	1st Period			2nd Period		
	15-16	17-18	19 & older	15-16	17-18	19 & older
30m run from a low start, sec.	4.5-4.4	4.3-4.0	4.0-3.9	4.4-4.3	4.3-3.9	3.9-3.8
30m run with a flying start, sec.	3.5-3.3	3.3-3.1	3.0-2.9	2.4-3.1	3.2-2.9	2.9-2.7
300m run with a high start, sec.	42.0-38.7	38.5-37.0	34.0-33.0	40.5-37.5	37.5-35.4	33.5-32.5
600m run with a high start, sec.	1.35.0-1.31.0	1.30.0-1.26.0	1.20.0-1.18.5	1.32.5-1.28.0	1.28.0-1.23.0	1.18.5-1.16.5
Triple jump from place, m.	7.50-7.70	7.80-8.20	8.40-9.00	7.50-7.80	7.90-8.50	8.80-9.30
10-fold jump from place, m	24-26	27-29	30-31	26-28	29-31	31-32
400m run, sec.	51.5-55.5	52.5-51.5	47.5-47.0	54.5-50.8	50.58-47.8	46.5-45.5

TABLE 13

Model Characteristics of the Level of Preparation of Women of Different Ages in the 400m Run During the First Preparatory Period [75]

Exercise	Stage of General Preparation			Stage of Specialized Preparation		
	15-16 years	17-18 years	19 & older	15-16 years	17-18 years	19 & older
30m run from a low start, sec.	---	---	---	4.9-4.7	4.7-4.6	4.5-4.4
30m run from a flying start, sec.	---	---	---	3.8-3.7	3.6-3.4	3.3-3.2
300m run with a high start, sec.	46.5-45.5	44.5-44.0	39.5-38.5	45.5-44.0	43.5-38.5	38.0-37.0
600m run with a high start, sec.	1.55.0-1.51.0	1.49.0-1.39.0	1.36.0-1.34.0	1.51.5-1.48.0	1.46.0-1.38.0	1.33.0-1.31.0
Triple jump from place, m.	6.70-6.80	7.00-7.10	7.40-7.50	6.80-7.00	7.10-7.40	7.60-7.70
10-fold jump from place, m	21-22	23-25	26-27	22-24	25-27	28-29

TABLE 14

Model Characteristics of the Level of Preparation of Women of Different Ages in the 400m Run During the Second Preparatory Period [75]

Exercise	Stage of General Preparation			Stage of Specialized Preparation		
	15-16 years	17-18 years	19 & older	15-16 years	17-18 years	19 & older
30m run from a low start, sec.	---	---	---	4.8-4.6	4.6-4.5	4.4-4.3
30m run from a flying start, sec.	---	---	---	3.7-3.6	3.5-3.3	3.2-3.1
300m run with a high start, sec.	45.5-43.5	43.5-40.5	38.5-37.5	44.2-42.2	42.2-39.0	37.0-36.0
600m run with a high start, sec.	1.51.0-1.46.0	1.44.5-1.35.5	1.50.0-1.29.5	1.50.0-1.44.5	1.43.5-1.34.5	1.31.0-1.27.5
Triple jump from place, m.	6.70-7.00	7.10-7.40	7.50-7.60	7.00-7.50	7.30-7.70	7.70-7.80
Ten-fold jump from place, m.	21-23	24-26	27-28	23-25	26-28	29-30

TABLE 15

Model Characteristics of the Level of Preparation of Women of Different Ages in the 400m Run During the First and Second Competitive Periods [75]

Exercise	First Period			Second Period		
	15-16 years	17-18 years	Older than 19	15-16 years	17-18 years	Older than 19
30m run from a low start, sec.	4.7-4.6	4.6-4.5	4.4-4.3	4.6-4.4	4.4-4.3	4.3-4.2
30m run from a flying start, sec.	3.7-3.6	3.4-3.3	3.2-3.1	3.5-3.3	3.3-3.2	3.2-3.1
300m run with a high start, sec.	44.0-42.0	42.0-39.0	37.0-36.0	43.5-41.5	41.5-38.5	36.0-35.0
600m run with a high start, sec.	1.49.0-1.45.0	1.43.0-1.33.0	1.31.5-1.28.0	1.48.0-1.42.0	1.41.0-1.33.0	1.30.0-1.26.5
Triple jump from place, m	6.80-7.00	7.00-7.40	7.50-7.70	7.00-7.30	7.40-7.70	7.70-7.90
Ten-fold jump from place, m	22-23	25-26	28-29	23-24	26-27	28-30
400m run, sec.	60.0-57.0	56.0-55.0	53.0-52.0	58.5-55.5	55.0-53.0	50.5-49.5

TABLE 16

Model Characteristics of Specialized Physical Preparation of Athletes Specializing in the Shot put [18]

Exercise	Result	
	Men	Women
8kg shot put throw, m	21.50	---
6kg shot put throw, m	25.50	18.50
5kg shot put throw, m	26.00	---
4kg shot put throw, from place, m	---	20.50
8kg shot put throw, m	---	25.00

TABLE 17

Model Characteristic of General Physical Preparation of High Level Athletes Specializing in the Shot put [18]

Exercises	Result	
	Men	Women
Standing Long Jump, m	3.40-3.60	2.90-3.10
Triple jump from place, m	10.00-10.50	8.50-8.60
Vertical jump, cm	95-100	85-90
20m run from a flying start, sec.	3.1-3.2	3.4-3.5
Power clean, kg	180-190	110-120
Throwing the shot backwards, m (Men—7.260kg, Women—4 kg)	21.50-22.50	21.50-22.50
Squat with a barbell, kg	270-280	180-190
Bench press, kg	240-260	140-160
Barbell snatch, kg	135-140	100-105

TABLE 18

Model Characteristics of Specialized Physical Preparation of Discus Throwers [18]

Exercises	Result	
	Men	Women
Throwing a 2.5 kg disc, m	60.00	---
Throwing a 1.5 kg disc, m	77.00	62.00
Throwing a 1 kg disc from place, m	---	62-64
Throwing a 0.75 kg disc, m	---	80-82
Throwing a 3 kg shot, m	45.00	30.00

TABLE 19

Model Characteristic of General Physical Preparation of High Level Athletes Specializing in the Discus [18]

Exercises	Result	
	Men	Women
Standing Long Jump, m	3.40-3.60	2.90-3.10
Triple jump from place, m	10.00-10.50	8.40-8.50
Vertical jump, cm	95-105	85-90
20m run from a flying start, sec.	3.1-3.2	3.4-3.5
Power clean, kg	180-190	110-120
Throwing the shot backwards, m (Men—7.260kg, Women—4 kg)	21.50-22.50	21.50-22.50
Squat with a barbell, kg	270-280	180-190
Bench press, kg	230-240	140-160
Barbell snatch, kg	135	100-105

TABLE 20

Model Characteristics of Specialized Physical Preparation of Javelin Throwers [18]

Exercises	Result	
	Men	Women
Throwing a 4kg shot from behind the head, m	27-28	---
Throwing a 3kg shot from behind the head, m	---	20-22
Throwing the competitive implement from place, m	70	55
Throwing a 0.9kg javelin, m	82-83	---
Throwing a 0.7kg javelin, m	89-90	67-68
Throwing a 0.5kg javelin, m	91-92	75

TABLE 21

Model Characteristics of General Physical Preparation for High Level Javelin Throwers [18]

Exercises	Results	
	Men	Women
Standing Long Jump, m	3.50-3.60	2.80-3.00
Triple jump from place, m	10.00-10.80	8.80-9.00
Vertical jump, cm	95-100	85-90
20m run from a flying start, sec.	3.0-3.1	3.3-3.4
Power clean, kg	150-160	110-115
Throwing the shot backwards, m (Men—7.260kg, Women—4 kg)	21.00-21.50	20.50-22.50
Squat with a barbell, kg	210-220	130-140
Bench press, kg	160-170	110-115
Barbell snatch, kg	120-130	95

TABLE 22

Model Characteristics of Specialized Physical Preparation of Hammer Throwers (men) [18]

Exercises	Result
Throwing a 16kg weight, m	24-25
Throwing a 16kg kettlebell, m	21-22
6kg Hammer throw, m	98
8kg Hammer throw, m	80-82
10kg Hammer throw, m	69

TABLE 23
Model Characteristics of General Physical Preparation of High Level Hammer Throwers (Men) [18]

Exercises	Results
Standing long jump, m	3.30-3.50
Triple jump from place, m	9.50-9.80
Vertical jump, cm	95-100
20m run from a flying start, sec	3.1-3.2
Power clean, kg	170-180
Throwing the shot backward, m	20-22
Squat with a barbell, kg	260-280
Barbell snatch, kg	130-135

TABLE 24
Model Characteristics of Physical Preparation of Javelin Throwers in the USSR in the Early Years of Preparation [18]

Exercises	Years			
	1974	1979	1981-1984	1985-1988
Standing long jump, m	2.70	2.80-2.90	2.70-2.80	2.70-2.80
Triple jump from place, m	8.00	8.20-8.40	8.50-8.60	8.30-8.40
Vertical jump, cm	---	---	85-90	85-90
Power clean, kg	85	---	---	---
Squat with a barbell, kg	120	160-170	130-140	130-140
Throwing a 3kg shot backward, m	18	18-20	19.50-20.50	19.50-20.50
20m run from a flying start, sec.	---	---	3.3-3.4	3.3-3.4
Throwing a 3kg shot from place, m	---	---	20-22	20-22
Throwing the 600g javelin from place, m	---	56-58	----	---

TABLE 25
Model Characteristics of Physical preparation of Javelin Throwers in the USSR in Different Years of Preparation [18]

Exercises	Years			
	1974	1979	1981-1984	1985-1988
Standing long jump, m	3.20	3.50	3.30-3.40	3.30-3.40
Triple jump from place, m	9.80	10.30-10.50	10.00-10.10	10.00-10.10
Vertical jump, cm	---	---	95-100	95-100
Power clean, kg	150	160-180	150-160	150-160
Squat with a barbell, kg	210	230-240	210-220	210-220
Throwing the shot backward, m	---	18-20	18.50-19.50	18.50-19.50
20m run from a flying start, sec.	---	---	3.0-3.1	3.0-3.1
Throwing a 4kg shot from place, m	---	---	27-28	27-28
Throwing the 600g javelin, m	---	105	105	105
800g javelin throw from place, m	---	79.5	70	70

TABLE 26

Model Characteristics of Physical Preparation of Hammer Throwers [33]

Exercises	Indices
Standing Long jump, m	3.4-3.5
Triple jump from place, m	9.5-9.8
Vertical jump in place, cm	9.5-10.0
Barbell squat, kg	260-280
Power clean, kg	170-180
Throwing a 16kg weight, m	24
Throwing a 16kg kettlebell, m	20
Hammer throw 6kg, m	88-89
Hammer throw 5kg, m	93-95

TABLE 27

Model Characteristics of Physical Preparation of Javelin Throwers [33]

Exercises	Indices	
	Men	Women
Standing Long jump, m	3.5	2.8-2.9
Triple jump from place, m	10.2-10.5	8.2-8.4
Vertical jump, cm	100-105	85-90
Power clean, kg	160-180	---
Barbell squat, kg	200-210	140-150
Throwing a 4kg shot from behind the head, m	29-31	----
Throwing a 3kg shot from behind the head, m	---	20-22
Throwing a 4kg shot backward, m	18-20	---
Throwing a 3kg shot backward, m	---	18-20
Throwing the javelin from place, m	79.50	56-58
Throwing the 600g javelin, m	105	---

TABLE 28

Model Characteristics of Physical Preparation of Discus Throwers [33]

Exercises	Indices	
	Men	Women
30m run from a walk, sec	3.1	3.4-3.5
Standing long jump, m	3.4-3.5	2.8-2.9
Triple jump from place, m	10.3-10.4	8.4-8.5
Vertical jump, cm	95-105	85-90
Power clean, kg	180	---
Barbell squat, kg	250-260	170-180
Bench press, kg	220-230	140-150
Throwing a shot backward, m	22-23	21-22
Throwing a 2.5kg "pancake", m	54-56	---
Throwing a 1.5kg disc, m	76-78	55-56
Throwing a 0.75kg disc, m	---	78-80

TABLE 29

Model Characteristics of Physical Preparation of Shot Putters [33]

Exercises	Indices	
	Men	Women
30m run with a flying start, sec	3.1-3.2	3.4-3.5
Standing long jump, m	3.4-3.5	2.9
Triple jump from place, m	9.5-10.00	8.6
Vertical jump, cm	95-100	85-90
Throwing a 7.260kg shot backward, m	21-22	---
Throwing a 4kg shot backward, m	---	21-22
Barbell squat, kg	270-280	170-180
Bench press, kg	240-250	140-150
3kg shot put, m	---	23.0-23.5
5kg shot put, m	---	18.0-18.5
6kg shot put, m	23.20	---
8kg shot put, m	21.30	---

TABLE 30
Model Characteristics of Specialized Physical Preparation of Middle and Long-Distance Runners [215]

Distance, m	Runners Specialization, m				
	800	1500	5000-10,000	3000 Steeple chase	Marathon
Women					
100	11.4-11.6	11.6-11.9	---	---	---
400	51.0-52.5	52.5-54.0	---	---	---
800	1.52.0	1.55.0-1.58.0	---	---	---
1500	3.56.0-4.00.0	3.53.0	---	---	---
3000	8.50.0-9.16.0	8.30.0-9.00.0	---	---	---
Men					
100	10.3-10.6	10.4-11.0	---	---	---
400	44.5-45.5	46.0-48.0	48.0-50.0	47.5-48.5	---
800	1.42.0	1.44.5-1.46.0	1.47.0-1.51.0	1.46.0-1.48.0	---
1500	3:36.0-3:43.0	3:30.0	3:36.0-3:38.0	3:36.0-3:38.0	---
3000	---	7.35.0-7.50.0	7.37.0	7.40.0-7.50.0	---
5000	---	---	13:05.0	13:20.0-13:30.0	13:30.0-13:45.0
10000	---	---	27:25.0	---	27:40:0-28:00:0
20000	---	---	---	---	58:00:0
30000	---	---	---		1:29:0

TABLE 31

Model Characteristics of the Physical and Technical Preparation of Middle and Long-Distance Runners [215]

Distance, m	Running Speed, $m\text{-}s^{-1}$		Running Activeness, relative units
	Anaerobic threshold	Max O^2 use	
800 Men	4.5	5.7	1.2-1.1
800 Women	4.0	5.0	1.2-1.1
1500 Men	4.8	5.8	1.0-1.1
1500 Women	4.3	5.2	1.0-1.1
5000	5.0	6.0	1.0
10,000	5.0	6.0	1.0
3000 Steeplechase	5.0	6.0	1.0
Marathon	5.2	6.0	1.0

TABLE 32

Model Characteristics of Athletes Having Different Levels of Sports Qualifications, Specializing in the Pole Vault [212]

Exercise	Sports Result, cm						
	330	400	500	540-550	570-580	590-595	600-605
60m run, sec	8.0-8.2	7.5	7.0-7.1	6.8-6.7	6.5-6.6	6.4-6.5	6.3-6.4
100m run, sec	13.5-14.0	12.5	11.5-11.6	11.0-11.2	10.6-10.8	10.5-10.6	10.3-10.4
Standing long jump, cm	240-245	270	290	305-310	310-315	315-320	320-325
Triple jump from place, cm	700-710	800	880	940	960	980	1000
Long jump with a run up, cm	530-550	630-650	685	720	740	760	780
Bench press, kg	30	50	80	95	115	125	130
Barbell snatch, kg	35	45	60	80	85	95	100-105
Barbell pull from behind the head, kg	---	25	35	45	50	55	60-65

TABLE 33
Model Characteristics of High Level Long Jumpers, High Jumpers and Triple Jumpers [296]

Exercises	Competitive Event					
	Long Jump		High Jump		Triple Jump	
	Men	Women	Men	Women	Men	Women
30m run with a low start, sec.	3.90	4.30	4.20	4.50	4.10	4.30
60m run from a low start, sec.	6.80	7.40	7.00	7.50	6.90	7.50
100m run from a low start, sec.	10.50	11.60	10.90	11.70	10.60	11.60
Barbell snatch, kg	85	55	80	50	80	55
Power clean, kg	105	---	100	---	105	---
Standing long jump, cm	340	280	340	280	345	285
Triple jump from place, cm	985	880	975	870	1060	990
Vertical jump, cm	90	75	95	75	90	80
Half squat with a barbell, kg	200	150	200	145	220	160

TABLE 34
Model Characteristics of Pole Vaulters Having Various Sports Qualifications [259]

Exercises	Sports Result, m		
	4.0-1.5	4.5-5.0	5.0-5.5
30m run from a low start, sec.	4.1-4.2	3.9-4.0	3.7-3.8
Flying 30m run, sec.	3.1-3.2	3.0-3.1	2.8-2.9
50m run with a low start, sec.	6.2-6.4	5.9-6.1	5.7-5.8
100m run, sec.	11.3-11.7	10.9-11.2	10.5-10.8
Long jump, m	6.0-6.60	6.50-6.80	7.0-7.50

The system for working out model characteristics oversees the search for more informative indices (results) and then showing the tie-ins between them. The most important ones are then separated which in turn allows for selecting and using these exercises in the cycles of sports form development. This then serves to resolve the tasks presented before each athlete in each stage.

We have in view here the achievement of a definite level of results in the base exercises at the beginning and only after this, to transfer them to the specialized-developmental and competitive exercises. In this case, discussion is of the distant transfer of trainedness. What is related to current transfer is overseen by the simultaneous achievement of

definite levels of results in the base exercises and in the means of specialized preparation. This to a great degree, is related to the specialized-developmental and competitive exercises. The given task is resolved only in cases of their simultaneous entry into the state of sports form during one or another cycle of their development.

Most model characteristics are very specific for each group of the track and field disciplines. However, some of them can coincide. This is noticed mainly in the speed-strength events. Here, we have in view several strength (snatch and power clean), jump (standing long jump, triple jump from place, vertical jump) and throw exercises (throwing the shot put forward and backward). According to the level of achievement in these exercises it is possible to some degree, to judge the speed-strength abilities of each individual separately. However, this does not to any degree determine the amount of increase in the competitive exercises (events).

In working out model characteristics in all groups in the track and field disciplines, specialists used individually-selected and collective-average methods. The first of them oversees selection of the individuals best test scores and the level achieved by one of the ten strongest athletes in the country or world in this or another track and field discipline. For example, one athlete shows the best result in the snatch and another in the standing long jump and a third in the squat with the barbell on the shoulders and so on.

In using the second method, the test scores for each of the exercises are added up, as for example, the results of the ten best athletes in the world are summed up and then averaged. The average result then serves as a base score for the athletes who want to achieve this sports result in the competitive exercise on the world standard level.

The collective-average method is used most frequently in determining the test scores of athletes having different sports qualifications. In the beginning, test scores are established for the means of general preparation, as this encompasses the stage method of constructing cycles of sports form development.

In our study, we did not take exercises from the general developmental group. Instead we took exercises from the specialized-preparatory group or exercises that when executed, used similar muscle groups or ensembles of muscles. Also the training work coincided with activation of those same body functions and systems, on which an increase in sports results in the competitive exercises depends. What was the same or close to the same was the regimes of muscle work and different functions of other body systems.

When it became clear that the means of general preparation do not always create the "base", "foundation", for growth of sports results in the main event, specialists began to carry out tests in specialized-developmental and close to competitive exercises. These exercises appear to be more informative and more "transferable" to the main event. Thus, in the track and field throws, with achievement of definite results in throwing lighter and heavier implements, it is possible to talk about the possibilities of achieving one or another level in throws of the competitive implement (tables 35-40). Results in the 100m run are in conformity with definite test results in the 60 and 150m on one or another level. Other examples can be seen in other track and field disciplines.

TABLE 35
Difference in Sports Results when Throwing a Lighter, Heavier and Competitive Weight Hammer (Men)

Implement	Difference, m
7.260 and 5 kg	+13 (±3.4)
7.260 and 6 kg	+7 (±1.1)
7.260 and 8 kg	-6 (±0.9)
7.260 and 9 kg	-12 (±1.2)
7.260 and 10 kg	-16 (±1.3)

TABLE 36
Difference in Sports Results when Throwing a Lighter, Heavier and Competitive Weight Shot (Men)

Implement	Difference, m
7.260 and 5 kg	+3 (±0.8)
7.260 and 6 kg	+1 (±0.3)
7.260 and 8 kg	-1 (±0.3)
7.260 and 9 kg	-3 (±0.9)
7.260 and 10 kg	-6 (±0.96)

TABLE 37
Difference in Sports Results when Throwing a Lighter, Heavier and Competitive Weight Discus

Implement	Difference, m	
	Men	Women
2.0 kg and 1.5 kg	+7 (±3.25)	---
2.0 kg and 1.75 kg	+5 (±0.86)	---
2.0 kg and 2.25 kg	-5 (±0.87)	---
2.0 kg and 2.5 kg	-11 (±1.86)	---
1.0 kg and 0.75 kg	---	+6 (±1.45)
1.0 kg and 1.250 kg	---	-7 (±1.24)
1.0 kg and 1.5 kg	---	-17 (±2.65)
1.0 kg and 2.0 kg	---	-22 (±2.87)

TABLE 38
Difference in Sports Results when Throwing a Lighter, Heavier and Competitive Weight Shot Put (Women)

Implement	Difference, m
4.0 and 3 kg	+1.5 (±0.45)
4.0 and 3.5 kg	+0.8 (±0.36)
4.0 and 5.0 kg	-1.5 (±0.54)
4.0 and 6.0 kg	-3 (±1.12)

TABLE 39
Difference in Sports Results when Throwing a Lighter, Heavier and Competitive Weight Javelin (Men)

Implement	Difference, m
800g and 600g	+9 (±2.8)
800g and 700g	+4 (±1.55)
800g and 900g	-13 (±2.57)
800g and 1200g	-20 (±3.6)

TABLE 40
Difference in Sports Results when Throwing a Lighter, Heavier and Competitive Weight Javelin (Women)

Implement	Difference, m
600g and 400g	+7 (±1.86)
600g and 500g	+4 (±1.64)
600g and 700g	-7 (±1.38)
600g and 800g	-16 (±2.42)

In conclusion, it should be noted that the search for new methods of constructing cycles of sports form development coincides with the appearance of studies in which it has been substantiated that the means of general preparation can create the "base", "foundation", for increasing results in the competitive events only in the training of low level athletes [57, 266]. The transfer of trainedness from general preparation exercises to the competitive is absent in high level athletes. If a certain number of general preparation means are used by then, it is for carrying out general warm up and restoration [57, 266].

At this time, more athletes have begun to move away from using the stage method of constructing cycles of sports form development. With decreased time limits given to resolving some task during different stages (most frequently 2-4 weeks), a rethinking started not only of the mechanisms of training transfer, but also the content of the bases for these model results.

First, most specialists began to re-work the model characteristics of the specialized-developmental and competitive exercises. Second, it became obvious that resolving the task of creating the "base", "foundation", is impossible in such a short period of time. Third, all the more specialists came to the conclusion that the training process should be constructed in such a manner, that the athletes simultaneously enter into a state of sports form not only in the test results, but in the specialized-developmental and competitive exercises.

It also became clear that achieving a definite level of test results, even in the specialized-developmental exercises, does not guarantee an increase in sports achievement in the main event. All of this once again is evidence of the complexity of the process of training transfer in situations relating to the training of high level athletes. For understanding this, it is necessary to have a new quality level of understanding.

****

The theoretical and experimental material that has been put together makes it possible to explain many factors involved in the process of training transfer. This is related primarily to the different methods of constructing cycles of sports form development. Each one of them is distinguished from the other in the system of using general-preparatory, special-preparatory, special-developmental and competitive exercises. The systems of exercises looked at appear as some kind of expediently organized aggregate that is always directed to achievement of the end purpose. This purpose is primarily directed to entry into the state of sports form in the competitive exercise at the end of the sports form development cycle and achievement of a definite level of sports results.

Depending upon the schematic of the means used for constructing the above mentioned cycles of sports training, transfer of training from one form of exercise to another can take place in sequence or at the same time. In the first case, are ways of constructing sports form development that consist of a certain number of stages, blocks. For each stage, block, the previous one creates the "base", "foundation" for the one following. In the second case, the discussion is primarily of the complex method. Here, the exercises used over the entire cycle of sports form development have a mutual effect on one another which then serves to produce simultaneous entry into the state of sports form as well as showing improvement in the competitive exercise.

The training process is constructed so that the general-preparatory, special-preparatory and special-developmental exercises promote an increase in results in the main event. Here, the "base", "foundation", is created along the lines of entry into the state of sports

form. This is current transfer of training. It distinguished from distant transfer by the fact that it simplifies transfer since the athlete enters into the sports form state in all of the exercises used at the same time. In distant transfer of training, at the beginning they enter into the state of sports form in one form of exercise and only later in others. In such situations, the process of training transfer is made more complex by the fact that the athletes must maintain the achieved level of preparation over the duration of each following stage, block in certain forms of exercises and at the same time experience further development in others. It is somewhat difficult to do this when organizing the training process.

For example, we can look closely at the stage-complex method of constructing cycles of sports form development. Here, the task during the stage of specialized preparation is to maintain the achieved level of preparation in the general preparatory exercises and to develop sports form in the specialized-preparatory, specialized-developmental and competitive exercises.

The regularities of sports form development reveal the essence of the individual limits of entering into the given state. First, the duration of the stages, blocks, during which the "base", "foundation", is created is made more precise; and second, it is evidence that when using the variational method of constructing cycles of sports form development, achievement of distant transfer of training from one stage, block, to the following ones, cannot be realized because of their short duration. Here the "base", "foundation", over the duration of each of the previous stages, blocks, can be created only when the succession in the means of training used is maintained. We have in view here that the entire cycle will be used for the general-preparatory, specialized-preparatory, specialized-developmental and competitive exercises. But, at the beginning of each stage, block, it is necessary to fulfill them according to the schematic, that is, these means are maintained but their composition changes periodically.

At the beginning, the proposed division of exercise classification regulates the system of exercises employed when using one or another means of constructing cycles of sports

form development. It likewise makes it possible to understand which forms of exercises create the "base" and later on, to which form of exercise it can be transferred to, and by so doing, make more precise the mechanisms of physical preparation transfer that are in line with the regularities of sports form development.

The proposed system of working out model characteristics makes it possible to search for the optimal level of results in the base exercises on each new level of sports improvement.

Characteristics of the Tests Used

The study of training transfer mechanisms begins with the fixing of separately taken amounts of physical and technical preparation of athletes in the process of using specific (or other) exercises and then establishing the inter-relationships between them. Foremost is to determine the influence the exercise has on the competitive exercise, which in all track and field events, is the most important test.

As a result of studying multiple literary sources that examined this problem, it was concluded that in all speed-strength events and in the endurance group, general and specialized tests are used in the training process. When talk is about general tests, we have in mind not those that determine preparation in general preparatory exercises, but of similar tests, used in mixed groups or between groups.

For testing the functional state of the heart-circulatory, blood vessel and respiratory systems, almost all of the same tests are used in practice in all disciplines of track and field. For example, maximum oxygen uptake is determined on a veloergometer and the limits possible while functioning at maximum O2 uptake, anaerobic threshold and others.

In speed-strength sports, they more frequently use tests such as the 60 meter run from a low start (blocks), barbell snatch, half squat with the bar on the shoulders, standing long jump, vertical jump (according to V.M. Abalakov), triple jump from place, and throwing the shot forward, backward. In specialized tests for each sport the exercises are very similar.

In cyclical sports, the most frequently used general tests for endurance are those which characterize the level of functioning of the heart-circulatory, blood vessel, and respiratory systems (already touched on above). Each event in this group has its own specific tests.

The reliability of many tests has already been shown. Foremost in most of these are those tests that show the level of preparation in specialized-developmental exercises.

Included here are test results in the competitive exercises, executed in lighter and more complex conditions. For example, in the throws, the tests measure results in throws with lighter and heavier implements. In the jumps, the results are recorded in jumps with a short approach run. In cyclical sports, the tests revolve around determining the number of segments executed at a given speed and by observing the planned intervals of rest between them.

The reliability of tests that use general preparatory and specialized-preparatory exercises still have not been fully confirmed. This will be tightened up in the near future.

Previous studies in which we tried to determine the exercises that produce a positive transfer of training to the competitive exercise are detailed in Chapter 2. We use those that are most frequently used in sports practice.

Methods Used to Determine the Effect of Training Transfer

As a general rule, all the research touching on the study of training transfer determines the amount of interrelationship between separate results of the athletes' motor activity. The number of factors studied depends upon the tests proposed, and the contingent and classification of the subjects. The amount and direction of training transfer are determined with the help of statistical analyses. To do this, correlations, regressions, dispersions, factor analyses and multiple correlations are used. Their effectiveness at this time is generally acknowledged and the essence of each is written up in specialized papers.

In studying the problems of training transfer, the amount of interrelation between achievements in specific training exercises is usually used. It is usually expressed by the coefficient of correlation.

It is absurd to criticize the generally used methods of statistical analysis when some researchers have started to use other methods in more recent studies without proposing some kind of exchange. In considering the pertinent facts received in the process of experimental studies on the given problem, we will nonetheless take it upon ourselves to switch the reader's attention to the fact that results in speed-strength disciplines, even in training elite athletes, do not always reflect the true essence of the interaction between different forms of activity and exercises. This is explained by the fact that the direction and amount of training transfer is dependent first of all on the integration of activity in the brain, which characterizes the most complex interactions between the excitatory-inhibitory processes. Thus, we study the inter-tie-ins with a minimum of 5-6 indices in athletes having various sports qualifications.

We will illustrate with one example, which according to our view, reflects the complexity of showing the positive inter-tie-ins between exercises. We will address only one of the

situations which frequently arise in the process of doing experimental studies on this problem. The following schematic of individual training sessions that were characteristic of what the athlete used the during the period of developing sports form, consisted of three exercises---A, B, and C. This exercise consecutiveness was used for the duration of the entire experiment. After its conclusion it was shown that sports results increased in the first (A) and in the third (C) exercise. There was no increase in the second (B) exercise.

The coefficient of correlation was sufficiently high between exercises A and B, which made it possible to think that both exercises had a positive action on one another. Naturally, the statistical analysis did not bring out the kind of influence exercise B had on exercise A or C. Based on this, a conclusion was made that exercise B was not effective, or did now show a positive influence on exercise A or C.

The aim of the second experiment was to show the correctness of this conclusion. The athletes used only two exercises--A and C for the duration of the study. After ending the experiment it was shown that there was no increase in sports results in these exercises. Apparently in the first experiment there was some kind of stimulating action of exercise B on exercises A and C. Thus it is possible to propose a "tie-in" effect of exercise B when exercises A and C show positive effects on one another only when together with exercise B. We believe that in the future, additional studies will resolve this interaction and propose corresponding methods of analysis.

Additional studies that looked at the problem of training transfer, revolved mainly around the problem of finding effective means of training and the interrelationships between them [25, 34, 49, 94, 128, 284, 288, 304]. In only some of the papers were the factors studied that made this process possible and which ensured it [34, 49, 153, 154]. Studies that examined means of training touched on the methodic for developing physical abilities (for example, determining the intensity zones, volume of training loads, muscle work regimes and others). Also studied was improvement of technique in one or another of these aspects (methods, zones of intensity and others).

The importance of these factors is generally known since an increase in achievement in any exercise is determined by not only its effectiveness, but by the use of the needed zones of intensity, volume of training loads and so on. At the same time, the method of training used ensures an increase in sports achievement through the utilization of exercise factors and the inter-action that takes place between them. From here it follows that without an increase in achievement with the exercises used, training transfer is not realized.

Factors that ensure training transfer are distinguished from one another as they reveal the essence of ordinary and complex training session construction, as well as micro-, meso- and macro cycles of training. Here the discussion revolves around the use of means of constructing cycles of sports form development. Foremost is that the means should ensure entry into the given state of sports form, and only after this, an increase in sports achievement and transfer of training.

Practically all studies that look at the problem of periodization of sports training [34, 153, 154, 181, 182], directly or indirectly touch upon the factors that make the transfer of training possible. They all throw light on creating "bases", "foundations", "prerequisites", "transferred variables", from one exercise to another. The conclusion is that certain means of constructing cycles of sports form development are more suited to the flow of trainability than others.

For example, in studying transfer of the means of constructing the above-mentioned cycles that oversee the stages of general and specialized preparation, the athlete first enters into a state of sports form in general preparation, and only later, in specialized. At the moment of entering into a state of sports form at the end of the second stage in the specialized-preparatory exercises, the level of general physical preparation decreases. This is not suitable for a positive transfer of training of general preparation means to specialized preparation means [34]. Instead of this method of constructing the cycles of

sports form development, a complex method is proposed which allows for simultaneous entry into a state of sports form in the exercises being used for the duration of their use.

According to our view the theoretical and experimental material in this chapter allows us to offer a solution based on the complexity and multi-sided aspects of this problem. For sports improvement from a practical standpoint, transfer of training depends on resolving all the tasks standing before athletes on any stage of training. This is related to the process of developing physical abilities and learning and improving technical mastery. At this time there are always several exercises (types of sports activity) functioning regardless of our wishes that some inter-activity is going on between the physical abilities and technical mastery. The factors can be positive, negative, or indifferent, but they will always be there and should be taken into consideration. Basically the effectiveness of the training process depends on them.

We should also mention that even in cases where only one exercise is used in training, there is inter-action between separately taken portions of even ordinary training sessions. We have in mind changes in the functional state of the central nervous system, as for example, those that occur in the first part of the session.

The short review of literature presented here touches upon the study of training transfer that allows for an explanation of the theoretical and experimental laws governing this process. This is related not only to determining effective means of training, but to the inter-relationships between general-preparatory, specialized-preparatory, specialized-developmental, and competitive exercises. The direction of the training transfer in many instances depends on the use of zones of intensity, volume of training loads, regimes of muscle work and so on.

The process of transferring training is organically tied in with the process of developing sports form, without which there cannot be any discussion of the transfer of training. Because of this, it becomes obvious that it is necessary to construct cycles of sports form

development from the information available in the theory and practice of sport. This will resolve the task of developing the necessary physical abilities and the transfer of training.

Chapter 2

Transfer of Physical Abilities When Using Different Types of Exercises

In the theory and practice of track and field over the last two decades, a group of exercises has been identified that creates the transfer "basis", "foundation", for increasing sports results in the competitive exercises. In the speed-strength sports, this does not mean only repeating the competitive action as a whole or its joint parts, but in the use of different strength, jump, run, and throw exercises. They can be local exercises as well as global movements.

In executing local exercises, separate parts or body links are used. For example, the squat, bench press, long jump from place, vertical jump and so on. In global action exercises (as for example the barbell clean) all the individual body links are included in the work. With the help of these exercises, the athletes resolve the problem of developing strength, speed-strength, explosive strength and other abilities necessary for improving results in the competitive exercises.

In cyclic sports that require the display of endurance, the number of exercises used in the training process is less than those used in speed-strength sports. In this case discussion is about the means of training that serve to develop aerobic and anaerobic abilities. The aerobic exercises create the "base", "foundation", for the anaerobic exercises. These exercises consist of runs for different distances in different work regimes, intensity zones,

periods of rest and so on. Strength, jump, and throw exercises are used sporadically and in small amounts, mainly for active rest or for resolving frequent problems that do not limit the growth of sports mastery in the competitive event. This conclusion was arrived at by specialists through experimental methods.

Positive interrelationships between exercises in each track and field event are determined with the use of correlational analyses. The data used was received mainly through the use of questionnaires from native and foreign athletes having different sports qualifications. The questionnaires were carried out over the course of four Olympic cycles. Also analyzed were tests results of individual athletes as recorded in different literature sources. Results of the correlational analyses having a direct relationship to the studied factors is presented further on in tables 41-84 and 89-103. A positive interrelationship between exercises begins at 0.349.

Transfer of Physical Abilities In The Sprint And Hurdles When Using Various Exercises

The use of competitive and specialized-developmental exercises in the sprint and hurdle events resolves the problem of developing speed, speed endurance and specialized endurance. For increasing *absolute speed,* mainly 20-60 meter segments are used. Longer segments for developing speed abilities are included in the training process less frequently since in the theory and practice of the track and field sprint, it is a given fact that different level athletes cannot increase the speed achieved after 55-60 meters [5, 52, 147, 180].

For developing *speed endurance,* 30-300 meter segments are used. The intensity of running these distances, as when developing speed abilities, varies between 90-100% of the best achievements for each athlete. Differences are noted only in the intervals of rest used after running the distance or series of distance segments. In developing speed abilities, the rests are somewhat longer than when developing speed endurance. However, in both cases, with an increase in the distance, there is an increase in the rest interval [5, 52, 96, 180, 216].

TABLE 41
Correlational Interrelationships Between Preparedness Results of 100m Runners Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

No. n/n	Indices (Results)	1	2	3	4	5	6	7
1	30m run with a flying start	*	0.678 / 0.778	0.724 / 0.804	0.756 / 0.876	0.654 / 0.678	0.688 / 0.765	0.721 / 0.682
2	30m run from blocks		*	0.865 / 0.794	0.724 / 0.885	0.652 / 0.698	0.697 / 0.782	0.565 / 0.654
3	60m run from blocks			*	0.798 / 0.824	0.675 / 0.688	0.724 / 0.750	0.694 / 0.597
4	100m run from blocks				*	0.756 / 0.850	0.578 / 0.767	0.712 / 0.685
5	120m run from a high start					*	0.654 / 0.812	0.546 / 0.669
6	150m run from a high start						*	0.607 / 0.844
7	200m run from a high start							*

Note: Here and further on, the coefficient of correlation of high level athletes is in the numerator and for low level athletes, in the denominator.

TABLE 42

Correlational Interrelationships Between Preparedness Results of 200m Runners Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

No. n/n	Indices	1	2	3	4	5	6	7
1	30m run with a flying start	*	0.789 0.839	0.756 0.876	0.788 0.765	0.708 0.730	0.657 0.835	0.645 0.624
2	60m run from a low start		*	0.765 0.790	0.698 0.724	0.724 0.786	0.607 0.576	0.681 0.612
3	100m run from a low start			*	0.687 0.867	0.708 0.765	0.765 0.745	0.642 0.607
4	150m run from a high start				*	0.707 0.888	0.765 0.812	0.676 0.783
5	200m run from a low start					*	0.724 0.842	0.486 0.607
6	300m run from a high start						*	0.698 0.786
7	400m run from a low start							*

TABLE 43

Correlational Interrelationships Between Preparedness Results of 400m Runners Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

No. n/n	Indices	1	2	3	4	5	6	7
1	60m run from a low start	*	0.867 0.824	0.721 0.820	0.712 0.756	0.689 0.712	0.765 0.698	0.624 0.576
2	100m run from a low start		*	0.786 0.867	0.765 0.698	0.750 0.721	0.712 0.804	0.645 0.587
3	150m run from a high start			*	0.845 0.786	0.786 0.703	0.714 0.689	0.615 0.588
4	200m run from a low start				*	0.803 0.878	0.824 0.765	0.687 0.603
5	300m run from a high start					*	0.876 0.816	0.724 0.698
6	400m run from a low start						*	0.786 0.824
7	600m run from a high start							*

TABLE 44

Correlational Interrelationships Between Preparedness Results of 110m Hurdlers Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

No. n/n	Indices	1	2	3	4	5	6	7
1	110m hurdles	*	0.760 / 0.860	0.654 / 0.546	0.670 / 0.568	0.804 / 0.854	0.760 / 0.800	0.562 / 0.420
2	60m from blocks		*	0.660 / 0.486	0.590 / 0.665	0.650 / 0.542	0.660 / 0.702	0.520 / 0.456
3	30m from blocks			*	0.768 / 0.667	0.846 / 0.745	0.390 / 0.426	0.414 / 0.361
4	60m from blocks				*	0.824 / 0.765	0.764 / 0.824	0.600 / 0.425
5	100m from blocks					*	0.786 / 0.854	0.803 / 0.731
6	150m from a high start						*	0.720 / 0.654
7	200m from blocks							*

TABLE 45
Correlational Interrelationships Between Preparedness Results of 400m Hurdlers Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

No. n/n	Indices	1	2	3	4	5	6	7
1	400m hurdles	*	0.768 0.678	0.724 0.690	0.656 0.742	0.788 0.704	0.856 0.789	0.890 0.806
2	60m with hurdles		*	0.896 0.824	0.712 0.688	0.660 0.567	0.567 0.425	0.365 0.380
3	110m hurdles			*	0.654 0.546	0.456 0.524	0.365 0.376	0.350 0.366
4	200m from a low start				*	0.760 0.698	0.806 0.765	0.780 0.665
5	300m from a low start					*	0.865 0.824	0.842 0.798
6	400m from a low start						*	0.856 0.745
7	600m from a high start							*

TABLE 46

Correlational Interrelationships Between Preparedness Results of 100m Women Runners Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

No. n/n	Indices	1	2	3	4	5	6	7
1	30m from a flying start	*	0.645 0.788	0.589 0.724	0.712 0.812	0.568 0.652	0.624 0.765	0.644 0.615
2	30m run from blocks		*	0.667 0.775	0.698 0.678	0.704 0.775	0.597 0.652	0.624 0.576
3	60m run from blocks			*	0.786 0.824	0.712 0.745	0.657 0.606	0.742 0.684
4	100m run from blocks				*	0.687 0.742	0.706 0.689	0.678 0.712
5	120m run with a high start					*	0.754 0.882	0.675 0.765
6	150m run with a high start						*	0.688 0.733
7	200m run with a high start							*

TABLE 47

Correlational Interrelationships Between Preparedness Results of 200m Women Runners Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

No. n/n	Indices	1	2	3	4	5	6	7
1	30m from a flying start	*	0.654 / 0.762	0.598 / 0.665	0.668 / 0.724	0.570 / 0.624	0.489 / 0.546	0.546 / 0.552
2	60m from blocks		*	0.689 / 0.772	0.625 / 0.675	0.678 / 0.683	0.588 / 0.526	0.516 / 0.678
3	100m from blocks			*	0.724 / 0.765	0.654 / 0.726	0.669 / 0.756	0.542 / 0.534
4	150m with a high start				*	0.667 / 0.754	0.736 / 0.789	0.468 / 0.512
5	200m from blocks					*	0.689 / 0.745	0.652 / 0.679
6	300m from blocks						*	0.721 / 0.803
7	400m from blocks							*

TABLE 48

Correlational Interrelationships Between Preparedness Results of 400m Women Runners Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

No. n/n	Indices	1	2	3	4	5	6	7
1	60m run from a low start	*	0.754 0.824	0.667 0.765	0.589 0.782	0.624 0.706	0.612 0.615	0.542 0.665
2	100m run from a low start		*	0.724 0.765	0.789 0.821	0.688 0.756	0.712 0.752	0.567 0.762
3	150m run from a high start			*	0.798 0.865	0.712 0.821	0.766 0.845	0.672 0.738
4	200m run from a low start				*	0.678 0.786	0.754 0.742	0.707 0.684
5	300m run from a high start					*	0.856 0.845	0.678 0.765
6	400m run from a low start						*	0.675 0.698
7	600m run from a high start							*

TABLE 49

Correlational Interrelationships Between Preparedness Results of 100m Women Hurdlers Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

No. n/n	Indices	1	2	3	4	5	6	7
1	100m hurdles	*	0.845 0.754	0.645 0.568	0.680 0.710	0.786 0.736	0.802 0.724	0.540 0.426
2	60m with hurdles		*	0.540 0.478	0.660 0.745	0.688 0.650	0.540 0.620	0.365 0.390
3	30m from blocks			*	0.846 0.724	0.788 0.802	0.456 0.368	0.420 0.376
4	60m from blocks				*	0.880 0.820	0.742 0.780	0.678 0.554
5	100m from blocks					*	0.865 0.812	0.742 0.780
6	150m with a high start						*	0.786 0.820
7	200m from blocks							*

TABLE 50

Correlational Interrelationships Between Preparedness Results of 400m Women Hurdlers Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

No. n/n	Indices	1	2	3	4	5	6	7
1	400m hurdles	*	0.688 / 0.742	0.698 / 0.725	0.742 / 0.658	0.712 / 0.728	0.778 / 0.698	0.845 / 0.780
2	60m hurdles		*	0.890 / 0.806	0.678 / 0.764	0.697 / 0.605	0.497 / 0.376	0.387 / 0.352
3	100m hurdles			*	0.605 / 0.546	0.397 / 0.406	0.388 / 0.350	0.354 / 0.356
4	200m from blocks				*	0.650 / 0.708	0.765 / 0.806	0.678 / 0.567
5	300m with a high start					*	0.789 / 0.760	0.865 / 0.724
6	400m from blocks						*	0.807 / 0.856
7	600m with a high start							*

For the development of *specialized endurance,* 100-600 meter segments are used. The training work is executed in the zone of 80-90% of maximum. Depending upon the segments and intensity zones (80-85%, 85-90%) used, the rest intervals between separate runs can be either 3-5 minutes or 6-10 minutes. Besides interval running, broken running is also used. Even here, the runs have their own methodological rules according to how the training session is organized with consideration given to the different segments, zones of intensity, intervals of rest and so on. We will not dwell on these as this information is not pertinent to our task [5, 52, 138, 180, 256].

Presented in tables 41-50 are the correlational analyses between competitive and specialized-developmental exercises. They indicate the presence of high level interrelationships between these exercises. The coefficients of correlation in most cases are in the range of 0.700-0.800.

For development of *speed-strength abilities* in the training of different level athletes, a large number of strength, jump, and throw exercises are used. Their portion of the total amount of training time, in relation to the tasks being resolved, the qualifications of the athlete and their individual characteristics, can comprise from 10-30% of the total sports form development cycle time. The strength exercises are executed with and without the barbell, in addition to using various training devices. The strength exercises, in comparison to others, produce a wider range of effects in the process of developing speed-strength abilities. With their use, it is possible to selectively develop the muscle strength abilities such as speed, strength and "explosiveness".

In experimental research, two strength exercises have been studied---the barbell snatch and the half squat with the barbell on the shoulders. These exercises are most frequently used in the training of athletes having various sports qualifications. They make it possible to evaluate the total level of development of strength abilities of all the body links of the athlete (barbell snatch) and strength of the leg extensors (half squat with barbell on shoulders).

Besides this, these two exercises, according to their biomechanical characteristics (direction of movement, consecutiveness of including muscle groups in the work, regimes of muscle work, and so on) duplicate many strength exercises that are systematically used in the training process. Knowing the results in each of these exercises makes it possible to predict achievement in other exercises and consequently, have a more complete picture of the transfer of physical abilities when using similar exercises.

The data received testify to the poor interrelationship between the competitive event and the snatch and the squat with the barbell on the shoulders. We will begin with the 100m run (tables 51, 56). With the men, the cumulative effect in these two exercises was seen up to the level of 11.10 - 11.40 seconds. With the women, in the snatch, it showed up

only on one level - 12.70-12.790 sec., and in the half squat with the barbell on the shoulders, on two levels (11.80-12.0 and 12.70-12.90 seconds).

In the men's and women's 200m run, a positive interrelationship between the snatch and the competitive event was not observed on all levels of sports mastery. What is pertinent to this is that in the half squat with the barbell on the shoulders, there is a cumulative effect which appears in the men on the level of 23.00-23.50 seconds and in the women, 25.00-25.50 seconds (tables 52, 57).

In men and women specializing in the 400m run, there is no correlational interrelationship between results in the snatch and the competitive event on all levels of sports mastery. In the half squat with the barbell on the shoulders it is observed on the 51.00-52.00 seconds level in the men and in the women, 55.00-56.00 seconds (tables 53, 58).

Somewhat different results are seen in the correlational analyses in the men's 110m hurdle run and in the women's 100m hurdles (tables 54, 59). In men, the cumulative effect in the snatch is lacking only on two levels of sports mastery---16.00-16.60 seconds and 15.00-15.50 seconds. In women, in the snatch a positive influence is not seen on all levels of sports mastery. In the half squat with the barbell on the shoulders the cumulative training effect in men appears on the 14.50-15.00 seconds level and in the women - only on the 13.30-13.80 seconds level.

In the 400m hurdle run, a positive interrelationship between the two strength exercises and the competitive event was not seen (table 55, 60). Coefficients of correlation varied from 0.196-0.320.

According to direction of movement, throws of the shot forward and backward have a consecutive inclusion of the basic body links that are close to that of the snatch exercise. They are similar to the power clean. However, there is a difference between them in the muscle work regimes. When using the throws of the shot forward and backward not only

is speed-strength developed, but also explosive abilities. If in the snatch, in most track and field sprint and hurdle events a cumulative effect is noted on some level of sports mastery, aside from the 400m hurdles, then the throws of the shot forward and backward have a place only with 110m hurdlers on two levels--13.50-14.00 seconds and 14.00-14.50 seconds. In the other events it is absent, both with the men and women (see tables 51-60).

Greater transfer is seen in the standing long jump (see tables 51-60). Results in the long jump, vertical jump and triple jump from place, make it possible to judge the speed-strength and explosive abilities of the leg muscles that play a role during the starts, starting acceleration and run over the distance. In almost all track and field sprint and hurdle events, there is a positive correlational interrelationship.

Absence of the cumulative training effect was seen only in the women's 400m run (see tables 51-60). The training effect was seen most frequently in the 100m, 110 and 100m hurdle runners. In men 100m runners, a positive relationship was found on two levels of sports results---11.10-11.40 sec. and 11.40-11.70 sec. In the long jump from place it was seen in women on the same comparative levels ---12.10-12.40 sec. and 12.40-12.70 sec.

In the 200m run, the cumulative effect of this exercise to the competitive exercise in men was seen on the level of 22.50-23.00sec. and in the women 25.00-25.50sec. It had a place on two levels in the 110m hurdle run ---14.00-14.50sec. and 16.00-16.50sec. and in the 100m hurdles, 13.0-13.80 sec. and 14.30-14.80sec.

In the vertical jump a positive transfer of physical abilities in the men's 100 meters was seen on three levels --- 10.80-11.10sec, 11.10-11.40sec, and 11.40-11.70sec, while in the women on two levels --- 12.10-12.40sec, and 12.40-12.70 sec. In the 200m run it had a place only with the women---24.50-25.0sec and 25.00-25.50sec. In the men it was absent on all levels. In the 110m hurdles the cumulative effect appeared on five levels of sports mastery while in the women 100m hurdlers on four levels. In the 400m and in the 400m hurdles there was no positive interrelationship with the men as well as with the women.

In the triple jump from place, a cumulative effect was seen on four levels of sports mastery in 100m women runners---11.50-11.80 sec. to 12.40-12.70 sec. With the men, the cumulative effect was seen in 110m hurdle runners---from 13.50-14.00sec to 15.00-15.50 sec. In the men's 100m, there was a positive transfer on three levels of sports mastery---10.80-11.10sec, 11.10-11.40sec and 11.40-11.70sec. In the women's 200m there was a positive transfer on two levels of sports mastery,--- 24.50-25.00 sec and 25.00-25.50 sec and in the 100m hurdles, 13.30-13.80sec and 14.30-14.80sec. In the men's 200m was this seen only on one level, ---23.00-23.50 sec. and in the 400m---50.00-51.00 sec. With the men and women in the 400m hurdles, it corresponded to 54.50-55.50sec. and 56-57.00sec.

TABLE 51
Correlational Interrelationship of Preparatory Results of Men 100m Runners of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	10.20-10.50sec	10.50-10.80sec	10.80-11.10sec	11.10-11.40sec	11.40-11.70sec
Barbell snatch	-0.186	0.178	0.267	0.396	0.356
Half squat with the barbell	0.245	0.267	-0.324	0.456	0.522
Standing long jump	0.178	-0.154	0.297	0.354	0.369
Vertical jump	-0.215	0.265	0.367	0.452	0.421
Triple jump from place	-0.198	0.268	0.385	0.362	0.452
10-fold jump from place	0.345	0.425	0.564	0.508	0.493
Jumps from leg to leg for 50m for time	0.406	0.498	0.561	0.524	0.488
Throwing the shot forward	0.167	-0.154	0.235	0.276	0.305
Throwing the shot backward	0.187	0.206	-0.267	0.305	0.324

TABLE 52

Correlational Interrelationship of Preparatory Results of Men 200m Runners of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation					
	20.50-21.00 sec	21.00-21.50 sec	21.50-22.00 sec	22.00-22.50 sec	22.50-23.00 sec	23.00-23.50 sec
Barbell snatch	-0.187	0.165	0.198	0.207	-0.225	0.305
Half squat with the barbell	-0.211	-0.226	-0.254	0.215	-0.312	0.367
Standing long jump	0.165	-0.188	0.267	0.301	0.387	0.342
Vertical jump	-0.124	0.156	0.207	0.256	-0.276	0.329
Triple jump from place	-0.187	0.245	-0.215	0.304	0.345	0.406
10-fold jump from place	0.206	-0.189	0.354	0.325	0.425	0.386
Jumps from leg to leg for 50m for time	0.315	0.398	0.456	0.376	0.412	0.452
Throwing the shot forward	-0.136	0.206	0.178	0.207	-0.256	0.178
Throwing the shot backward	-0.189	0.209	-0.226	0.187	0.242	-0.278

TABLE 53

Correlational Interrelationship of Preparatory Results of Men 400m Runners of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation					
	46.00-47.00 sec	47.00-48.00 sec	48.00-49.00 sec	49.00-50.00 sec	50.00-51.00 sec	51.00-52.00 sec
Barbell snatch	-0.186	0.214	0.189	-0.256	0.345	0.324
Half squat with the barbell	-0.244	0.256	0.250	0.324	-0.316	0.367
Standing long jump	0.165	-0.145	0.156	-0.226	0.278	0.330
Vertical jump	0.206	0.194	-0.208	0.265	-0.325	0.344
Triple jump from place	-0.156	0.187	0.242	0.307	0.376	0.345
10-fold jump from place	-0.215	0.276	0.305	0.398	0.356	0.342
Jumps from leg to leg for 50m for time	0.637	0.456	0.376	0.487	0.341	0.317
Throwing the shot forward	0.125	-0.167	-0.145	0.267	-0.198	0.254
Throwing the shot backward	0.179	-0.189	0.227	0.214	0.244	0.310

TABLE 54

Correlational Interrelationship of Preparatory Results of Men 110m Hurdlers of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation					
	13.50-14.00 sec	14.00-14.50 sec	14.50-15.00 sec	15.00-15.50 sec	15.50-16.00 sec	16.00-16.50 sec
Barbell snatch	0.398	0.424	0.367	0.324	0.367	0.308
Half squat with the barbell	-0.298	0.325	0.360	0.352	-0.387	0.356
Standing long jump	-0.345	0.376	-0.324	0.307	-0.312	0.362
Vertical jump	0.506	0.456	0.395	0.407	0.346	0.377
Triple jump from place	-0.387	0.408	0.356	0.349	-0.326	0.321
10-fold jump from place	0.476	0.456	0.422	0.377	0.406	0.347
Jumps from leg to leg for 50m for time	0.487	0.406	0.477	0.412	0.324	0.355
Throwing the shot forward	-0.256	0.278	0.215	0.245	0.324	0.302
Throwing the shot backward	0.367	0.358	0.307	0.255	-0.289	0.324

TABLE 55

Correlational Interrelationship of Preparatory Results of Men 400m Hurdlers of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation					
	49.50-50.50 sec	50.50-51.50 sec	51.50-52.50 sec	52.50-53.50 sec	53.50-54.50 sec	54.50-55.50 sec
Barbell snatch	0.245	0.198	-0.214	0.226	0.254	0.324
Half squat with the barbell	-0.207	0.240	0.276	-0.265	0.263	0.320
Standing long jump	-0.342	0.306	0.256	0.211	-0.198	0.227
Vertical jump	0.305	0.324	0.312	-0.256	0.276	0.310
Triple jump from place	-0.267	0.214	0.277	0.245	-0.345	0.356
10-fold jump from place	0.425	0.367	0.356	0.401	0.345	0.307
Jumps from leg to leg for 50m for time	0.546	0.524	0.467	0.421	0.386	0.402
Throwing the shot forward	-0.245	0.289	0.307	0.267	0.288	0.312
Throwing the shot backward	0.278	0.324	0.307	-0.298	0.301	0.345

TABLE 56

Correlational Interrelationship of Preparatory Results of Women 100m Runners of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	11.20-11.50 sec	11.50-11.80 sec	11.80-12.10 sec	12.10-12.40 sec	12.40-12.70 sec
Barbell snatch	0.225	0.207	0.306	-0.376	0.324
Half squat with the barbell	-0.198	0.315	0.375	-0.345	0.412
Standing long jump	0.250	0.266	0.325	-0.370	0.362
Vertical jump	-0.187	-0.324	0.337	0.425	0.349
Triple jump from place	-0.245	0.365	0.398	0.352	0.412
10-fold jump from place	0.267	0.452	0.387	0.421	0.376
Jumps from leg to leg for 50m for time	0.387	0.456	0.425	0.387	0.354
Throwing the shot forward	0.156	0.145	-0.189	0.206	-0.185
Throwing the shot backward	0.167	-0.188	0.153	-0.189	0.124

TABLE 57

Correlational Interrelationship of Preparatory Results of Women 200m Runners of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation					
	22.70-23.00 sec	23.00-23.50 sec	23.50-24.00 sec	24.00-24.50 sec	24.50-25.00 sec	25.00-25.50 sec
Barbell snatch	-0.124	0.154	0.135	0.225	-0.206	0.245
Half squat with the barbell	0.178	-0.180	0.193	0.198	0.325	0.367
Standing long jump	0.205	-0.176	-0.224	0.267	0.378	0.325
Vertical jump	0.145	0.189	0.225	0.276	-0.356	0.375
Triple jump from place	0.214	-0.187	-0.267	0.345	0.425	0.387
10-fold jump from place	0.178	0.225	0.392	0.452	0.376	0.456
Jumps from leg to leg for 50m for time	0.456	0.421	0.567	0.654	0.555	0.612
Throwing the shot forward	-0.126	0.163	0.152	-0.212	0.178	0.254
Throwing the shot backward	0.156	-0.178	0.245	0.209	-0.215	0.267

TABLE 58

Correlational Interrelationship of Preparatory Results of Women 400m Runners of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation					
	50.00-51.00 sec	51.00-52.00 sec	52.00-53.00 sec	53.00-54.00 sec	54.00-55.00 sec	55.00-56.00 sec
Barbell snatch	-0.201	0.186	-0.216	0.256	0.267	0.297
Half squat with the barbell	0.178	0.196	0.225	0.278	-0.345	-0.376
Standing long jump	0.145	-0.188	0.265	0.207	0.255	0.279
Vertical jump	0.177	0.225	-0.254	-0.267	0.239	0.321
Triple jump from place	0.245	0.259	-0.235	0.326	0.286	0.324
10-fold jump from place	0.206	-0.276	0.367	0.326	0.367	0.302
Jumps from leg to leg for 50m for time	0.457	0.558	0.425	0.365	0.375	0.324
Throwing the shot forward	0.198	0.209	0.176	-0.226	0.267	0.240
Throwing the shot backward	0.226	-0.187	0.256	-0.203	0.221	-0.198

TABLE 59

Correlational Interrelationship of Preparatory Results of Women 100m Hurdlers of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation					
	12.80-13.30 sec	13.30-13.80 sec	13.80-14.30 sec	14.30-14.80 sec	14.80-15.30 sec	15.30-15.80 sec
Barbell snatch	0.178	0.226	-0.193	0.167	-0.212	0.189
Half squat with the barbell	0.307	-0.378	0.287	-0.224	0.198	0.214
Standing long jump	-0.245	0.367	0.324	0.366	-0.325	0.278
Vertical jump	0.367	-0.325	0.405	0.356	0.309	0.352
Triple jump from place	0.225	0.376	0.324	0.376	-0.321	-0.307
10-fold jump from place	0.387	0.325	0.388	0.355	0.367	0.430
Jumps from leg to leg for 50m for time	0.452	0.387	0.412	0.387	0.425	0.367
Throwing the shot forward	-0.225	0.178	0.165	0.215	0.209	-0.230
Throwing the shot backward	-0.178	0.193	0.245	-0.188	0.180	0.193

TABLE 60

Correlational Interrelationship of Preparatory Results of Women 400m Hurdlers of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation					
	54.00-55.00 sec	55.00-56.00 sec	56.00-57.00 sec	57.00-58.00 sec	58.00-59.00 sec	59.00-60.00 sec
Barbell snatch	0.176	0.165	0.207	0.245	-0.188	0.216
Half squat with the barbell	0.224	0.276	-0.208	0.265	0.251	0.196
Standing long jump	0.220	-0.176	0.245	0.214	0.246	0.312
Vertical jump	0.324	0.367	-0.256	0.269	0.214	0.267
Triple jump from place	-0.265	0.329	0.367	-0.287	0.265	0.303
10-fold jump from place	0.387	0.345	0.408	0.364	0.387	0.321
Jumps from leg to leg for 50m for time	0.456	0.407	0.356	0.392	0.342	0.376
Throwing the shot forward	0.256	-0.221	0.242	0.193	-0.187	0.208
Throwing the shot backward	0.324	-0.287	0.267	0.245	-0.208	-0.280

Now we will look more closely at the results of the correlational analyses which revealed the essence of the positive interrelationship between the competitive events and the ten-fold jump from place and the leg to leg jumps for 50m. First it should be noted that these two exercises appear more transferable than other specialized-preparatory exercises (barbell clean, half squat with the barbell on the shoulders, throwing the shot put forward and backward, long jump from place, triple jump and vertical jump). Here we don't have in view higher coefficients of correlation but the number of cases of positive interrelationships which appear on different levels of sports mastery in each of the track and field sprint and hurdle events (see tables 51-60).

Thus in the ten-fold jump from place, on the fifth level of sports results, the cumulative training effect appears in the men's 110m hurdle run, ---from 13.50-14.0 sec to 15.50-16.00 sec. and in the women's 100m hurdle run, --- from 12.80-13.3sec to 15.3-15.8sec.

It had a role in the men's 100m run in four instances from 10.50-10.80sec to 11.0-11.70sec and in the women's 100m,--- from 11.50-11.80sec to 12.40-12.70sec.

The same held true in the women's 200m run, --- from 23.50-24.00sec to 25.00-25.50sec and in the men's 400m hurdle run, --- from 49.50-50.50sec to 52.50-53.50sec as well as in the women's, from 54.00-55.00sec to 58.00-59.00sec. The positive transfer was observed in the men's 200m on three levels of sports mastery --- 21.50-22.00sec, 22.50-23.00sec and 23.00-23.50sec and on two levels in the men's 400m, --- 49.00-50.00sec and 50.00-51.00sec and in the women's 400m, 52.00-53.00sec and 54.00-55.00sec.

In the jumps from leg to leg for 50m, the cumulative effect appeared on all levels with the men as well as with the women in the 100m run. In regard to the 200m run with the men it was not observed except on one level (20.50-21.00sec), and with the women, it had a place only on the 25.50sec to 12.70sec level. In the men's 400m, a positive transfer took place on four levels (from 46.00-47.00sec to 49.00-50.00sec) and with the women, on five levels (from 50.00-51.00sec to 54.00-55.00sec). In all cases there was a cumulative training effect in the women's 100m hurdles (from 12.80-15.80sec) and in the men's 400m hurdles (from 49.50-55.50sec). In the men's 110m hurdles the cumulative effect was seen only on one level (15.50-16.00sec). The same occurred in the women's 400m hurdles (58.00-59.00sec).

With an increase in a number of take-offs when executing the above mentioned jump exercises, there is an increase in the number of cases of positive transfer of physical abilities on different levels of sports mastery. This makes it possible to propose that of all the jump exercises found in sports practice (and there are several dozens of these) the most transferable to the competitive movement are those that are executed over long segments of time. Related to this are the different jumps from leg to leg, multiple jumps, skips on one leg, double leg jumps and others, for distances ranging from 20-30 to 100-150m.

The transfer ability of these exercises can be explained by the fact that they, to a good extent, repeat the biomechanical parameters of the competitive movement, have a similar appearance to the muscle work regimes, and use the same intensity zones. The duration of the effect can correspond to the entire distance or its main joint parts (as for example the starting acceleration), and if necessary, the effect can be made greater. Besides this, all of these exercises can be executed in lighter as well as in more complex (with weights, jumps or skips for height and other) conditions.

Since the problem of using of lighter and more complex conditions when executing jump exercises has been touched upon, it should be noted that there is a straight line relationship to the specialized-developmental and competitive exercises. They have been and are used at the present time by athletes of various sports qualifications.

Without expanding this problem we propose that with time, the volume of jump exercises with the use of lightened and more complex conditions will significantly increase in comparison to the amount of work which is presently being done. Of course specialists will have to resolve several problems. First will be to show the optimal correlation between training loads executed in the standard, lightened and more complex conditions. Second will be to determine the weight to be used. Third will be to not use lighter and more complex conditions sporadically as is presently being done, but systematically for the duration of the entire cycle of developing sports form. Only in this way will it be possible to resolve the problem of developing speed (lightened conditions) and strength (more complex conditions) abilities.

Specialists should also devote attention to the selection of the optimal angles of incline of the roads used for development of speed or strength capabilities. Dependent upon this is not only the effectiveness of developing the necessary physical abilities, but also the number of technical errors that appear. These errors always play a role when doing the exercises.

The absence of the cumulative training effect from the snatch and half squat with the barbell on the shoulders to the competitive event in the men's and women's 400m hurdles, as well as the barbell snatch to the 200 and 400m can be interpreted in different ways. In one case, it indicates the ineffectiveness of the given exercise, while in another, that the positive transfer is conditioned by the use of other methodological means. This relates primarily to the number of repetitions in one set, the compactness of the strength training sessions or their parts, and likewise the zones of intensity used.

It is obvious that the cumulative effect from strength exercises will appear only when they are close to the competitive event according to the biomechanical aspects and methodological parameters.

Transfer of Physical Abilities in the Jumps When Using Different Exercises

Considering the specifics of training in the track and field jumps, we studied the influence of different runs (sprints), jumps, throws and strength exercises that are most frequently used in sport practice and their relationship to the main movement (event).

The system of training jumpers has been made more complex in the last 10 years considering the duration of the cycles of developing sports form during which a large number of specialized exercises are used together with repetition of the competitive event and its' separate segments [42, 81,212]. The percentage of special exercises, in comparison to the total volume of training time, was 50-60%. Improving the competitive event by repeating the entire movement comprised 20-30% of the total time. A frequent exception to this were high jumpers whose total training loads in the competitive event training were 10-20% greater than athletes specializing in other jump events. The percent of strength and throwing exercises varied between 15-25%.

Now we will analyze the factual material touching on the problem of training transfer of different exercises to the competitive exercise. We will begin with the men's and women's long jump. The correlational analyses (tables 61,62) substantiate that the positive cumulative effect is observed when all types of run and jump exercises are used and the two throwing exercises—throwing the shot forward and backward are absent. The greatest interrelationships were seen in the jumps with a short approach run, in the 30m run with a flying start and in the ten-fold jump from place. In the barbell snatch with men, a positive training transfer was observed when the sports results were from 6.5-7.3m and in women from 5.0-6.1m. Several others were seen in the half squat with the barbell on the shoulder. In the women, the cumulative effect appeared on all levels of sports results and in the men only on three, from 6.5-7.6m.

TABLE 61

Correlational Interrelationship of Preparatory Results of Long Jumpers of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	8.20-7.90m	7.90-7.60m	7.60-7.30m	7.30-7.00m	7.00-6.50m
30m run with a flying start	0.765	0.689	0.742	0.730	0.712
30m run from the blocks	0.687	0.724	0.730	0.680	0.654
60m run from the blocks	0.789	0.773	0.698	0.654	0.686
100m run from the blocks	0.645	0.724	0.670	0.680	0.558
Long jump from place	0.567	0.514	0.566	0.600	0.489
Triple jump from place	0.624	0.568	0.608	0.468	0.520
5-fold jump from place	0.756	0.708	0.689	0.725	0.680
10-fold jump from place	0.765	0.745	0.776	0.689	0.724
Jump from a short run-up	0.765	0.890	0.786	0.766	0.721
Barbell snatch	-0.256	-0.187	0.224	-0.365	0.456
Half squat with a barbell	0.245	-0.214	0.356	0.425	0.403
Throwing the shot forward	0.167	-0.188	0.225	-0.276	0.246
Throwing the shot backward	-0.255	-0.263	0.245	-0.230	0.324

TABLE 62

Correlational Interrelationship of Preparatory Results of Women Long Jumpers of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	7.00-6.70m	6.70-6.40m	6.40-6.10m	6.10-5.50m	5.50-5.00m
30m run with a flying start	0.876	0.824	0.855	0.786	0.824
30m run from the blocks	0.742	0.780	0.725	0.689	0.690
60m run from the blocks	0.806	0.765	0.803	0.765	0.720
100m run from the blocks	0.698	0.730	0.688	0.675	0.720
Long jump from place	0.567	0.624	0.560	0.607	0.524
Triple jump from place	0.665	0.725	0.703	0.645	0.567
5-fold jump from place	0.765	0.706	0.745	0.683	0.725
10-fold jump from place	0.780	0.824	0.767	0.760	0.699
Jump from a short run-up	0.924	0.967	0.876	0.830	0.856
Barbell snatch	0.267	0.203	-0.336	0.390	0.456
Half squat with a barbell	0.524	0.467	0.506	0.425	0.398
Throwing the shot forward	0.167	-0.124	0.220	-0.187	0.150
Throwing the shot backward	0.120	-0.178	0.156	-0.242	0.256

With men and women high jumpers a correlational interrelationship was observed in all running and jumping exercises. However, the significance was much greater in the jump exercises than in the running exercises. The most informative and transferable exercise appears to be the vertical jump with a short run-up. The correlational interrelationships in the men vary between 0.876-0.945 and in the women, from 0.865-0.965. They are also sufficiently high in the jumps for distance from a run-up. In the men, the interrelationship in one case exceeded 0.800 and in five others-0.700. In the women, it varied from 0.680 to 0.808.

There was no positive transfer in the two throwing exercises---throwing the shot forward and throwing the shot backward. In the barbell snatch, the cumulative training effect was seen only with the men and only on one level of results --- 1.80-1.90m. Making up for

this is that an effect is always observed when using the second strength exercise—the half squat with the barbell on the shoulders. More details of the correlational analyses in the exercises used are presented in tables 63-64.

TABLE 63
Correlational Interrelationship of Preparatory Results of Men High Jumpers of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	2.30-2.20m	2.20-2.10m	2.10-2.00m	2.00-1.90m	1.90-1.80m
30m run with a flying start	0.398	0.365	0.405	0.368	0.424
30m run from the blocks	-0.367	0.425	0.387	-0.356	0.405
60m run from the blocks	0.425	0.365	0.405	-0.354	0.390
100m run from the blocks	0.685	0.654	0.705	0.678	0.603
Long jump from place	0.542	0.546	0.456	0.490	0.600
Triple jump from place	0.460	0.506	0.405	0.466	0.380
5-fold jump from place	0.570	0.506	0.600	0.524	0.544
10-fold jump from place	0.945	0.925	0.880	0.912	0.876
Jump from a short run-up	0.765	0.786	0.805	0.756	0.706
Barbell snatch	-0.187	0.190	-0.245	0.330	-0.356
Half squat with a barbell	0.657	0.700	0.685	0.745	0.688
Throwing the shot forward	0.205	0.178	-0.242	0.187	0.255
Throwing the shot backward	-0.165	0.245	0.206	-0.254	0.280

TABLE 64

Correlational Interrelationship of Preparatory Results of Women High Jumpers of Various Qualifications in Several Specialized-Preparatory, Specialized-Devclopmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	2.00-1.90m	1.90-1.80m	1.80-1.70m	1.70-1.60m	1.60-1.50m
30m run with a flying start	0.424	0.505	0.398	0.456	0.402
30m run from the blocks	0.367	0.456	0.405	0.412	0.366
60m run from the blocks	0.390	0.367	0.400	0.365	0.380
100m run from the blocks	0.607	0.705	0.654	0.660	0.595
Long jump from place	0.600	0.524	0.621	0.550	0.580
Triple jump from place	0.560	0.706	0.542	0.456	0.488
5-fold jump from place	0.650	0.570	0.666	0.564	0.428
10-fold jump from place	0.886	0.965	0.905	0.890	0.865
Jump from a short run-up	0.778	0.765	0.680	0.724	0.808
Barbell snatch	0.245	0.256	-0.206	0.240	-0.324
Half squat with a barbell	0.650	0.785	0.690	0.724	0.690
Throwing the shot forward	-0.145	0.178	0.156	0.205	-0.178
Throwing the shot backward	-0.206	0.178	-0.245	0.221	0.245

A general picture of the correlational relationship between the competitive exercise and other means of training used in the men's and women's triple jump differed very little from that which was observed in the long jump and high jump (tables 65-66). Here once again, a cumulative effect appears in all the running and jumping exercises. In addition, the coefficients of correlation in these exercises are somewhat higher than with the long jumpers and high jumpers.

TABLE 65

Correlational Interrelationship of Preparatory Results of Men Triple Jumpers of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	17.00-16.50m	16.50-16.00m	16.00-15.50m	15.50-15.00m	15.00-14.00m
30m run with a flying start	0.765	0.780	0.689	0.720	0.690
30m run from the blocks	0.680	0.720	0.654	0.680	0.646
60m run from the blocks	0.876	0.790	0.824	0.756	0.700
100m run from the blocks	0.705	0.745	0.650	0.688	0.624
Long jump from place	0.678	0.645	0.705	0.605	0.645
Triple jump from place	0.788	0.856	0.765	0.780	0.724
5-fold jump from place	0.856	0.905	0.885	0.804	0.783
10-fold jump from place	0.924	0.867	0.900	0.845	0.786
Jump from a short run-up	0.954	0.906	0.924	0.890	0.906
Barbell snatch	-0.178	0.188	0.226	0.200	0.286
Half squat with a barbell	0.398	0.324	0.454	0.370	0.356
Throwing the shot forward	0.124	0.103	0.225	-0.165	0.207
Throwing the shot backward	-0.212	-0.167	0.187	0.214	0.288

TABLE 66

Correlational Interrelationship of Preparatory Results of Women Triple Jumpers of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	14.50-14.00m	14.00-13.50m	13.50-13.00m	13.00-12.50m	12.50-12.00m
30m run with a flying start	0.824	0.766	0.790	0.740	0.680
30m run from the blocks	0.760	0.685	0.704	0.670	0.678
60m run from the blocks	0.670	0.745	0.724	0.786	0.705
100m run from the blocks	0.650	0.620	0.596	0.630	0.560
Long jump from place	0.456	0.565	0.626	0.480	0.564
Triple jump from place	0.654	0.700	0.624	0.650	0.476
5-fold jump from place	0.788	0.765	0.806	0.745	0.702
10-fold jump from place	0.865	0.806	0.854	0.786	0.790
Jump from a short run-up	0.906	0.866	0.776	0.754	0.700
Barbell snatch	0.221	0.176	-0.250	0.312	0.350
Half squat with a barbell	0.456	0.396	0.425	0.366	0.380
Throwing the shot forward	0.124	0.120	-0.188	0.167	0.245
Throwing the shot backward	-0.225	0.186	0.245	-0.220	0.265

The most transferable exercises appear to be three jump exercises—triple jump from place and with a short run-up, five- and ten-fold jumps. Coefficients of correlation in the triple jump with a short run up in the men vary from 0.890 - 0.954 and in the women from 0.700 to 0.906. They are also high in the ten-fold jump. In the men, the amount of interrelationship in one case exceeded 0.700, in three cases---0.800 and in one case---0.900. With the women it varied between 0.786 - 0.865.

In the snatch, the correlational interrelationship took place only in the women and only on one level of performance, 12.0-12.5m. In the half squat with the barbell on the shoulders the correlational effect existed on all levels of sports mastery and in the men, it was absent on the 6.0-16.5m level. There was no training transfer in the two throwing exercises ---throwing the shot forward and backward. Here the correlational interrelationship varied from 0.103-0.265.

Results of the correlational analysis between the exercises used by pole vaulters having different sports qualifications are presented in table 67. They testify to the presence of a high interrelationship between the competitive exercise and all the running exercises. Its greatest amount was fixed at 0.745-0.865 in the 30m run with a flying start. Somewhat less significant was the 30 and 60m runs with a low start (blocks) and the 100m run.

TABLE 67
Correlational Interrelationship of Preparatory Results of Men Pole Vaulters of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	5.80-5.50m	5.50-5.20m	5.20-4.90m	4.90-4.60m	4.60-4.00m
30m run with a flying start	0.865	0.856	0.789	0.745	0.776
30m run from the blocks	0.742	0.778	0.675	0.705	0.688
60m run from the blocks	0.786	0.745	0.720	0.765	0.680
100m run from the blocks	0.705	0.742	0.680	0.712	0.654
Vertical jump	0.660	0.705	0.656	0.565	0.600
Long jump from place	0.556	0.605	0.524	0.567	0.620
Triple jump from place	0.624	0.580	0.526	0.587	0.606
5-fold jump from place	0.580	0.621	0.564	0.542	0.567
Pole vault with a short run-up	0.845	0.808	0.745	0.786	0.706
Long jump with run-up	0.654	0.702	0.650	0.712	0.657
Barbell snatch	0.386	0.365	0.452	0.396	0.360
Half squat with a barbell	0.456	0.506	0.422	0.390	0.425
Bench press	-0.306	0.387	0.356	0.452	0.405
Throwing the shot forward	0.189	0.156	-0.224	0.256	0.206
Throwing the shot backward	-0.214	0.198	0.245	-0.244	0.305

A cumulative effect was seen in all the jump exercises. The most transferable of them is the pole vault with a short run up and long jumps from a full run up. A positive transfer was observed on all levels of sports results in the barbell snatch and in the half squat with the barbell on the shoulders. In the bench press, the cumulative effect was not seen except at the 5.50-5.80m level. There was no positive interrelationship with the two throwing exercises --- throwing the shot forward and throwing the shot backward.

Results of the correlational analysis of the means of training used by the women pole vaulters are seen in table 68. Here, a positive interrelationship begins with 0.423. It shows the presence of a positive transfer in all the running and jumping exercises with the competitive exercise. The greatest cumulative effect is observed in the 60m run from blocks (0.856 and 0.886), in the 30m run from blocks (0.786 and 0.724), and in the pole vault with a short run up (0.788 and 0.865). Low coefficients of correlation are observed in the vertical jumps (0.588 and 0.662), in the standing long jump (0.657 and 0.624), in the triple jump from place (0.612 and 0.587), in the five-fold jump from place (0.594 and 0.620), and likewise in the long jump with a full run up (0.586 and 0.564).

TABLE 68

Correlational Interrelationship of Preparatory Results of Women Pole Vaulters of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation	
	2.80-3.20	3.20-3.70
30m run from the blocks	0.786	0.724
60m run from the blocks	0.856	0.886
100m run from the blocks	0.687	0.712
Vertical jump	0.568	0.662
Long jump from place	0.657	0.624
Triple jump from place	0.612	0.587
5-fold jump from place	0.594	0.620
Pole vault with a short run-up	0.788	0.865
Long jump with a run-up	0.586	0.564
Barbell snatch	0.512	0.556
Half squat with a barbell	0.488	0.564
Bench press	0.542	0.546
Throwing the shot forward	0.376	0.425
Throwing the shot backward	0.380	0.350

In the men, the indices in the above mentioned exercises were somewhat higher (see table 67). A weak positive interrelationship was observed in the barbell snatch (0.512 and 0.556), in the half squat with the barbell on the shoulders (0.488 and 0.564) and in the bench press (0.542 and 0.546). In throwing the shot forward and backward, a cumulative effect existed only in the first exercise on the level of 3.20-3.70m (0.425).

Correlational analyses in the specialized-preparatory, specialized-developmental and competitive exercises allowed us to show a general picture of transfer of physical abilities from one means of training to another. It was seen that in all the jumpers, the greatest amount of interrelationship was observed between results in the jumps using a short and full (competitive) approach run. The coefficient of correlation varied most frequently between 0.750-0.900.

High amounts of transfer of the cumulative effect was seen in all the jump exercises in the long jumpers, triple jumpers, and pole-vaulters. What is pertinent to the men and women athletes specializing in the high jump, is that in all cases, a weak interrelationship between the test results was observed on the 0.400 level.

In we compare the amounts of correlational interrelationship between single and triple jumps (vertical jump, long jump, and triple jump from place) and multiple jumps (five- and ten-fold) then it can be seen that the second form of exercises (multiple jumps) have a greater number of cases in which the correlation is higher than with the first exercises.

The most transferable strength exercise is the half squat with the barbell on the shoulders. Here, both with the men and women, in the high jump and in the pole vault as well as with the women in the long jump and triple jump, the transfer of physical abilities is observed on all levels of sports mastery. In the men's long jump it appears on three levels and in the triple jump,--- on four. In the second strength exercise (barbell snatch) the cumulative training effect had a place on several levels of sports mastery in most events except for the women's high jump and men's triple jump.

A positive influence on sports results increases in the competitive event, on all levels of sports mastery, was seen with the barbell snatch, half squat with the barbell on the shoulders and the bench press.

The least transferable was the throwing of the shot forward and throwing the shot backward. Only in one case (women specializing in the pole vault) was a cumulative effect noticed.

Transfer of Physical Abilities in the Throws with the Use of Different Types of Exercises

The core of the training system for throwers appears to be, that over the duration of the yearly cycle, the athletes use a sufficiently large number of exercises repeating the basic movement in lighter and more difficult conditions --- i.e., using implements having different weights. The deviation range when using lighter and heavier implements in comparison to the competitive implement weight, can vary from several percent to the tens and even hundreds of percent.

It is generally known that for developing strength abilities, heavier implements are used and for speed, lighter. In the last two decades the total training loads used in the year-round training cycle with the use of lighter, heavier and competitive weight implements varied between 30-50% of the total amount of time used for training.

In the last 50-60 years in the past century, athletes basically used the competitive weight implement. Heavier and lighter implements were used sporadically and in small volume. It was thought that heavier implements should be used in the fall-winter season and lighter weights-should be included in the training immediately before the beginning of competition. Usually the heavier and lighter implements were used during 4-6 week cycles.

Literary sources which touch on the study of this problem [18, 33, 265, 266] testify to the positive influence of lighter and heavier implements on an increase in sports achievements in the basic throws. It was correctly noted that heavier implements can have a positive influence on an increase in physical abilities and a negative one on technical mastery [18, 152].

The experimental material received by us in the process of evaluating questionnaires filled out by athletes having various sports qualifications (see tables 69-84) testify to the

presence of a positive correlational interrelationship between lighter, heavier and competitive weight implements in the structure of the entire movement in all types of throws, on different levels of sports mastery. The greatest amounts of correlational interrelationships were most frequently found in cases where the deviations between the lighter and heavier implement weights was insignificant in relation to the competitive---from 10-20%. The smallest correlation was fixed in the hammer throw when athletes had results in the at 60-65m range when throwing the 16kg weight (0.425). A weak interrelationship (0.365) was observed between results in the shotput with weights of 5.0 and 7.260 kg in athletes throwing the shot 20-21m.

The compiled data once again substantiated the correctness of the position in the theory and practice of track and field, that throws with lighter and heavier implements appear to be the most transferable to the competitive exercise. The reason for this is that they are identical to themselves according to the basic parameters beginning with the technical and rhythmical composition and ending with the consecutiveness of inclusion of the muscular groups in the execution, the muscle work regimes and so on.

What is pertinent here is that those negative consequences, which always have a place here, are so insignificant that after ceasing use of one or another lighter or heavier implement, they can be eliminated in several weekly cycles. The latter of these (heavier implements) relates to the deviations in technical mastery which has been noted by several authors [18, 152]. Foremost among these is the change in the release angle of the implement during the final effort, the deviation or lean of the trunk backward, the decreased amplitude of movement of the implement and so on.

In practically all track and field disciplines, there are no identical actions, according to all parameters of the exercise, that repeat those in the competitive event. Because of this, when using one or another exercise, it is necessary to a large measure, to think of its positive effects, not about its negatives. The exercises should be selected so that the positive influence prevails.

Results of the correlational analysis give evidence not only to the fact that lighter and heavier implements have a positive effect on increasing the sports result in the competitive exercise (event), but to the presence of training transfer to the competitive action with the assistive exercises (see tables 69-84).

TABLE 69

Correlational Interrelationship Between Preparatory Results in Several Specialized-Preparatory, Specialized-Developmental Exercises with Lighter and Heavier Implements with Results in the Shot Put Throw by Athletes Having Various Qualifications

Exercise	Sports Result, Coefficient of Correlation						
	14-15m	15-16m	16-17m	17-18m	18-19m	19-20m	20-21m
Throwing a 5kg shot	0.768	0.702	0.724	0.564	0.512	0.456	0.365
Throwing a 6kg shot	0.872	0.765	0.689	0.654	0.607	0.582	0.498
Throwing a 8kg shot	0.654	0.669	0.754	0.788	0.845	0.824	0.754
Throwing a 9kg shot	---	---	0.706	0.806	0.765	0.824	0.724
Throwing a 10kg shot	---	---	0.552	0.605	0.786	0.765	0.714
Throwing a 6kg shot from place	0.882	0.786	0.765	0.806	0.776	0.721	0.687
Throwing a 8kg shot from place	0.712	0.687	0.722	0.742	0.825	0.786	0.670
Barbell snatch	0.410	-0.387	0.406	-0.354	0.276	0.211	0.197
Power clean	-0.366	0.324	-0.287	-0.212	0.226	0.268	0.107
Squat with a barbell	0.521	0.605	0.724	0.807	0.657	0.398	0.165
Bench Press	0.574	0.665	0.642	0.786	0.602	0.605	0.126
Standing long jump	0.398	0.344	-0.324	0.245	0.221	0.156	0.127
Triple jump from place	0.345	0.367	0.325	0.214	0.242	-0.198	0.222
Vertical jump	0.566	0.488	0.376	0.324	0.256	0.224	0.178
Throwing a shot forward	-0.367	0.321	0.298	0.246	-0.200	0.242	0.192
Throwing a shot backward	-0.387	0.345	-0.309	0.288	0.244	-0.187	0.156
Running 30m from blocks	0.426	0.367	0.312	0.242	0.212	-0.178	0.198

TABLE 70

Correlational Interrelationship Between Preparatory Results in the Shot Put in Men Athletes Having Various Qualifications when Using Lighter, Heavier and Competitive Implements Throwing from Place and in the Entire Movement

No. n/n	Indices (Results)	1	2	3	4	5	6	7	8
1	Throwing a 5kg shot	*	0.665 / 0.542	0.768 / 0.365	0.422 / 0.398	--- / 0.724	--- / 0.714	0.675 / 0.542	0.561 / 0.432
2	Throwing a 6kg shot		*	0.872 / 0.498	0.678 / 0.752	0.546 / 0.765	0.476 / 0.387	0.788 / 0.712	0.670 / 0.724
3	Throwing a 7.260kg shot			*	0.654 / 0.754	--- / 0.724	--- / 0.714	0.865 / 0.764	0.715 / 0.760
4	Throwing a 8kg shot				*	0.690 / 0.542	0.654 / 0.712	0.650 / 0.812	0.808 / 0.851
5	Throwing a 9kg shot					*	0.754 / 0.825	0.456 / 0.524	0.520 / 0.611
6	Throwing a 10kg shot						*	0.887 / 0.824	0.780 / 0.812
7	Throwing a 7.260kg shot from place							*	0.775 / 0.841
8	Throwing a 8kg shot from place								*

Note: here and further on, the amounts of coefficient of correlation of the athletes of low qualifications are presented in the numerator and high level athletes in the denominator.

TABLE 71

Correlational Interrelationship Between Preparatory Results in Several Specialized-Preparatory, Specialized-Developmental Exercises, Exercises with Lighter and Heavier Implements with Results in the Shot Put in Women Athletes Having Various Qualifications

Exercise	Sports Result, Coefficient of Correlation						
	13-14m	14-15m	15-16m	16-17m	17-18m	18-19m	19-20m
Throwing a 3kg shot	0.765	0.745	0.645	0.687	0.654	0.324	0.567
Throwing a 3.5kg shot	0.778	0.742	0.742	0.789	0.738	0.736	0.788
Throwing a 5kg shot	0.654	0.765	0.704	0.789	0.845	0.792	0.765
Throwing a 6kg shot	0.554	0.589	0.524	0.524	0.627	0.785	0.806
Throwing a 7.250kg shot	---	---	---	0.665	0.765	0.675	0.706
Throwing a 3.5kg shot from place	0.865	0.804	0.842	0.708	0.658	0.742	0.697
Throwing a 6kg shot from place	0.487	0.567	0.506	0.765	0.724	0.708	0.745
Barbell snatch	0.556	-0.387	0.394	0.345	-0.287	0.245	0.245
Power clean	0.425	0.367	-0.302	-0.265	0.214	-0.198	0.197
Squat with a barbell	0.605	0.567	0.424	0.455	0.396	-0.345	0.226
Bench Press	0.547	0.654	0.567	0.508	0.456	0.367	0.356
Standing long jump	0.456	0.421	0.366	-0.307	-0.293	-0.245	0.224
Triple jump from place	0.425	-0.365	0.305	0.276	0.224	-0.198	0.241
Vertical jump	0.514	0.467	0.424	0.356	0.267	0.212	0.224
Throwing a shot forward	0.396	-0.324	0.278	-0.250	0.221	-0.187	0.226
Throwing a shot backward	0.422	0.456	0.387	-0.324	0.226	0.235	-0.229
30m run from blocks	0.498	0.425	0.376	-0.309	0.256	0.187	0.167

TABLE 72

Correlational Interrelationship Between Preparatory Results in the Shot Put in Women Athletes Having Various Qualifications when Using Lighter, Heavier and Competitive Implements Throwing from Place and in the Entire Movement

No. n/n	Indices	1	2	3	4	5	6	7
1	Throwing a 3kg shot	*	0.765 0.567	0.655 0.765	0.456 0.612	0.089 0.365	0.742 0.688	0.612 0.654
2	Throwing a 4kg shot		*	0.654 0.765	0.554 0.806	 0.706	0.789 0.842	0.824 0.708
3	Throwing a 5kg shot			*	0.564 0.589	0.456 0.396	0.664 0.720	0.785 0.698
4	Throwing a 6kg shot				*	0.675 0.624	0.397 0.645	0.664 0.712
5	Throwing a 7.260kg shot					*	 0.706	0.612 0.765
6	Throwing a 4kg shot from place						*	0.721 0.694
7	Throwing a 5kg shot from place							*

TABLE 73
Correlational Interrelationship Between Several Specialized-Preparatory, Specialized-Developmental Exercises and Exercises with Lighter and Heavier Implements with Results in the Discus Throw by Women Athletes Having Various Qualifications

Exercise	Sports Result, Coefficient of Correlation					
	40-45m	45-50m	50-55m	55-60m	60-65m	65-70m
Throwing a 1.5kg disc	0.789	0.845	0.678	0.742	0.645	0.548
Throwing a 1.8kg disc	0.825	0.768	0.812	0.856	0.835	0.789
Throwing a 2.25kg disc	0.765	0.742	0.812	0.857	0.798	0.849
Throwing a 2.5kg disc	0.567	0.667	0.824	0.765	0.895	0.824
Throwing a 3kg shot from place	0.467	0.487	0.675	0.724	0.697	0.765
Throwing a 4kg shot from place	0.397	0.425	0.567	0.825	0.820	0.768
Barbell snatch	0.455	-0.367	0.312	0.256	0.214	-0.112
Power clean	0.405	0.436	0.392	-0.226	0.198	0.168
Squat with a barbell	0.398	0.345	-0.376	0.295	0.225	-0.097
Bench Press	0.567	0.465	0.324	0.376	0.254	0.245
Standing long jump	0.651	0.542	0.307	0.297	-0.210	0.242
Triple jump from place	0.287	0.276	0.305	-0.226	-0.198	0.197
Vertical jump	0.456	0.367	0.321	0.264	0.197	0.251
Throwing a shot forward	0.265	-0.211	0.128	0.167	0.198	0.219
Throwing a shot backward	0.407	0.365	0.321	-0.245	0.197	-0.176
30m run from blocks	0.266	-0.245	0.207	0.189	0.210	-0.124

TABLE 74

Correlational Interrelationship Between Preparatory Results in the Women Discus Throwers Having Various Qualifications when Using Lighter, Heavier and Competitive Implements Throwing from Place and in the Entire Movement

No. n/n	Indices	1	2	3	4	5	6	7	8
1	Throwing a 1.5kg disc	*	0.772 0.832	0.789 0.548	0.435 0.567	0.365 0.398	0.786 0.645	0.456 0.392	0.365 0.452
2	Throwing a 1.8kg disc		*	0.825 0.789	0.876 0.812	0.738 0.765	0.690 0.736	0.567 0.662	0.447 0.367
3	Throwing a 2kg disc			*	0.765 0.849	0.567 0.824	0.889 0.782	0.467 0.765	0.397 0.768
4	Throwing a 2.25kg disc				*	0.740 0.804	0.678 0.756	0.624 0.655	0.706 0.788
5	Throwing a 2.5kg disc					*	0.546 0.652	0.398 0.745	0.436 0.703
6	Throwing a 2kg disc from place						*	0.657 0.789	0.704 0.845
7	Throwing a 3kg shot from place							*	0.654 0.720
8	Throwing a 4kg shot from place								*

TABLE 75

Correlational Interrelationship Between Several Specialized-Preparatory, Specialized-Developmental Exercises and Exercises with Lighter and Heavier Implements With Results in the Discus Throw by Women Athletes Having Various Qualifications

Exercise	Sports Result, Coefficient of Correlation					
	40-45m	45-50m	50-55m	55-60m	65-70m	70-75m
Throwing a 0.75kg disc	0.886	0.765	0.745	0.820	0.702	0.642
Throwing a 1.25kg disc	0.668	0.650	0.786	0.724	0.864	0.765
Throwing a 1.5kg disc	0.456	0.556	0.624	0.785	0.888	0.789
Throwing a 2kg disc	0.425	0.652	0.674	0.721	0.789	0.765
Throwing a 3kg shot from place	0.459	0.424	0.688	0.798	0.762	0.884
Barbell snatch	0.567	0.672	0.554	0.486	0.265	0.228
Power clean	0.429	0.498	0.389	0.298	-0.167	0.211
Squat with a barbell	0.466	0.421	-0.387	0.305	0.252	0.145
Bench Press	0.689	0.608	0.542	0.442	0.376	0.276
Standing long jump	0.688	0.754	0.657	0.456	0.367	0.398
Triple jump from place	0.456	0.424	0.368	0.305	0.224	0.226
Vertical jump	0.589	0.456	0.307	0.254	-0.212	0.269
Throwing a shot forward	0.388	0.342	-0.245	0.225	-0.265	0.241
Throwing a shot backward	0.457	0.424	-0.365	0.312	-0.207	0.212
30m run from blocks	0.396	0.324	0.292	0.205	-0.224	0.267

TABLE 76

Correlational Interrelationship Between Preparatory Results in the Women Discus Throwers Having Various Qualifications when Using Lighter, Heavier and Competitive Implements Throwing from Place and in the Entire Movement

No. n/n	Indices	1	2	3	4	5	6	7
1	Throwing a 0.75kg disc	*	0.886 0.642	0.668 0.765	0.456 0.789	0.425 0.765	0.786 0.665	0.459 0.874
2	Throwing a 1kg disc		*	0.668 0.765	0.456 0.789	0.425 0.765	0.724 0.845	0.456 0.607
3	Throwing a 1.25kg disc			*	0.686 0.782	0.546 0.678	0.624 0.675	0.409 0.524
4	Throwing a 1.5kg disc				*	0.660 0.745	0.488 0.452	0.376 0.566
5	Throwing a 2kg disc					*	0.355 0.393	0.586 0.654
6	Throwing a 1kg disc from place						*	0.554 0.607
7	Throwing a 3kg shot from place							*

TABLE 77

Correlational Interrelationship Between Several Specialized-Preparatory, Specialized-Developmental Exercises and Exercises with Lighter and Heavier Implements with Results in the Javelin Throw by Men Athletes Having Various Qualifications

Exercise	Sports Result, Coefficient of Correlation						
	50-55m	55-60m	60-65m	65-70m	70-75m	75-80m	80-85m
Throwing a 0.6kg javelin	0.765	0.780	0.845	0.678	0.677	0.565	0.687
Throwing a 0.7kg javelin	0.678	0.730	0.737	0.654	0.725	0.845	0.731
Throwing a 0.9kg javelin	0.556	0.498	0.678	0.398	0.678	0.578	0.646
Throwing a 1kg javelin	0.405	0.466	0.766	0.608	0.733	0.698	0.702
Throwing a 3kg shot from place	0.546	0.478	0.724	0.767	0.789	0.654	0.645
Throwing a 4kg shot from place	---	---	0.642	0.567	0.669	0.541	0.597
Barbell snatch	0.467	0.489	0.405	0.486	0.245	0.198	-0.212
Power clean	0.560	0.425	0.397	0.408	0.287	0.178	-0.225
Squat with a barbell	0.167	-0.254	0.197	0.233	-0.168	0.157	0.201
Bench Press	0.377	-0.298	0.205	0.156	-0.198	0.167	0.165
Standing long jump	0.388	0.425	0.389	0.377	-0.256	0.209	-0.178
Triple jump from place	0.405	0.456	0.385	0.365	0.267	0.226	-0.159
Vertical jump	0.365	0.389	0.396	0.242	0.205	0.176	-0.204
Throwing a shot forward	-0.276	-0.356	0.309	-0.256	-0.187	0.265	0.202
Throwing a shot backward	0.297	-0.326	0.255	0.209	0.188	-0.177	0.125
30m run from blocks	0.556	0.451	0.366	0.321	0.297	-0.207	0.179

TABLE 78

Correlational Interrelationship Between Preparatory Results in the Men Javelin Athletes Having Various Qualifications when Using Lighter, Heavier and Competitive Implements Throwing from Place and in the Entire Movement

No. n/n	Indices	1	2	3	4	5	6	7	8
1	Throwing a 0.6kg javelin	*	0.665 / 0.607	0.765 / 0.687	0.725 / 0.706	0.398 / 0.456	0.678 / 0.546	0.365 / 0.456	0.324 / 0.420
2	Throwing a 0.7kg javelin		*	0.678 / 0.731	0.875 / 0.824	0.393 / 0.567	0.765 / 0.687	0.324 / 0.446	0.298 / 0.542
3	Throwing a 0.8kg javelin			*	0.556 / 0.646	0.405 / 0.702	0.679 / 0.776	0.546 / 0.645	--- / 0.597
4	Throwing a 0.9kg javelin				*	0.675 / 0.765	0.567 / 0.605	0.456 / 0.702	0.503 / 0.678
5	Throwing a 1kg javelin					*	0.405 / 0.702	0.824 / 0.742	0.675 / 0.786
6	Throwing a 0.8kg javelin from place						*	0.688 / 0.783	0.725 / 0.808
7	Throwing a 3kg shot from place							*	0.546 / 0.645
8	Throwing a 4kg shot from place								*

TABLE 79

Correlational Interrelationship Between Several Specialized-Preparatory, Specialized-Developmental Exercises and Exercises with Lighter and Heavier Implements With Results in the Javelin Throw by Women Athletes Having Various Qualifications

Exercise	Sports Result, Coefficient of Correlation					
	40-45m	45-50m	50-55m	55-60m	60-65m	65-70m
Throwing a 0.5kg javelin	0.765	0.765	0.654	0.688	0.724	0.622
Throwing a 0.7kg javelin	0.560	0.665	0.786	0.865	0.789	0.755
Throwing a 0.9kg javelin	0.424	0.365	0.642	0.569	0.724	0.675
Throwing a 2kg shot from place	0.365	0.388	0.678	0.721	0.654	0.561
Throwing a 3kg shot from place	0.305	0.325	0.456	0.677	0.598	0.645
Barbell snatch	0.604	0.556	0.467	0.377	0.289	0.221
Power clean	0.560	0.450	-0.325	0.245	0.277	-0.250
Squat with a barbell	0.245	-0.198	0.167	0.241	0.198	0.189
Bench Press	0.425	0.305	-0.207	0.176	0.156	-0.176
Standing long jump	0.476	-0.327	0.288	0.226	0.189	-0.227
Triple jump from place	0.456	0.398	0.356	-0.324	0.265	0.198
Vertical jump	0.466	0.324	0.297	0.216	-0.189	0.265
Throwing a shot forward	0.307	-0.388	0.305	-0.254	0.224	0.254
Throwing a shot backward	0.278	0.324	-0.277	0.198	0.245	0.230
30m run from blocks	0.654	0.552	0.478	0.376	0.244	-0.253

TABLE 80

Correlational Interrelationship Between Preparatory Results in the Women Javelin Athletes Having Various Qualifications when Using Lighter, Heavier And Competitive Implements Throwing from Place and in the Entire Movement

No. n/n	Indices	1	2	3	4	5	6	7
1	Throwing a 0.5kg javelin	*	0.765 0.622	0.567 0.706	0.487 0.625	0.765 0.698	0.387 0.665	0.412 0.546
2	Throwing a 0.6kg javelin		*	0.560 0.755	0.424 0.675	0.824 0.685	0.365 0.561	0.305 0.645
3	Throwing a 0.7kg javelin			*	0.396 0.683	0.624 0.607	0.455 0.534	0.567 0.624
4	Throwing a 0.8kg javelin				*	0.378 0.442	0.478 0.450	0.524 0.612
5	Throwing a 0.6kg javelin from place					*	0.678 0.765	0.650 0.708
6	Throwing a 2kg shot from place						*	0.654 0.789
7	Throwing a 3kg shot from place							*

TABLE 81

Correlational Interrelationships Between Several Specialized-Preparatory, Specialized-Developmental Exercises and Exercises with Lighter and Heavier Implements With Results in the Hammer Throw by Men Athletes Having Various Qualifications

Exercise	Sports Result, Coefficient of Correlation						
	45-50m	50-55m	55-60m	60-65m	65-70m	70-75m	75-80m
Throwing a 5kg hammer	0.867	0.765	0.789	0.824	0.542	0.645	0.564
Throwing a 6kg hammer	0.812	0.866	0.875	0.786	0.766	0.790	0.664
Throwing a 8kg hammer	0.564	0.521	0.689	0.869	0.805	0.842	0.798
Throwing a 9kg hammer	---	---	---	0.675	0.589	0.745	0.765
Throwing a 10kg hammer	---	---	---	0.542	0.745	0.801	0.824
Throwing a 16kg weight	---	---	---	0.452	0.586	0.677	0.609
Barbell snatch	0.560	0.467	0.559	0.451	0.245	0.198	0.245
Power clean	0.490	0.542	0.457	0.421	0.356	0.215	0.270
Squat with a barbell	0.620	0.546	0.524	0.437	0.225	0.147	0.196
Long jump from place	0.425	0.507	0.433	0.397	0.256	-0.214	0.127
Triple jump from place	0.396	0.452	0.405	0.366	-0.266	-0.165	0.098
Vertical jump	0.425	0.390	0.422	0.360	-0.247	0.200	0.124
Throwing a shot forward	0.455	0.424	0.398	0.245	0.167	0.178	-0.168
Throwing a shot backward	0.540	0.425	0.476	-0.378	0.298	-0.245	0.256
30m run from a low start	0.178	0.387	0.330	-0.242	0.197	0.227	0.226

TABLE 82

Correlational Interrelationship Between Preparatory Results in the Hammer Throw With Men Athletes Having Various Qualifications when Using Lighter, Heavier and Competitive Implements in the Full Exercise

No. n/n	Indices	1	2	3	4	5	6	7
1	Throwing a 5kg hammer	*	0.845 0.654	0.867 0.564	0.688 0.756			
2	Throwing a 6kg hammer		*	0.812 0.664	0.786 0.697			
3	Throwing a 7.260kg hammer			*	0.564 0.798	0.765	0.824	0.609
4	Throwing a 8kg hammer				*	0.865	0.724	0.687
5	Throwing a 9kg hammer					*	0.834	0.645
6	Throwing a 10kg hammer						*	0.756
7	Throwing a 16kg weight							*

TABLE 83

Correlational Interrelationship Between Several Specialized-Preparatory, Specialized-Developmental Exercises and Exercises with Lighter and Heavier Implements With Results in the Hammer Throw by Women Athletes Having Various Qualifications

Exercise	Sports Result, Coefficient of Correlation		
	45-50m	50-55m	55-60m
Throwing a 3kg hammer	0.876	0.788	0.724
Throwing a 5kg hammer	0.742	0.712	0.825
Throwing a 6kg hammer	0.654	0.698	0.876
Barbell snatch	0.578	0.670	0.590
Power clean	0.625	0.560	0.542
Squat with a barbell	0.560	0.602	0.524
Long jump from place	0.425	0.396	0.256
Triple jump from place	0.245	0.196	0.224
Vertical jump	0.520	0.426	0.368
Throwing a shot forward	-0.345	0.276	-0.212
Throwing a shot backward	0.504	0.425	0.478
30m run from blocks	0.250	-0.186	0.240

TABLE 84

Correlational Interrelationship Between Preparatory Indices in the Hammer Throw in Women Athletes Having Various Qualifications when Using Lighter, Heavier and Competitive Implements

No. n/n	Indices	1	2	3	4
1	Throwing a 4kg hammer	*	0.876 0.850	0.845 0.780	0.876 0.650
2	Throwing a 3kg hammer		*	0.760 0.620	0.588 0.480
3	Throwing a 5kg hammer			*	0.812 0.702
4	Throwing a 6kg hammer				*

This double edged inter-effect between lighter, heavier and competitive weight implements is so great that by knowing the best result in one of the exercises it is possible with great precision, within several percent, to determine the level of achievement in other exercises. For example, two-time Olympic hammer throw champion Yu. Sedikh, appears not only as the official world record holder in the throw of the competitive implement (86.74m), but unofficially in the throws of two lighter (5 and 6kg) and three heavier (8, 9, and 10kg) weights. We will take note that he was for several years, the possessor of the world record in throwing a weight of 16kg---23.90m (tables 85-86). Another Olympic champion in this event, S. Litvinov, likewise had results such as Sedikh in the throw of the implement weighting of 6, 8, and 10kg. In his time, he established the world record in the competitive throws three times.

TABLE 85

Level of Sports Achievement by Two-Time Olympic Champion and World Record Holder U.Sedykh when Throwing Lighter and Heavier Implements and Likewise in Several Specialized-Preparatory Exercises

Exercise	Absolute best results of the strongest athletes in the world	Personal bests by U. Sedykh
Throwing the 7.260kg hammer, m	86.74	86.74
Throwing the 5kg hammer, m	100	100
Throwing the 6kg hammer, m	96	96
Throwing the 8kg hammer, m	80.46	80.46
Throwing the 9kg hammer, m	75.50	75.50
Throwing the 10kg hammer, m	70.20	70.20
Throwing the 16kg weight, m	24.50	23.90
Barbell snatch, kg	155	120
Power clean, kg	190	155
Squat with a barbell, kg	300	230
Throwing the shot forward, m	20.50	16
Throwing the shot backward, m	22.50	18
Long jump from place, m	3.50	3.10
Triple jump from place, m	10.90	9.00
Vertical Jump, cm	110	80
30m run from blocks, sec.	3.8	4.0

TABLE 86

Test Result Dynamics in Throwing Lighter, Heavier and Competitive Implements and in Several Specialized-Preparatory Exercises by Olympic Champion, U.Sedykh

Exercise	Years						
	1980	1981	1982	1983	1984	1985	1986
Throwing the 7.260kg hammer, m	81.80	80.14	81.66	80.94	86.34	80.50	86.74
Throwing the 5kg hammer, m	97.00	95.00	96.00	95.00	99.00	96.00	100
Throwing the 6kg hammer, m	96.00	90.00	93.00	91.00	95.00	90.00	96.00
Throwing the 8kg hammer, m	77.50	74.00	76.00	75.00	80.00	75.50	80.46
Throwing the 9kg hammer, m	72.00	70.00	72.00	71.50	75.00	71.00	75.50
Throwing the 10kg hammer, m	67.00	64.00	67.50	66.50	69.50	65.50	70.2
Throwing the 16kg weight, m	23.70	---	---	---	23.40	---	23.85
Barbell snatch, kg	115	115	110	115	120	120	120
Power clean, kg	155	155	155	155	155	155	155
Squat with a barbell, kg	230	230	230	230	230	230	230
Throwing the shot forward, m	16.00	15.50	16.00	---	---	---	16.00
Throwing the shot backward, m	18.00	18.00	17.50	18.00	---	---	18.00
Long jump from place, m	3.10	3.10	3.10	3.10	3.10	3.15	3.15
Triple jump from place, m	9.00	9.00	9.00	9.00	---	---	---
Vertical Jump, cm	85	85	80	80	80	85	---

And still another example is related to the training of women. Olympic champion in the shotput N. Lisovskaya, was the official world record holder in the throw of the competitive implement and unofficial in the throw of the 3, 7, 5 and 6kg shot. Similar examples exist in other track and field throw events.

There is almost always a place for mutually correlated interrelationships between special-developmental exercises (throws and "shot putting" various implements having different weights from place) and exercises with lighter, heavier and competitive implements. The amounts of these interrelationships are sufficiently great (see tables 69-84). There is no relationship in only two places out of the many. In javelin throwers, no positive interrelationship is observed between throws of a lighter implement weighing 0.6kg and throws of a heavier implement weighing 3 and 4 kg from place. There is also no interrelationship between throws with a lighter implement weighing 0.7kg and heavier ones weighing 4kg.

In the women, there is no cumulative effect at the 40-45m level in throws with the competitive implement and in standing throws with the shot weighing 3kg. Here once again as between the lighter, heavier and competitive weight exercises, there is a tight interrelationship between knowing the result in the throws from place, and making an early prognosis of sports achievement in the entire throw. Also the opposite, at a definite level of sports achievement in the competitive exercise, there exists a definite level of results in the throw from place.

In sports practice, in each track and field throw event, a specific number of specialized developmental exercises are used, mainly throws of the implement of various weights from place starting in various positions. To a lesser degree, there are exercises that repeat other joint parts of the total competitive movement. Discussion here is related mainly to the throwing steps taken by the javelin thrower, the turns by the hammer and discus thrower, and glides or skips by shotputters. It appears to us that in the future, their portion of the total volume of training loads will increase somewhat.

However, the effect from using them will have a place only in instances where lighter or heavier implements are used. In sports practice, many specialists are already convinced that the use of imitational exercises without resistance, do not have a positive influence on the development of physical abilities of low as well as high level athletes.

For development of speed-strength abilities of the legs, specialists recommend an increase in the volume of training loads of specialized-developmental exercises up to reasonable amounts in order to avoid the errors made by throwers in past years. We have in mind the "throwing" boom which lasted for several Olympic cycles, in which the athletes in one training session executed from 200-300 or more throws from place using lighter or heavier implements. My record holders were included in this group.

For example, some hammer throwers executed up to 500 [1] throws of a weight in one training session. The "throwing" boom began after the 19th Olympic games in Mexico and ended before the 22nd Olympic games in Moscow. We did not want to witness the "imitational" or "turn-skip" booms. There should be an optimal amount everywhere or the after-effect will be fraught with negative consequences.

We will now look at the interrelationship between specialized-preparatory and competitive exercises. We will begin with means of developing strength abilities. Their total sum at the present time comprises from 30-60% of the total amount of time taken in training during the cycles of developing sports form. From a questionnaire given to athletes having different sports qualifications, we were able to determine two global strength exercises (snatch and power clean) and two local exercises (squat with a barbell on the shoulders and bench press). The exceptions here appear to be hammer throwers, for whom we did not consider results in the bench press, as this exercise is not used by most of them in the process of training.

In the discus throw a positive correlational interrelationship between indices in the snatch and throws of the competitive implement was observed on the level of 45-50m in men

and in women, 55-60m. In the power clean and in the barbell squat, a positive interrelationship ended at the level of 50-55m. In the bench press, with the men the cumulative effect was seen on the 55-60m level and in the women, 65-70m.

In hammer throwers, a positive interrelationship between results in the throws of the competitive implement and the snatch was observed on the level of 60-65m, with the power clean at the 65-70m level and with the barbell squat, at the 60-65m level. In women, the cumulative training effect was fixed between the above mentioned exercises at the level of 45-60m.

A positive transfer in the shot put with results in the barbell snatch were seen on the level of 17-18m, but with the power clean at 14-15m, in the squat with the barbell on the shoulders at 19-20m and in the bench press, 18-19m. In women, transfer of the cumulative effect to the competitive event was fixed in the barbell snatch at the level of 15-16m, in the power clean at 14-25m, in the squat with the barbell on the shoulders at 17-18m, and in the bench press, 19-20m.

In the javelin throw, a positive interrelationship was seen between indices in the competitive event and in the snatch and power clean on the level of 65-70m. At the 50-55m level there was no correlation seen in the squat with the barbell on the shoulders and in the bench press. In the women, a positive transfer to the competitive event was seen with results in the barbell snatch on the level of 60-65m, in the power clean up to 50-55m, and in the bench press, up to 45-50m. There was no cumulative transfer effect with the barbell squat.

The compiled data is evidence of the fact that the transfer of physical abilities with strength exercises to the competitive event is seen up to the determined level of sports results. In this, the results in some strength exercises are somewhat higher than in others. Thus, the indices in the barbell snatch serve to achieve higher results in the main event in the shot put (men), in the hammer throw (men and women) in the discus throw and javelin (women). In the power clean, the cumulative effect was even greater in the discus

throw and in the hammer throw (men and women). Indices in the barbell squat have greater transfer to the shot put, hammer and discus (men and women). In the bench press, the transfer is seen for a long time in the shotput and discus throw (men and women).

If we take into consideration individual and not group indices in the above mentioned strength exercises, then it is very possible that in individual cases we will see the cumulative effect appearing on different levels of sports mastery for each athlete. They will be very individualized. It may show that in women it can be even higher than in men. This is fully explainable since the level of strength indices in women, according to sexual indicators, are significantly lower than in men.

Some of the biomechanical characteristics (as for example consecutiveness of including body links in the work being done), and likewise the muscle work regimes, of throws of the shot forward and backward are also seen in the barbell snatch and to a certain extent, in the power clean. Besides this, in the process of executing these exercises all body links of the throwers participate in the work being done. However, ignoring the coordinational similarity between the above mentioned exercises, results of the correlational analysis show that the cumulative effect of the throwing exercises to the competitive event in all throw events is seen only on the lower levels of sports achievements.

Thus in the discus throw, results in the throw of the shot forward do not serve to increase results in the competitive event on all levels of sports mastery. In women, the cumulative effect is seen only on the level of 40-45m. In throws of the shot backward, a positive transfer has a place both with the men as well as with the women. In men, it is seen up to the level of 45-50m and in the women up to 50-55m.

In the men's hammer throw, results in the throws of the shot forward that served in the transfer of the cumulative effect was seen up to the level of 55-60m, and in the women it was absent. What is pertinent to the positive correlational interrelationship between

results in the competitive exercise and the throw of the shot backward, was fixed at the level of 60-65m with the men and in women, at 45-60m.

In the men's shotput a positive transfer was seen with results in the throw of the shot forward and throws of the shot backward up to the level of 14-15m. In the women, the cumulative effect was seen at the level of 13-14m in throws of the shot forward and in throws of the shot backward, 15-16m.

Results of the correlational analysis in these exercises give evidence of the fact that training transfer to the competitive event in throws of the shot forward in the javelin throw are seen only on the level of 55-60m and in the women, 45-50m. There is no positive interrelationship between throws of the shot backward and the competitive event in the men, and in the women, it had a place only up to the level of 40-45m.

We should remember that the separate weight of these two throw exercises executed during the cycles of developing sports form is low as the total time taken in the training process is relatively small---from 5-10%.

Even less transfer, in comparison to the two throw exercises, was seen in the 30m run from the blocks. In discus and hammer throwers the cumulative effect was absent on all level of sports mastery. In return, it had a place in the hammer throw on the level of 50-55m, in the shotput at 15-16m and in javelin throwers, 60-65m. On a sufficiently high level of sports achievements was a positive interrelationship seen in the women shot putters at 16-17m, in the women's javelin throw at 60-65m and in the discus throw, the cumulative effect was seen up to the level of 45-50m.

A relatively great number of jump exercises for development of speed-strength and "explosive" abilities of the leg muscles are used in all track and field throw events. The number of jumps (take-offs), executed during separate training sessions most frequently vary between 30-50 repetitions. Jump exercises are used to a greater extent in the training process by javelin and discus throwers (men and women), than by hammer

throwers and shotputters (men and women). Jump exercises show greater transfer to the competitive event in comparison to results in the 30m run from blocks. In almost all throw events there was a positive transfer. Exceptions to this were in the discus throw in which there was no positive interrelationship between the triple jump from place and the main movement on all levels of sports mastery.

Together with this, in the discus throwers the cumulative effect with the standing long jump and in hammer throwers with the vertical jump, each had a place in low and high level athletes. Results of the correlational analysis showed that in most cases, a positive interrelationship between the three jump exercises (standing long jump, vertical jump, and triple jump from place) and the competitive event, was seen up to a definite level of sports mastery.

A positive transfer with results in the standing long jump was seen in the discus throwers up to the level of 50-55m, in the hammer throw up to 65-70m, in the javelin throw up to 70-75m and in the shot put up to 15-16m. In women, these indices were as follows: in the discus throw it was seen on all levels of sports mastery, in the shotput up to the level of 16-17m, in the hammer throw up to 55-60m, and in the javelin throw up to 40-45m.

The cumulative training effect of the triple jump to the competitive event was seen in the hammer throw up to the level of 65-70m, in the javelin throw up to 70-75m and in the shotput up to 16-17m. In the women, it was seen in the discus throw at the level of 50-55m, javelin throw, 50-55m and shotput, 15-16m. A positive correlational interrelationship between these two exercises was not seen in women hammer throwers.

Positive indices were recorded with the vertical jump and the competitive event in the men's and women's discus throw, up to the level of 45-50m. On one and the same level of results a cumulative effect in the shot put for both men and women was seen at the 16-17m level. In the hammer throw, a positive transfer was seen in these two exercises with the men up to the level of 65-70m and in the women, on all levels. In the javelin throw,

the cumulative effect was seen on the level of 60-65m in the men and in the women, 40-45m.

Analysis of the experimental data received related to a positive correlational interrelationship between the specialized-preparatory exercises (strength, throws, jumps and runs) and the competitive event substantiate the following:

1. In the training of men shot putters, of the ten specialized-preparatory exercises used most frequently, the cumulative effect was seen at the level of 14-15m in four instances. Most transfer appears to be in the bench press and in the squat with the barbell on the shoulders. In the former exercise, the transfer of training ended at the level of 18-19m and in the latter, at 19-20m.

   In the training of women, a positive interrelationship in four exercises ends on the level of 15-16m. Two of them end at 14-15m and in the others, there was no transfer. In the bench press, the positive transfer of training was observed up to the level of 19-20m and in the squat with the barbell on the shoulders, 17-18m.

2. In the training of discus throwers, of the ten specialized-preparatory exercises used, there was a transfer of training in four cases at the level of 45-50m, in two at 50-55m and at one each in the remaining cases. The greatest transfer was seen in the bench press. Here, the positive cumulative effect was seen on the level of 55-60m. In the training of women a positive interrelationship (four exercises) was most frequently noted on the level of 50-55m. In the bench press, the transfer of training ended at the level of 65-70m and in the standing long jump, 70-75m.

3. In the training of men hammer throwers, in six out of the nine exercises the cumulative effect ended at the level of 60-65m. An increase in sports results in the competitive event was seen most of all in the positive effect of the power clean. Here, the positive interrelationship exists at the level of 65-70m. In the

training of women, the cumulative effect was observed on all levels of sports mastery in five of the nine exercises.

4. In the training of javelin throwers, most transfer is seen from the barbell snatch, power clean, standing long jump and triple jump. The cumulative effect had a place at the 65-70m level. In training of the women, four exercises had a positive transfer ending at the level of 40-45m and in two cases, on the 45-50 and 55-60m levels. Most transfer appears in the barbell snatch and in the 30m run from a low start. A positive training transfer in these exercises has a place at the level of 55-60m.

In conclusion, we will note that in the theory and practice of track and field throws, there is sufficient experimental material to substantiate that the leading throwers (world and Olympic champions and world record holders) do not always have the best absolute results in the specialized-preparatory exercises. The absolute best achievements are considered those which were shown by the athletes over the duration of several past decades. Most frequently these indices were of athletes during one or another Olympic cycle moving into the world elite. In addition, former or present world record holders in the throws of the competitive implement always appear as unofficial world record holders, or they show results close to them, in the throws of lighter and heavier implements, as well as in specialized-developmental exercises (see tables 85, 87).

TABLE 87

Level of Sports Achievements by World Record Holder U. Shulta when Throwing Lighter and Heavier Implements and in Several Specialized-Preparatory Exercises

Exercise	Absolute best results of the strongest athletes in the world	Personal achievements by U. Shulta
Throwing a 2kg disc, m	74.08	74.08
Throwing a 1.8kg disc, m	75.00	75.00
Throwing a 2.250kg disc, m	68.80	68.80
Throwing a 2.5kg disc, m	60	60
Throwing a 2kg disc from place, m	62.50	56.70
Throwing a 4kg shot from place, m	36.60	34.50
Barbell snatch, kg	155	135
Power clean, kg	185	170
Squat with a barbell, kg	300	260
Bench Press	280	235
Throwing the shot forward, m	20.92	19.50
Throwing the shot backward, m	23.20	21.50
Long jump from place, m	3.63	3.35
Triple jump from place, m	11.20	9.80
Vertical Jump, cm	97	85
30m run from blocks, sec.	3.7	3.9

TABLE 88
Test Result Dynamics in Throwing Lighter, Heavier and Competitive Implements and in Several Specialized-Preparatory Exercises by Olympic Champion, R. Ubartasa [18]

Exercise	Years				
	1984	1985	1986	1987	1988
Throwing a 2kg disc, m	66.92	63.86	67.88	68.64	71.20
Throwing a 2kg disc from place, m	59.10	56.00	60.50	60.30	62.52
Throwing a 2.25kg disc from place, m	54.60	51.50	56.60	56.00	58.32
Throwing a 2.25kg disc with a turn, m	62.90	60.50	64.80	63.40	68.74
Throwing the 2.5kg "pancake" from place, m	50.24	47.50	51.12	52.10	---
Throwing the 2.2kg "pancake" with a turn, m	58.20	55.50	59.20	58.50	62.14
Throwing a 3kg shot from place, m	42.44	40.10	43.20	43.00	44.23
Throwing a 4kg shot from place, m	33.60	31.96	34.50	---	---
Throwing a 1.8kg disc with a turn, m	71.50	68.70	---	71.20	---
Throwing the shot forward, m	20.55	19.92	21.30	20.92	20.81
Throwing the shot backward, m	22.56	21.90	23.40	23.23	23.20
Standing long jump, m	3.63	3.57	3.52	3.58	3.57
Double leg jump, m	7.35	7.21	7.30	7.34	7.40
Triple leg jump from place, m	10.80	11.20	11.05	10.90	---
Throwing a 16kg weight forward, m	13.52	13.38	13.92	14.26	---
Throwing a 16kg weight backward, m	14.92	14.61	15.09	15.40	---
Bench press, m	230	200x3	220x2	220x3	240
Squat with the barbell on the shoulders, kg	250	250x3	250x3	280x3	250x5
Power clean, m	140	140	155	160	185
Barbell snatch, kg	130	120	---	---	---

It was likewise noted that the increase in test results in specialized-developmental and specialized-preparatory exercises accompanied the increase in sports achievements in a definite order over the duration of one or another yearly cycle. In table 88 are the preparatory results of Olympic champion R. Yubartasa over five years of sports improvement (table 88). They substantiate that in 29 cases, with an increase in sports results in the throws of lighter and heavier implements from place and with turns, there was an increase in results in the competitive exercise and in only five cases, did this not transpire. There was an increase in results in the specialized-preparatory exercises in 32 instances in conjunction with an increase in the competitive event and in 17 cases this did not happen.

Regarding the interrelationship between indices in the throws of lighter, heavier and competitive weight implements, an increase or decrease in results in one of them leads to an adequate change in the other as seen in the data put together in table 86. Of them, we can see that in Olympic champion Yu. Sedikh, that in 35 instances with a change in the test results in the lighter and heavier implements there was a corresponding change in the throw of the competitive weight. In only three instances did the results increase or decrease insignificantly one from the other. Changes in results in specialized-preparatory exercises in eight cases showed adequate changes in results in the competitive exercise and in only 27 cases were they autonomous.

It is possible to bring in many similar examples from sports practice. All of them always give evidence of the adequate inter-influence between exercises with the use of lighter and heavier implements, competitive and specialized preparatory exercises.

Transfer of Physical Abilities When Using Different Exercises in Cyclical Events Requiring the Display of Endurance

An increase in sports achievement in the cyclical events that require the display of endurance, is conditioned by the presence of a high level of development of the anaerobic and aerobic abilities and the corresponding body systems. For their improvement, a large number of different exercises is used. The exercises are different from one another first of all by the duration of the training effect---the distance of the segments used. For development of the alactate anaerobic abilities short segments are used---anywhere from 10-30 up to 150m so that the duration of work does not go above 20sec and the intensity of the work overcome is maximal.

The lactate anaerobic abilities are developed when using longer distances from 150-400m and the time of covering these distances varies between 30-60 sec and the intensity of the training work is in the zone of 90-95% of maximum. For simultaneous improvement of the lactate anaerobic and aerobic abilities, training loads that last anywhere from 1-5min with the intensity at 80-95% of maximum are used. This can take the form of segments that are over 400m long up to several kilometers [154, 183, 215, 216].

Long segments are used most frequently to improve aerobic abilities. The segments used depend upon the specialty of the athletes and their level of mastery. Depending on the level of mastery, segments can be up to 10-30km or identical loads that can be fulfilled over the duration of several hours using a low zone intensity [154, 183, 215, 216].

We should also note that in the process of developing anaerobic capabilities, the duration of the training segments, the use of intensity zones as well as the distances and character of the rest between separate segments or series, are taken into consideration. We will now look at the segments (distances) that are used most frequently in the training of athletes specializing in different events requiring the display of endurance.

We will begin with middle distance runners. They use segments anywhere from 60-100m up to 10-15km in length. Runners specializing in the steeplechase (3,000m with hurdles) 5,000m and 10,000m (both men and women) as well as women specializing in the 3,000m run, use distances from 100m to 20-30km. Marathoners use distances from 400m – to several 10s of kilometers. Also used are training loads lasting more than 2hrs.

In sports walking, running as well as walking are used for short and long distances. For women specializing in the 10km walk, the distances vary from 1-20km, and for 20 and 50km men walkers—from 1-30km. The latter as well as marathoners, do training work lasting more than 2hrs.

After competition a general picture of the means and methods of developing anaerobic and aerobic abilities used in cyclical sports that require endurance is revealed. In general terms, we will present experimental material which shows the range of transfer of the physical abilities in the middle, long and super long running distances as well as in sports walking for the 10 (women), and 20 and 50km (men) events.

In the men's and women's 800m run, there is a range of transfer of physical abilities beginning with the 60m run from a low start and ending with the 5000m run (tables 89, 97). The latter distances with the men, had a place on two levels of sports mastery (1:56:00-2:00:00 and 1:52:00 1:56:00) and with the women, on one level (2:15:00-2:20:00). The greatest amounts of correlational interrelationship were fixed in the 400, 600, and 1000m runs. In performers of both sexes, the correlation varied from 0.700-0.900. In men, the biggest transfer was with the 1000m run (0.912, 0.876, 0.905, 0.856). A sharp decrease in the amount of correlational interrelationship was observed in the 1500m run in men and women. A weak interrelationship was seen with the 3000 and 500m runs.

The range of transfer of physical abilities in the men's 1500m run begins with the 60m segment and ends with the 5000m distance. The cumulative effect has a place on all

levels of sports mastery. In women, as in the men, the range of transfer begins with the 60m but ends on the 10,000m distance. In the latter case it appears on three of the five levels of sports mastery. The greatest amount of correlational interrelationship is observed in participants of both sexes in the 800, 1000 and 3000m runs (table 90, 98).

Results of the correlational analysis of 800 and 1500m runners shows that with an increase in the competitive distance, the range of transfer of physical abilities increases. Thus, for men participants in the "long sprint" (800m) transfer is seen with the 5000m distance, and in the women specializing in the 1500m run, transfer has a place in the 10,000m distance. In the 800m runners greatest transfer was seen with the 600 and 1000m and with the 1500m runners, in the 800, 1000, and 3000m runs.

In comparing the amounts of interrelationship between results in the competitive running distance with women specializing in the 800 and 1500m, we came to the conclusion that in the 800m runners, results in the 1500m run were more transferable to the competitive event (coefficient of correlation varied from 0.657-0.788), than in the 1500m runners (from 0.380-0.652).

Analysis of the results of the ten strongest 800 and 1500m runners in the world throughout the history of track and field, shows that the world record holders in the 1500m run frequently demonstrate a higher level of achievement in the 800m run than world record holders in the 800m run in the 1500m distance. Only one athlete, S. Coe was able to have a world record in both distances.

The range of transfer of physical abilities in steeplechase runners begins with the 600m run (three levels of sports mastery) and ends with the 10,000m run. A positive transfer is not observed with results in the 100 and 400m runs. The most transferable were the 3,000 and 5,000m runs. Here the coefficient of correlation in four instances was greater than 0.700 and in one---0.800 (table 91). In the 600, 800, 1,000, 1,500 and 10,000m runs, the coefficient was very low (from 0.356-0.497), which signifies the weak interrelationship between the studied indices. However, some of the strongest athletes

show high sports results not only in the 5,000m distance but in the 1,500, 3,000, and 10,000m. Note that the leading runner, H. Rono, set the world record in the 5,000, 10,000m and steeplechase in his time.

In the women's 3,000m the range of transfer of physical abilities is somewhat greater (table 99), than with the steeplechase runners. Here it begins with the 400m run and ends with the 10,000m run. The positive interrelationship had a place on all levels of the segments tested. Most transfer was in the 1,000, 1,500, and 5,000m runs. The coefficients of correlation varied from 0.725-0.906. Transfer to the competitive event from the 100 and 200m runs were non-existent. Practice substantiates that many of the strongest 3,000m women runners in the world (Olympic and world champions and record holders) showed the greatest results in the mixed distances. Thus, the former world record holder in this distance, T. Kazankina, two time Olympic champion in the 1500m and one time winner in the 800m and American M. Decker who was world champion in the 1500 and 3000m runs.

The range of transfer of physical abilities in the 5000m run, both in the men as in the women, begins with the 600m run (table 92, 100). In men, transfer appears on all levels of sports mastery and in women, only on two (16.00-16.30 and 16.30-17.00min). The cumulative effect is also seen in the marathon results. Here it is observed both in the men as in the women only on two levels of sports mastery. The 800, 1000, 1500, 3000 10,000m and half marathon, show a positive transfer taking place on all levels of sports mastery. The greatest transfer appears in the 3,000 and 10,000m run. In men, the coefficient of correlation in these distances was somewhat higher than in the women.

Results of the correlational analysis substantiates that the range of transfer of physical abilities in athletes specializing in the 10,000m run begins with results in the 600m run and ends with results in the marathon (table 93, 101). The first distance has a place on two consecutive levels (28.00-28.30 and 28.30-29.00min), and the second, on all levels from 28.00-34.00min. In the women, the range of transfer is somewhat less than in the men. It begins with results in the 1,500m run. However, runners of both sexes show that

the greatest coefficient of correlation was in the 5,000m run as well as in the half marathon and marathon.

Results of the last ten world record holders in the 5,000 and 10,000m is evidence of the fact that only one athlete was able to set a world record in both distances. This is despite the fact that all runners in the 5000 and 10000m show high sports results and also frequently run both of these distances in the Olympic games (V. Kotz, L. Viren, M. Ifter and others). It appears that the ten strongest runners in the world in the 5000m in all of track and field history, in most cases do not appear as the strongest top ten runners in the 10,000m. Here the discussion is of the ten best results shown by the athletes in the 5,000m and 10,000m. Also, the ten strongest runners in the 10,000m rarely enter into the top group of the strongest runners in the world in the 5,000m. And here is still another interesting fact. In comparing the transfer (coefficients of correlation) results in the 10,000m run to results in the 5000m run (tables 93, 101) and results in the 5,000m to results in the 10000m (tables 92, 100), it can be seen that in the first case, the coefficients of correlation are somewhat higher than in the second.

The range of transfer of physical abilities in men marathoners begins with the 5000m run and in the women with the 3000m run (tables 94, 102). In the men, the cumulative effect in the 5000m distance is observed on all levels of sports mastery and in the women, in the 3000m run only on two beginning levels (2:55:00-3:05:00 and 3:05:00-3:15:00). Most transfer was seen from the 10,000m run and the half marathon. The coefficient of correlation for women as for the men, varied from 0.700-0.800 and more.

Results of the strongest marathoners over the last five Olympic cycles is evidence of the fact that not one of the men was able to establish a world record in the 10,000m and be victorious in the marathon. However, some of the strongest 10,000m runners in the world (K. Lopesh), by switching to the marathon became Olympic champion. A somewhat different picture is seen with the women. G. Waitz set a world record in the marathon four times, two times in the 3000m, one time each in cross country at the 15km, 10 and 20mile distances, and likewise, in the half marathon. Another outstanding

woman, I. Christianson was world record holder in the marathon and also in the 5,000 and 10,000m.

As a rule, most of the strongest world marathon runners show high results in the 10,000m run. This is explained first of all by the fact that almost all of them began by specializing in long distance running and only later, after the passage of time, went over to the marathon. In bettering their sports results in the marathon they also improved their results in the 10,000m run. But none of them set a record at this distance during this time. Besides this, in most cases the time (year) of setting personal bests in both distances did not coincide.

In athletes specializing in the 10km walk, the cumulative effect was fixed at two running distances (5,000 and 10,000m) and in the 1 and 5km walks (table 103). The cumulative effect was absent only on one level of sports results (the 5,000m run). In the running exercises the coefficient of correlation in all cases was very low---from 0.354 up to 0.387 which shows the weak interrelationship between indices in the 5,000 and 10,000m run with the competitive event. In the 1km walk, it varied on the level of 0.700-0.800. In the 5km walk, the coefficient of correlation in three cases exceeded 0.800 and in one, 0.700.

The range of transfer of physical abilities in athletes specializing in the 20km walk begins with special developmental exercises and results in the 1km walk and ends with results in the 50km walk (table 95). The cumulative effect also has a place in the 10,000m run. The biggest coefficients of correlation were fixed in the 10km walk and the smallest in the run at this distance—from 0.354-0.387. In the 50km walkers, the transfer of physical abilities to the 1km walk is observed on two levels of sports mastery and in the 5, 10, and 20km walks on all levels (table 96). Most transfer was with the results in the 10 and 20km walks. A weak correlation of the interrelationship was observed with indices in the 10,000m run.

Results of the correlational analysis of athletes specializing in the 20 and 50km walks show that in the first group, results in the 10 and 50km have the greatest transfer while

for the second group (50km) results in the 10 and 20km walks. Almost the same was the cumulative effect with achievements in the 10,000m run and 1km walk. Here, the coefficient of correlation in all instances did not go above 0.400, which indicates the weak interrelationship between them.

TABLE 89
Correlational Interrelationship Between Preparatory Results in the 800m Run in Athletes Having Different Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation			
	1:45.00-1:48.00	1:48.00-1:52.00	1:52.00-1:56.00	1:56.00-2:00.00
60m run from blocks	0.675	0.605	0.702	0.645
100m run from blocks	0.730	0.650	0.598	0.625
200m run from blocks	0.687	0.765	0.624	0.600
400m run from blocks	0.786	0.720	0.744	0.690
600m run from a high start	0.865	0.824	0.798	0.812
1000m run from a high start	0.912	0.876	0.905	0.856
1500m run from a high start	0.652	0.598	0.610	0.605
3000m run from a high start	0.405	0.376	0.425	0.412
5000m run from a high start	0.325	0.325	0.376	0.350

TABLE 90

Correlational Interrelationship Between Preparatory Results in the 1500m Run in Athletes Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	3.35.00-3.40.00	3.40.00-3.45.00	3.45.00-3.50.00	3.50.00-3.55.00	3.55.00-4.05.00
60m run from blocks	0.567	0.506	0.567	0.490	0.512
100m run from blocks	0.504	0.566	0.487	0.524	0.540
200m run from blocks	0.467	0.524	0.506	0.480	0.530
400m run from blocks	0.567	0.605	0.542	0.580	0.488
600m run from a high start	0.645	0.604	0.620	0.610	0.580
1000m run from a high start	0.765	0.788	0.689	0.756	0.760
1500m run from a high start	0.865	0.806	0.844	0.780	0.830
3000m run from a high start	0.820	0.876	0.845	0.802	0.765
5000m run from a high start	0.546	0.426	0.403	0.452	0.390
10,000m run from a high start	0.325	-0.280	0.245	0.312	-0.342

TABLE 91

Correlational Interrelationship Between Preparatory Results in the Steeplechase (3000m Run With Hurdles) in Athletes Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	8.30.00-8.45.00	8.45.00-9.00.00	9.00.00-9.15.00	9.15.00-9.30.00	9.30.00-9.45.00
100m run from blocks	0.245	0.207	-0.267	0.198	0.242
400m run from blocks	0.345	0.312	-0.276	0.211	0.275
600m run from a high start	0.397	0.356	0.366	0.314	0.297
1000m run from a high start	0.357	0.390	0.356	0.402	0.356
1500m run from a high start	0.456	0.386	0.421	0.388	0372
3000m run from a high start	0.476	0.497	0.398	0.425	0.387
5000m run from a high start	0.786	0.761	0.789	0.812	0.721
10,000m run from a high start	0.425	-0.387	0.420	0.386	0.356
3000m run	0.812	0.745	0.705	0.736	0.725

TABLE 92

Correlational Interrelationship Between Preparatory Results in the 5000m Run in Athletes Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	13.30.00-13.45.00	13.45.00-14.00.00	14.00.00-14.30.00	14.30.00-15.00.00	15.00.00-16.00.00
100m run from blocks	0.187	-0.212	0.165	0.186	0.145
200m run from blocks	-0.165	0.178	-0.205	0.198	0.167
400m run from blocks	0.265	0.287	-0.324	0.297	0.306
600m run from a high start	0.389	0.425	0.407	0.360	0.385
800m run from a high start	0.456	0.388	0.402	0.427	0.391
1000m run from a high start	0.397	0.451	0.405	0.433	0.378
1500m run from a high start	0.425	0.421	0.465	0.501	0.437
3000m run from a high start	0.789	0.725	0.845	0.398	0.721
10,000m run from a high start	0.807	0.742	0.788	0.751	0.685
Half marathon	0.405	0.452	0.396	0.354	0.365
Marathon	-0.365	0.354	0.330	0.287	0.307

TABLE 93

Correlational Interrelationship Between Preparatory Results in the 10,000m Run in Athletes of Different Qualifications in Several Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	28.00.00-28.30.00	28.30.00-29.00.00	29.00.00-29.30.00	29.30.00-30.00.00	30.00.00-34.00.00
100m run from blocks	0.124	-0.256	0.187	0.165	0.187
400m run from blocks	0.245	-0.187	0.256	0.245	0.301
600m run from a high start	0.456	0.398	0.336	0.340	0.286
1000m run from a high start	0.365	0.345	0.412	0.451	0.342
1500m run from a high start	0.452	0.386	0.427	0.398	0.412
3000m run from a high start	0.398	0.456	0.387	0.425	0.476
5000m run from a high start	0.867	0.767	0.832	0.795	0.765
Half marathon	0.824	0.854	0.765	0.724	0.654
Marathon	0.856	0.768	0.775	0.789	0.814

TABLE 94

Correlational Interrelationship Between Preparatory Results in the Marathon Run in Athletes of Different Qualifications in Several Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	2:10:00-2:20:00	2:20:00-2:30:00	2:30:00-2:40:00	2:40:00-2:50:00	2:50:00-3:00:00
1500m run from a high start	-0.256	0.187	0.226	0.187	0.256
3000m run from a high start	-0.187	0.165	0.182	-0.240	0.256
5000m run from a high start	0.654	0.586	0.487	0.480	0.422
10,000m run from a high start	0.768	0.825	0.725	0.756	0.689
Half marathon	0.876	0.865	0.805	0.744	0.702

TABLE 95

Correlational Interrelationship Between Preparatory Results in the 20km Walk in Athletes Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation			
	1:20:00-1:25:00	1:25:00-1:30:00	1:30:00-1:35:00	1:35:00-1:50:00
10,000m run	0.367	0.387	0.365	0.354
1km walk	0.387	0.354	0.400	0.379
5km walk	0.456	0.412	0.378	0.356
10km walk	0.768	0.806	0.618	0.824
50km walk	0.675	0.624	0.567	0.425

TABLE 96

Correlational Interrelationship Between Preparatory Results in the 50km Walk in Athletes Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation			
	3:45:00-4:00:00	4:00:00-4:15:00	4:15:00-4:30:00	4:30:00-4:45:00
10,000m run	0.387	-0.365	0.356	0.380
1km walk	-0.342	-0.336	0.386	0.397
5km walk	0.456	0.489	0.387	0.452
10km walk	0.657	0.587	0.554	0.600
20km walk	0.675	0.706	0.624	0.421

TABLE 97

Correlational Interrelationship Between Preparatory Results in the 800m Run in Women Athletes of Different Qualifications in Several Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	1.57.00-2.00.00	2.00.00-2.03.00	2.03.00-2.10.00	2.10.00-2.15.00	2.15.00-2.20.00
60m run from blocks	0.456	0.570	0.524	0.580	0.624
100m run from blocks	0.580	0.586	0.612	0.657	0.606
200m run from blocks	0.650	0.700	0.685	0.702	0.670
400m run from blocks	0.690	0.768	0.703	0.756	0.780
600m run from a high start	0.490	0.873	0.824	0.925	0.888
1000m run from a high start	0.742	0.783	0.765	0.805	0.768
1500m run from a high start	0.380	0.467	0.456	0.524	0.478
3000m run from a high start	0.412	0.350	0.376	0.420	-0.386

TABLE 98

Correlational Interrelationship Between Preparatory Results in the Women's 1500m Run in Athletes Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	4.00.00-4.05.00	4.05.00-4.10.00	4.10.00-4.15.00	4.15.00-4.25.00	4.25.00-4.35.00
60m run from blocks	0.405	0.380	0.424	0.398	0.456
100m run from blocks	0.368	0.390	0.422	0.405	0.637
200m run from blocks	0.370	0.424	0.390	0.478	0.450
400m run from blocks	0.580	0.576	0.540	0.490	0.564
600m run from a high start	0.606	0.703	0.670	0.724	0.655
800m run from a high start	0.680	0.657	0.712	0.678	0.756
1000m run from a high start	0.712	0.765	0.724	0.786	0.745
3000m run from a high start	0.768	0.845	0.790	0.865	0.876
5000m run from a high start	0.398	0.426	0.506	0.421	0.398
10,000m run	0.245	0.305	0.352	0.365	-0.387

TABLE 99

Correlational Interrelationship Between Preparatory Results in the Women's 3000m Run in Athletes Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation			
	8:45.00-9:00.00	9:00.00-9:15.00	9:15.00-9:30.00	9:30.00-9:45.00
100m run from blocks	-0.312	0.340	-0.305	0.326
200m run from blocks	0.287	-0.315	0.356	0.372
400m run from blocks	0.356	0.412	0.380	0.378
600m run from a high start	0.456	0.420	0.397	0.456
800m run from a high start	0.398	0.711	0678	0624
1000m run from a high start	0.798	0.725	0.742	0.791
1500m run from a high start	0.876	0.906	0.854	0.887
5000m run from a high start	0.845	0.825	0.806	0.765
10,000m run from a high start	0.425	0.430	0.512	0.425

TABLE 100

Correlational Interrelationship Between Preparatory Results in the Women's 5000m Run in Athletes Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation			
	15.00.00-15.30.00	15.30.00-16.00.00	16.00.00-16.30.00	16.30.00-17.00.00
100m run from blocks	0.265	-0.324	0.298	0.325
200m run from blocks	0.325	-0.245	0.15	0.340
400m run from blocks	0.266	0.325	0.316	0.321
600m run from a high start	0.341	-0.327	0.357	0.386
800m run from a high start	0.456	0.554	0.478	0.452
1000m run from a high start	0.556	0.426	0.478	0.471
1500m run from a high start	0.467	0.552	0.411	0.387
3000m run from a high start	0.645	0.598	0.678	0.624
10,000m run from a high start	0.789	0.824	0.766	0.680
Half marathon	0.654	0.602	0.578	0.560
Marathon	0.405	-0.376	0.341	0.330

TABLE 101

Correlational Interrelationship Between Preparatory Results in the Women's 10,000m Run in Athletes Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	30.00-31.00	31.00-32.00	32.00-33.00	33.00-34.00	34.00-40.00
100m run from blocks	0.245	0.265	-0.312	0.287	0.324
400m run from blocks	-0.326	0.276	0.254	-0.298	0.315
600m run from a high start	0.288	0.326	0.325	-0.305	-0.336
800m run from a high start	0.337	-0.312	0.340	0.325	0.341
1000m run from a high start	0.341	-0.321	0.326	0.357	0.366
1500m run from a high start	0.456	0.498	0.397	0.426	0.412
3000m run	0.425	0.476	0.398	0.415	0.433
5000m run	0.876	0.865	0.824	0.789	0.825
Half marathon	0.786	0.806	0.764	0.790	0.765
Marathon	0.765	0.802	0.745	0.688	0.642

TABLE 102

Correlational Interrelationship Between Preparatory Results in the Women's Marathon in Athletes Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation			
	2:35:00-2:45:00	2:45:00-2:55:00	2:55:00-3:05:00	3:05:00-3:15:00
1500m run	0.267	-0.306	0.267	-0.303
3000m run	0.305	-0.341	0.287	0.365
5000m run	0.398	0.376	0.425	0.357
10,000m run	0.786	0.697	0.725	0.688
Half marathon	0.867	0.854	0.796	0.817

TABLE 103
Correlational Interrelationship Between Preparatory Results in the Women's 10km Walk in Athletes Having Different Qualifications in Several Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation			
	42.00-43.00	44.00-45.00	46.00-48.00	48.00-50.00
5000m run	-0.324	0.354	0.367	0.377
10,000m run	0.387	-0.364	0.405	0.380
1km walk	0.721	0.756	0.789	0.802
5km walk	0.865	0.824	0.789	0.825

In this section of experimental material related to the study of runners specializing in middle, long and ultra long distances, the correlational interrelationships between results in the specialized-developmental and competitive events, show that with an increase in the distance, transfer of physical abilities begins with the longer segments. Thus, in the 800 and 1500m runs, the cumulative effect is already seen with indices in the 60m run. In the men's steeplechase it appears with results in the 600m run and in the women's 3000m run with indices in the 400m run.

A positive transfer of physical abilities with 5000m runners was fixed with results in the 600m run. In the longer distances, in the men, the cumulative effect was seen in the 600m run and with the women, with results in the 1000m run. In men marathoners the cumulative effect had a place in the 5000m distance and in the women marathoners—3000m.

In middle distance runners, the ranger of transfer of physical abilities ends at the 5,000m distance and in the 3,000m run with women and steeplechase for men, at 10,000m. With long distance runners the cumulative effect was seen with indices in the marathon run. With athletes specializing in the 10 (women) 20 and 50km (men) walk, the transfer of physical abilities begins with indices in the 1km walk.

Results of the correlational analysis also substantiate that in most events requiring the display of endurance, with a decrease in the difference between the competitive distances

and the test exercises used, the coefficient of correlation increases. This is related to both the short and long segments in relation to the competitive event. The difference is that the range of transfer in the short distances in most endurance events is significantly wider than in the long distances. The exceptions here appear to be athletes specializing in the marathon, women in the10km walk and men in the 50km walk. In these cases, it is not possible to observe the presence of the cumulative effect with distances that are longer than the competitive event. In sports practice similar tests do not exist.

The greatest range of transfer of physical abilities in all events requiring endurance, is explained by the specifics of the interaction of systems involved in the training effect and the body systems of the individual. The first of these (training effect) depends upon the use of a definite aggregate of means for developing aerobic, anaerobic-alactate and anaerobic-lactate abilities. The second reflects the essence of the different short term and long term adaptational reactions, which in the end result, allow for entry into the sports form state and move the transfer of physical abilities in a particular manner. Discussion in this case is about the presence of general and specific reactions.

The general reactions reflect the functional state of the heart-circulatory, blood vessel and respiratory systems. These reactions are present in all forms of sports activity. In relation to the functioning of the central nervous system, its amount of participation here in comparison to the speed-strength disciplines in track and field, is significantly less. The specific reactions have a relationship first of all to the adaptation to the of the corresponding changes (select) in the nerve-muscular (peripheral) structure. They are related to the transformation of the morphological changes in the red and white muscle fibers, their capillarization and innervations, and likewise form of energy and energy supply factors.

In the theory and methods of physical education over almost the last four decades, the question of the influence of aerobic training loads on the anaerobic-alactate and anaerobic-lactate has been studied. It is now believed that the first creates the "base", "foundation", for the others. As a result, in most literature sources, it is recommended to

use means of developing aerobic capabilities and to use them at the beginning of the cycles of developing sports form. The duration of their use as for example, when using stages in constructing the periods, usually lasts several months and its variants from 2-4 weeks.

The specifics of the created "base", "foundation", can only be guessed at. But most often it means increasing the functional state, first of all of the cardiovascular, blood vessel and respiratory systems. Also looked at is the formation and energy provision for the aerobic, anaerobic-alactate and anaerobic-lactate training loads. Almost nothing is said about the achievement of a definite level of sports results in the longer distances in comparison to the competitive event.

With sorrow, in the literature sources available to us, we did not see any research studies that looked at the influence of anaerobic-alactate and anaerobic-lactate training loads not only one on the other, but on the aerobic. But the fact that they can have a specific interaction with each other, as substantiated in a great deal of factual material, can reveal the essence of the reactions produced by one or another of these body systems in response to only the aerobic, anaerobic-alactate and anaerobic-lactate training loads.

By considering the data available we will try to further reveal all the transferable (fully and partially) and non-transferable factors from one form of activity to another. Besides this, we will examine the positive and negative interactions between the aerobic and anaerobic training loads. In our discussions we will compare the most frequently used logical biochemical and pedagogical tests that use aerobic, anaerobic-alactate and anaerobic-lactate training loads. We will then try, from a theoretical standpoint, to explain many questions regarding the interaction between them. Especially important in this is to show the interaction of factors that can be used in sports practice.

In table 104, data is presented that characterizes the transferred factors from aerobic training loads to anaerobic-alactate. Most of the functional indices that have a relationship to the activity of the cardiovascular and respiratory systems (6 of 7), are fully

transferable. The non-transferable factors include tests that determine the level of lactic acid in the blood and likewise most of the energy forming and energy ensuring work factors. In work fulfilling aerobic training loads the red (slow) muscle fibers participate while in the anaerobic-alactate—the white (fast) fibers.

The first form of loads (aerobic) does not show an influence on the development of sports form in the second form of loads. In other words, in the state of sports form development the aerobic and anaerobic-alactate abilities of the athlete that come into play are not-dependent on one another (our data). It is also necessary to note that in the theory and methods of physical education, it is known that aerobic training loads act favorably on the break up of lactic acid and in other restorative processes. Aside from this, aerobic work shows negatively on the development of speed capabilities.

Several other results were received when determining the inter-influence between aerobic and anaerobic-lactate training loads (table 105). It appears that of the 16 tests looked at, only four were non-transferable. The greatest differences were seen in the content of lactic acid after aerobic and anaerobic-lactate training loads. The anaerobic-lactate regime serves the flow of different adaptational processes in the white muscle fibers and in the aerobic regime – red fibers. The anaerobic exercises do not have an influence on the time of entering into the state of sports form in development of anaerobic-lactate capabilities.

However, the anaerobic-lactate training loads shorten the amount of time needed to enter sports form in the aerobic exercises. The aerobic training work serves to break up the lactic acid, the content of which reaches 250-300mg per 100ml of blood after anaerobic-lactate loads.

The anaerobic-alactate training loads, in suppressing most of the test indices, give in to the anaerobic-lactate (table 106). We have in view here mainly those tests that study the functional state of the heart-circulatory, blood vessel and respiratory systems. But, they also have other energy forming and energy ensuring work factors. The anaerobic-alactate

training loads do not influence the time of entering the state of sports form in anaerobic-lactate. At the same time the latter (anaerobic-lactate) shorten the amount of time for entering into the given state in the first form of loads (anaerobic-alactate). However, in using the anaerobic-alactate and anaerobic-lactate training loads, one and the same muscle fibers participate –the white.

Presented in table 107, are the transferable factors of the anaerobic-lactate training loads to the anaerobic-alactate loads. The data presented show that the anaerobic-lactate loads bring about much greater functional shifts in the corresponding body systems than the anaerobic-alactate, even though the same (white) muscle fibers participate in the work. It is not known why, but the first form of work shortens the time period for entering into the state of sports form in the second form of loads. They have different sources of energy formation, time of its effect, and likewise the duration of its apportionment.

Anaerobic-alactate and aerobic training loads bring about the same reactions of the heart-circulatory system—(CV). Also coinciding are indices from other tests which characterize the functional state of the respiratory system (oxygen debt, maximum oxygen uptake (MO2)) that takes place at the level of lactic acid accumulation (table 108). Non-transferable factors here are all the remaining factors – 13 out of 15. The presence of such a large number of non-transferable factors can be explained by the fact that in using the anaerobic training loads, the body must execute work in oxygen deficient conditions.

Aerobic training loads are accompanied with the use of a great amount of oxygen which distinguishes them from the anaerobic loads. In aerobic loads the transport and utilization of oxygen is determined by the structure of the body systems. They have different energy formation and energy ensuring work factors. In using anaerobic-alactate training loads we allow for the flow of different adaptational restructurings in the white muscle fibers and in the aerobic, red fibers. The latter factor apparently explains to a great extent why these two forms of training do not have an influence on the time of entering into a state of sports form. It is true that when using several means of

constructing cycles of sports form development, the time of their use can coincide or be different.

The anaerobic-lactate training loads are more transferable to the aerobic than to the anaerobic-alactate (table 109). In most cases, the functional state of the cardiovascular system, blood vessel and respiratory systems, when using the anaerobic-lactate work is significantly higher than in aerobic. The same amounts are seen in the level of oxygen utilization in the process of working out. There are identical indices of maximum oxygen utilization. Because of this, lactic acid content when using anaerobic-lactate training loads is several times higher than in cases when using aerobic -- 250-300mg as opposed to 80-100mg. Energy formation and energy ensuring work factors often coincide.

Anaerobic-lactate training work brings about specific adaptational changes in the white muscle fibers and aerobic work brings about specific adaptational changes in the red fibers. Anaerobic-alactate training loads shorten the amount of time of entering into a state of sports form in the aerobic exercises. At this time the latter appear to be inert in comparison to the first.

TABLE 104
Characteristics of Transferred Factors from Aerobic to Anaerobic-Alactate Training Loads (Collective Data)

Indices	Fully transferred factors	Frequently transferred factors	Non-transferred factors
Heart rate in 1 min	-----	-----	Up to 150 Up to 180
Respiratory frequency cycles in 1 min		-----	Up to 60 14-19
Lung ventilation, Liters per min^{-1}	120-140 60-80	-----	-----
Oxygen reserve, Liters	90-150 12-20	-----	-----
Oxygen debt, Liters	10-15 up to 15	-----	-----
Level of Oxygen use during the time of work, %	95 and more insignificant	-----	-----
Maximum O2 uptake, Liters	5.5-6 5.5-6	-----	-----
Content of lactic acid per 100ml of blood, mg	-----	-----	Up to 100 Up to 200
Energy expenditure, kCal	Up to 750 40-80	-----	-----
Energy source	-----	-----	Carbohydrates, fats ATP
Time of developing energy, sec.	-----	-----	From 90 to 18 0
Time energy is acting	-----	-----	Several hours to 30 sec.
Duration of maximum distribution of energy, sec.	-----	-----	120-130 up to10
Types of muscle fibers participating in the work	-----	-----	Red White
The influence on the time on entering the state of sports form	No effect No effect	-----	-----

Note: In the numerator are the results of aerobic processes and in the denominator, anaerobic-alactate.

TABLE 105

Characteristics of Transferred Factors from Aerobic to Anaerobic-Lactate Training Loads (Collective Data)

Indices	Fully transferred factors	Frequently transferred factors	Non-transferred factors
Heart rate in 1 min	-----	-----	Up to 150 Up to 200
Respiratory frequency cycles in 1 min	Up to 60 Up to 60	-----	-----
Lung ventilation, Liters per min^{-1}	-----	120-140 140-160	-----
Oxygen reserve, Liters	90-150 30-50	-----	-----
Oxygen debt, Liters	-----	10-15 20-22	-----
Level of Oxygen use during the time of work, %	About 100 About 100	-----	-----
Maximum O2 uptake, Liters	5.5-6 5.5-6	-----	-----
Content of lactic acid per 100ml of blood, mg	-----	-----	80-100 250-300
Energy expenditure, kCal	Up to 750 150-250	-----	-----
Energy source	Carbohydrates, fats Carbohydrates	-----	-----
Time of developing energy, sec.	-----	-----	From 90 to 180 15-20
Time energy is acting	Several hours 30-180 sec	-----	-----
Duration of maximum distribution of energy, sec.	Up to 300 From 30 to 90	-----	-----
Type of muscle fibers participating in the work	-----	-----	Red White
The influence on time on entering the state of sports form	-----	-----	No influence Shortens

Note: In the numerator are the results of aerobic processes and in the denominator, anaerobic-lactate.

TABLE 106

Characteristics of Training Transfer Factors from Aerobic-Alactate Training Loads to the Aerobic-Lactate (Collective Data)

Indices	Fully transferred factors	Frequently transferred factors	Non-transferred factors
Heart rate in 1 min	-----	-----	Up to 180 Up to 220
Respiratory frequency cycles in 1 min	-----	-----	14-19 up to 60
Lung ventilation, Liter per min^{-1}	-----	-----	60-80 140-160
Depth of exhalation, Liter	-----	-----	0.4 0.5 Vital Capacity
Oxygen reserve, Liter	-----	-----	12-20 30-50
Level of Oxygen use during the time of work, %	-----	-----	Insignificant About 100
Maximum O2 uptake, Liter	-----	-----	About 5 5.5-6
Content of lactic acid per 100ml of blood, mg	-----	-----	100-200 250-300
Energy expenditure, kCal	-----	-----	40-80 150-200
Energy source	-----	-----	ATP Carbohydrates
Time of developing energy, sec.	-----	-----	0 15-20
Time energy is acting	-----	-----	Up to 30 sec From 30 to 180 sec
Duration of maximum distribution of energy, sec.	-----	-----	Up to 10 From 30 to 90
Types of muscle fibers participating in the work	White White	-----	-----
The influence or effect of time on entering the state of sports form	-----	-----	No influence Shortens

Note: In the numerator are the results showing the flow of the anaerobic-alactate processes and in the denominator, aerobic-lactate.

TABLE 107

Characteristics of Training Transfer from Anaerobic-Lactate Training Loads to the Anaerobic-Alactate (Collective Data)

Indices	Fully transferred factors	Frequently transferred factors	Non-transferred factors
Heart rate in 1 min	Up to 220 Up to 180	-----	-----
Respiratory frequency cycles in 1 min	Up to 60 14-19	-----	-----
Lung ventilation, Liter per min^{-1}	140-160 60-80	-----	-----
Depth of exhalation, Liter	0.5 Vital Capacity 0.4	-----	-----
Oxygen reserve, Liter	30-50 12-20	-----	-----
Level of Oxygen use during the time of work, %	10-40 5-10	-----	-----
Maximum O2 uptake, Liter	-----	5.5-6 About 5	-----
Content of lactic acid per 100ml of blood, mg	250-300 100-200	-----	-----
Energy expenditure, kCal	150-250 40-80	-----	-----
Energy source	-----	-----	Carbohydrates ATP
Time of developing energy, sec.	15-20 0	-----	-----
Time energy is acting	-----	-----	From 30 to 180 sec Up to 30 sec
Duration of maximum distribution of energy, sec.	-----	-----	From 30 to 90 sec Up to 10 sec
Types of muscle fibers participating in the work	-----	-----	White White
The influence or effect of time on entering the state of sports form	-----	-----	Shortens No influence

Note: In the numerator are the results of aerobic-lactate processes and in the denominator, anaerobic-alactate.

TABLE 108

Characteristics of the Training Factors from Anaerobic-Alactate Training Loads to the Aerobic (Collective Data)

Indices	Fully transferred factors	Frequently transferred factors	Non-transferred factors
Heart rate in 1 min	Up to 180 Up to 150	-----	-----
Respiratory frequency cycles in 1 min	-----	-----	14-19 Up to 60
Lung ventilation, Liter per min^{-1}	-----	-----	60-80 120-140
Oxygen reserve, Liter	-----	-----	12-20 90-150
Oxygen debt, Liter	Up to15 10-15	-----	-----
Level of Oxygen use during the time of work, %	-----	-----	Insignificant 95 and over
Maximum O2 uptake, Liter	5.5-6 5.5-6	-----	-----
Content of lactic acid per 100ml of blood, mg	200 100	-----	-----
Energy expenditure, kCal	-----	-----	40-80 up to 750
Energy source	-----	-----	ATP Carbohydrates, fats
Time of developing energy, sec.	-----	-----	0 from 90 to 180
Time energy is acting	-----	-----	0 Several Hours
Duration of maximum distribution of energy, sec.	-----	-----	Up to 10 120-130
Types of muscle fibers participating in the work	-----	-----	White Red
The influence of time on entering into the state of sports form	-----	-----	No influence No influence

Note: In the numerator are the results of anaerobic-alactate processes and in the denominator, aerobic.

TABLE 109

Characteristics of Training Transfer from Anaerobic-Lactate Training Loads to Aerobic (Collective Data)

Indices	Fully transferred factors	Frequently transferred factors	Non-transferred factors
Heart rate in 1 min	Up to 220 Up to 150	-----	-----
Respiratory frequency cycles in 1 min	Up to 60 Up to 60	-----	-----
Lung ventilation, Liter per min^{-1}	140-160 120-140	-----	-----
Oxygen reserve, Liter	-----	-----	30-50 90-150
Oxygen debt, Liter	20-22 10-15	-----	-----
Level of Oxygen use during the time of work, %	About 100 About 100	-----	-----
Maximum O2 uptake, Liter	5.5-6 5.5-6	-----	-----
Content of lactic acid per 100ml of blood, mg	250-300 80-100	-----	-----
Energy expenditure, kCal	-----	-----	150-250 up to 750
Energy source	-----	Carbohydrates Carbohydrates, fats	-----
Time of developing energy, sec.	-----	-----	15-20 from 90 to 180
Time energy is acting	-----	-----	30-180 sec Several hours
Duration of maximum distribution of energy, sec.	-----	-----	From 30 to 90 Up to 300
Types of muscle fibers participating in the work	-----	-----	White Red
The influence of time on entering into the state of sports form	-----	-----	Shortens No influence

Note: In the numerator are the results of anaerobic-lactate processes and in the denominator, aerobic.

The test scores presented in tables 104-109 give evidence to the fact that the aerobic, anaerobic-alactate and anaerobic-lactate training loads have a positive influence on increasing the functional capabilities of the heart-circulatory, respiratory and blood vessel

systems. However, the level of functional shifts when using each form of training load separately can be more expressed in some individual cases, less significantly in others and sometimes they coincide. This means that in response to the effect of the aerobic and anaerobic-alactate and anaerobic-lactate training loads, the above mentioned body systems respond with specific reactions that initially serve in short term adaptational restructurings and later in the long term.

If all types of training loads bring about a definite shift in the functional state of the cardiovascular, respiratory and blood vessel systems, then a natural conclusion follows -- all of them are beyond our desire for some form of interaction between them. If we agree with such a conclusion, it is possible to propose that with the use of definite means of constructing cycles of sports form development, then not only does aerobic training work create the base, foundation, for the anaerobic, but the latter in some cases will have an influence on the first.

The combined use of aerobic, anaerobic-alactate, anaerobic-lactate training loads (we have in view situations in which the variational and complex methods of constructing the above mentioned cycles are used) will appear in a specific interrelationship and have a definite form of action or influence on the development of one or another type of endurance. In some situations the transfer can be positive, in others negative and sometimes neutral. The reaction noted in a given situation depends upon the optimal combination of the three forms of training loads.

In sports practice, there are many examples verifying the fact that with the correct combination of aerobic and anaerobic means of training, athletes can show high results in several distances. For example, S. Auita more than once set a world record in the 1500m, 5,000m, and 2 mile runs. Besides this, tenths of a second differences distinguished him from other record achievements in the 2,000m, 3,000m and 1 mile runs. And here are still more results in other events: 200m-22.8 400m-46.9, 1000m-2:15.16, steeple chase-8:21.92 and 10,000m-27:26.11.

The presence of an interrelationship between aerobic, anaerobic-alactate and anaerobic-lactate training loads is substantiated by our data which we accumulated in studying the development of sports form after the transitional periods in cyclical sports events. It was found that anaerobic-lactate loads shorten the time for entering into the sports form state in aerobic and anaerobic-alactate. At this time, the latter do not influence (do not shorten) the amount of time taken to enter the given state in the anaerobic-lactate training loads.

We will now look at specific reactions of several body systems during the use of aerobic, anaerobic-alactate and anaerobic-lactate training loads. We will analyze the transitional forms of the different adaptational restructurings that influence one another. We will begin with comparison of the adaptational changes that take place in the red and white muscle fibers. It has long been considered that the aerobic training loads serve to change the first type of fiber (red) and the anaerobic the second (white). They take up a full specter of adaptational restructurings beginning with capillarization and innervations and ending with fine changes in the structure of the red and white muscle fibers.

The specific adaptational changes that take place in the red fibers do not have any bearing on the changes that take place in the white. This means that the functional changes that take place in the nerve-muscle system under the influence of aerobic training loads, cannot show positively on increasing the functional abilities of those structures in which adaptational changes take place in response to the use of anaerobic exercises. This means that in the red as in the white muscle fibers, the adaptational changes that take place do not depend upon one another and as a rule, the beginning and ending processes depend to a great extent on the methods of constructing the cycles of developing sports form.

Thus by using stages, adaptational restructurings begin to take place in the red muscle fibers and later in the white, in as much as this method is used for the duration of the first stage (general preparatory) of using aerobic exercises, and the second (specialized preparatory)—anaerobic. In situations in which the variational and complex methods of constructing cycles of sports form development are used, adaptational restructurings will

take place simultaneously since these methods presuppose the use of aerobic and anaerobic training loads in a definite correlation to one another for the duration of the entire training micro-cycles.

The methods used in constructing the cycles of sports form development can to a full measure, explain instances where the acquisition of maximum levels of aerobic and anaerobic abilities are not attained on each level of sports improvement. Specialists in this area most often are interested in the reasons for a decrease in the achieved level of aerobic productivity at the moment of achieving this level when carrying out the anaerobic loads. Are these "scissors" in training regularities or are such results due to the system of training used?

We think that the reason for the non-coinciding of the top limits of acquiring maximum aerobic and anaerobic productivity acquisition, where the first (aerobic) decreases long before the appearance of the second (anaerobic), appear as unknown regularities in the development and maintenance of sports form. This concept was developed in the specifics of the so called "hetero-chronicity" (not occurring at the same time) principle of sports training in regard to the flow of adaptational processes, restoration of different functional abilities of the body systems and so on. We believe that with time, specialists will study this question and that in the theory and methods of physical education, the truth will be brought out which shows the false presuppositions.

We will close on this looking at the transferable and non-transferable factors when using different types of training loads. We will note that according to the experimental studies, we were unable to get experimental data to reveal the essence of the interrelationship between the competitive and specialized-developmental exercises with specialized-preparatory exercises (strength, jump, throws and so on). This is explained by the fact that these latter forms of exercises in sports practice are used sporadically and are far from being used by all athletes. There is also an absence of individual test results in the means of speed-strength preparation with the use of strength, jump and throw exercises.

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The data received by us makes it possible to make several conclusions touching on the question of transfer of the cumulative effect from one type of exercise to another. We will begin with the speed-strength exercises. In all instances there is a positive interrelationship between the competitive event and specialized-developmental exercises. Positive transfer of physical abilities in the track and field throws had a place on all levels of sports mastery when using lighter and heavier implements in the total or complete movement. Specialized-preparatory exercises have a positive influence on an increase in the sports result in the basic event but up to a specific level of sports mastery. Further on, they do not show a positive effect.

However, in this case it does not mean that specialized-preparatory exercises should be excluded from the training. In our view, it is necessary to use them but to a somewhat lesser volume to maintain the achieved level, as well as for carrying out restorative measures. It is very possible that with time, other methods of developing physical abilities will be proposed which will widen the range of transfer with the specialized-preparatory exercises to the competitive and specialized-developmental exercises. Specialized-preparatory exercises can appear as "stimulational factors" which on the brain level, create conditions for the transfer to the main movement.

In cyclical exercises that require the display of endurance, we have a definite range of transfer of physical abilities. As a rule, in comparison to the competitive event, it begins with shorter distances and ends with longer distances. The exceptions here appear to be the ultra long distances (running, walking), where it is impossible to fix the results in events that go beyond the competitive distance (marathon, 10km walk -- women, 50km -- men). The presence of a wide range of transfer of physical abilities in each event requiring the display of endurance, once again substantiates that in order to achieve a definite level of sports results, it is necessary to master one or another form of aerobic and anaerobic productivity. They must correspond to the middle, long and ultra long distances in a specific manner.

Carried out by us in tables 104-109, are the transferred and non-transferred factors that allow specialists to more professionally uncover the essence of the interaction between the aerobic, anaerobic-alactate and anacrobic-lactate type training loads. It may be that not only do aerobic loads create the base or foundation for the anaerobic-alactate and anaerobic-lactate but that the latter may have a positive effect on the first.

Chapter 3

Transfer of Motor Skills

The question of motor skill transfer illuminates the problems faced in learning and improving of technique in the track and field events. At the present time, as brought out in a survey of the literature, technique is less studied than the problem of physical ability transfer even though many tasks are resolved in the process of motor skill transfer, that not only coincide but are organically linked. This first of all touches on the understanding of the very essence of training -- its specificity and unity of the processes involved in learning and improving technique and the development of physical abilities.

The effectiveness of motor skill transfer depends on:

1. Knowing the mechanisms of forming simple and complex motor actions as well as the principles of how specific body systems function in the process of working out and improving the motor actions;
2. Selection of means (general preparatory, specialized-preparatory, specialized-developmental, competitive exercises) and methods (part, whole, mixed) of training;
3. The zones of training load intensities that are used;
4. The formation of a rational movement rhythm;
5. Duration of the training loads used in the learning and improvement of technical mastery, and on the duration of separate training sessions, in micro-, meso, and macro- cycles of training;
6. The structure of ordinary and complex training sessions used in the cycles of sports form development.

Each of these factors will be looked at in this chapter. First it is necessary to note that in the theory and methods of track and field, there are but a limited number of studies that reveal the essence of these problems.

General Principles of Coordination of Motor Activity

It is generally known that even during the time of Descartes the principles of coordination of activity coincided with the principles of working out and establishing conditioned reflexes. The conditioned reflex was considered a natural reaction in response to external or internal influences, where the strength and direction of the reaction corresponded precisely to the amount and character of the irritants coming in on the afferent pathways. Any complex movement is looked at as the sum of reflexes and reflex arcs. It was noted that the conditioned reflex activity is coordinated and directed by the central nervous system. It was believed that the basis of coordination is in the interaction of antagonistic forces. Some of them excite and others, in opposition to them, inhibit.

The nature of motor activity coordination does not negate the conditioned reflex. Even at the present time, even though more than three centuries have passed since the time of Descartes, the only thing that has changed is the presentation of the mechanisms of forming and establishing conditioned reflexes according to the principles of body system functioning that ensure its activity. It has been shown that a conditioned reflex does not appear as a simple mechanical reflexive act. Each reflex reflects a complex process of individual development. They can serve as "construction blocks" of complex reflexes, tying in to individual chains, stereotypes and so on [7, 23, 30, 62, 170, 203].

It became clear that the processes of excitation and inhibition do not appear as being different, according to their natural appearance. They are mutually tied in between themselves and reflect the active state of living tissue. Depending upon the influence of different factors (strength of the excitatory agents, state of the nerve-muscle system and so on) the excitatory phase can transition into the inhibitory and the inhibitory into the excitatory [4, 13, 171, 175, 302].

It appeared that the reaction response was not always adequate to the strength of the influence (stimulus). To a great extent it is determined by the state of the nerve-muscle

system at the moment the influence of the external or internal agent is applied [14, 27, 37], the need by the body systems [7], what is allowed by the persons genetic makeup [7, 195, 253, 302] and so on. Revealed was a "general pathway" of coinciding impulses from various efferent centers. The shown mechanisms of the struggles between them as a result of which there appear maintenance of certain ones and inhibition of others [15, 131, 171, 302]. All of this allows for the unification of the different reactions into one system.

Many authors are in agreement that the mechanism for forming and locking in a conditioned reflex tie is explained by the summation in the dominant center of brain excitation, which receives participation from different parts of the central nervous system [47, 170, 171, 228]. The dominant inter-central interrelationships was shown by the leading physiologist A. A. Yukhtomski [229], who isolated two stages of dominance formation. In the beginning stage there is a strengthening in the bed of excitation that is available because of the influence of other irritants. On the second stage there is a summation in the bed (breeding ground) of excitation that takes place in definite nerve centers of the brain. That is, it acquires a property of specificity [76, 151]. Some authors consider this dominance a simple form of a temporary tie-in [174, 177, 197, 198].

At the beginning two sided principles are revealed [7, 171, 177], and after this, multi-sided tie-ins [12, 13, 24, 131], mechanisms of mutual interrelationships between them [13, 170, 171, 175], and the appearance of opposite tie-ins [7, 131, 171]. This makes it possible to conclude that in the conditioned reflex activity, there lies not a reflex arc, but a reflex circle [7, 25]. This is in agreement with the "theory of the functionality of systems" [7], which explains conditioned reflexes: Impulses move not only from the periphery to the center (afferent pathway) but also from the center (efferent pathway) toward the periphery forming a reflex circle [7, 25].

It was shown that the information coming from the center to the periphery on the efferent pathway is distinguished from the pathway which is followed from the periphery to the center. A change in the force and character of the following opposite tie-in information is

explained by the integration of the brain activity [7, 26, 185, 277, 285]. It is natural that it has definite functional laws in its foundation, which by the way, have been studied very little. Only one thing is clear, that the process of reworking the impulses on the brain level is corrected by the needs of the body systems to the information coming in [149], and likewise, the "commands permitted" by the genetic make up [253].

It was always thought that coordination of motor activity is achieved by equilibrium between opposite acting forces. In classical physiology, the discussion was of the interaction between the processes of excitation and inhibition, where irradiation of the excitation is limited by the inhibitory "boundary" [170] and then directed into the needed "course" [171].

According to N.A. Bernstein [25, 26] movement coordination is the over coming of surplus degrees of freedom by including the necessary specific conditions of motor activity of the muscles or muscle groups and extinguishing the reactive forces that arise from special muscular efforts.

Regardless of the different views of the determining agents that ensure the interrelationship between the opposite struggling forces (excitation and inhibition, reactive forces, extensors and flexors), it is clear, that in working out and improving motor acts, the discussion is of definite coordination between separate muscles and muscle groups, which is directed by the corresponding activity of different levels of the central nervous system. For many years it was considered that locking in the conditioned reflex tie-ins took place only on the brain level but then Bernstein [25] proposed that they can also take place on the spinal level.

In the process of forming motor acts a definite sequence is worked out for including individual body links which are made more precise on the brain level and the force of the impulses arising on the afferent pathway. When "worked over" they are directed, according to the efferent pathway to the muscles, by exciting some and inhibiting others. This is first of all related to the antagonistic muscles (flexors and extensors).

In classical physiology, specialists who examined the principles of coordination of motor activity, always speak of the laws of formation and establishment of conditioned reflexes. In sports physiology they write of the dynamic stereotype in similar situations. A. N. Krestovnikov [126] transformed the learning of conditioned reflexes in the theory and practice of sport. The dynamic stereotype, according to his thinking, is nothing different from a long term conditioned reflex tie. After it is worked out a definite deep dynamic system is formed. It is --- and can be --- the expedient sum total of different -- according to form and content -- "thin and deep", dynamic temporary ties [119, 121]. The dynamic stereotype as a definite system of reflexes, includes motor and vegetative reflexes, and is an integrated form and presentation of the ending purpose of its activity [7, 26].

According to E. I. Boyko [30], in man there is a general mechanism for working out and consolidating various types of skills. It does not correspond to only one "skill" and cannot be called a dynamic stereotype in the full sense of this term. Thin and deep dynamic temporary ties are reflected as "dynamic varitypes"

General coordination of man's motor activity in one instance can be explained by the sum working out of conditioned reflexes [84, 170], and in a second, by the presence of a definite number of dynamic functional systems of which there are as many as there are existing exercises [7], and in the third instance, by the number of acquired dynamic stereotypes [80, 126]. There are also specialists who write about the formation of complex "fusion" of the created and acquired reflexes and coordination [13, 115].

The plasticity of nerve functions appears as one of the important principles in the formation and establishment of new coordination's and reworking of the old. According to I.P. Pavlov and his students [13, 115, 131], conditioned reflexes can be tied in to complex groups of reflexes, links and systems. All of this helps to create new conditioned reflexes. Without exaggeration, it can be stated that each complex dynamic stereotype (conditioned reflex) consists of a definite number of simple reflexes. The latter can be worked out both on a local as well as on a global level.

In the first instance we have in mind that simple reflexes can be formed in the process of fulfilling simple local exercises, as for example, the bench press. In the second—the global, all the body links of the individual are acting during the motor activity. The already worked out dynamic stereotype then serves as a "building block" for forming new motor acts. "Dynamic varitypes" which were noted by Boyko [30] have the ability to spread out on the entire, earlier worked out dynamic stereotype, and serve to form new ones in the process of ontogenetic development.

Means of Training that Allow Transfer of Motor Skills

The theoretical and experimental material related to the search for means of training that allow transfer of physical abilities as outlined in chapter 2, is fully substantiated by the view of the "specifists". They believe that the transfer of training is possible only when similar exercises and motor actions are used. It likewise became clear that there are poly-structural properties of physical exercises and, poly-functional and poly-systemic properties of specific body systems in the foundation of transfer of physical abilities.

In the first case (poly-structural), in the process of executing the exercises, similar muscle groups participate. In the second case—the discussion relates to different movements according to form and structure, that bring forth identical levels of activation of specific body systems. The poly-systemic aspect is explained by the inclusion of similar local body links in the process of executing simple as well as complex exercises (according to coordinational structure). The transfer of motor skills, as distinguished from the transfer of physical abilities, is explained mainly by the poly-structural and poly-systemic properties. The poly-functional can only serve to fulfill the exercises in the process of their mastery and improvement.

The transfer of motor skills is a more specific process than the process of physical ability transfer. If a positive transfer of physical abilities to the competitive exercise is possible with specialized-preparatory and special-developmental exercises, then in the transfer of motor skills a positive interaction is possible only between specialized-developmental and competitive exercises. Special-preparatory exercises only serve in the display of the motor potential of an athlete and achievement of a definite level of physical preparation. The poly-structural properties of the exercises used presuppose the inclusion of similar muscle groups and their localization in definite body links where specialized-developmental exercises can repeat the main motor action as a whole or its separate parts. In each track and field event there are a sufficient number of similar exercises that serve the positive transfer of motor skills.

The use of specialized-preparatory exercises not only delays the process of learning and improvement of technical mastery, but carries with it irreparable harm. We have in mind here not only an increase in unneeded muscle mass, but in sprints and hurdles, as well as in the jumps, it limits the achievement of one or another level of sports result, and serves to increase coordinational tension. For example, excessive development of the arm and shoulder girdle muscles shortens the amplitude of movement of the implement in the hammer and javelin throws, and "tightens up" sprinters, hurdlers and jumpers. Hypertrophy of the muscles leads to a decrease in flexibility and this shows up negatively on sports results in those events that require great mobility in these or other links of the motor support system.

Another example related to the training of sprinters, hurdlers, jumpers and javelin throwers is excessive development of "slow" muscle mass (red muscle fibers) that does not promote the display of speed and reactive abilities of the nerve-muscle system [154]. In the latter case we have in mind instantaneous switching from one regime of muscle work to another.

When we speak of the poly-structural properties of exercises we have in mind the use of similar forms of motor activity. Their execution is fulfilled by complete muscle groups. When the basic movement links coincide, a positive transfer of skills is observed and when the similarity is minor—a negative [128].

The more the working elements coincide in the process of mastering and improving technique in one or another track and field event, the greater is the positive transfer of motor skill. It is especially in these cases that discussion is of the training of high level athletes. Here it is expedient to use specialized developmental global exercises as the base. They have the training form of the competitive exercise. For example, throwing lighter and heavier implements when executing the total movement in the throws, and in some cyclical events, running uphill or downhill on an inclined pathway.

A positive transfer of motor skills using localized exercises to the competitive event is most frequently observed in the training of novices and low level athletes. But even here the more the exercise of a local nature repeats one or another portion of the main movement, the more the positive effect will be expressed. In the throws this relates to exercises such as the final effort from place. In sprinting and in hurdling, similar exercises can be "running in place" or "running in support".

It is always necessary to take into consideration that when using the competitive exercise training form, there can be not only a positive effect, but also a negative. For example, in the throws, the use of heavier or shortened (cable) implements shows up negatively on execution of certain technical elements [18, 152]. This also happens in relation to the amount of increase in the implement weight and release angle [18].

When using lighter implements some authors come up with a negative effect on the rhythmic structure of the entire throw of the competitive implement [18]. However, there are studies that show that when observing certain methodological methods, the negative consequences can be avoided totally or be brought to a minimum [20, 33].

In the track and field group of sprint and hurdle runs there is a change in the angle of thigh flexion in the hip joint, shin in the ankle joint, lean of the trunk and take-off angle when using uphill and downhill running on an incline road. The deviations to one or another side from the optimal biomechanical characteristics, do not show a substantial influence on the process of improving technical mastery in high level athletes. They can be eliminated over the course of several weekly cycles if the given exercises are excluded from the training.

If the discussion relates the use of these exercises in training beginners and low level athletes, then they can produce non-correctable harm, since in these athletes the only change that takes place is in the learning and stabilization of running technique. In high level athletes the motor skills are very stable and it is very difficult to disturb them. To do this, it is necessary to use special methodological means over a long period of time.

The use of supplementary weights in the high jump interferes with many movement characteristics (space-time, strength, rhythm and others) Based on this, it is necessary to select a resistance (waist belt, waist jacket) so that the weight does not cause a substantial change in technique. It should not be more than 3-5% of the proper weight of the athletes [81].

The level of motor potential displayed is determined by the structure of the exercises used especially in complex-technical events such as in sports gymnastics. Here is has been shown that when using such exercises it is necessary to observe the angles seen in the positions which are used in the process of executing the competitive movements [154]. It appears that even in the transfer of physical abilities, the transfer is realized more effectively with practiced exercises on the unpracticed by observing the given position. This is especially so in the process of acquiring strength abilities [80, 96].

The Sequence of Including Specific Body Links in the Athletes Work

Most track and field events appear as multi-link exercises. In executing them, many muscle groups and body links of the athlete are included. Each exercise consists of a definite number of simple and complex (according to coordination) movements. In the process of learning and improving technique, a specific sequence of including them in practice is worked out. In some cases it can be rational -- precisely corresponding to the basic biomechanical regularities of the given movement, and in other cases – non-rational, as a consequence of their interfering with one another.

In the process of learning and mastering technique, it is necessary to pay attention so that the exercises used repeat precisely the same consecutiveness of including the athlete's separate body links that correspond to execution of the competitive movement. Only by observing this rule is it possible to have a positive transfer of the specialized-developmental exercises to the competitive event. This is also related to the use of the training forms of the competitive exercise that are used when executed in lighter and more difficult conditions.

If the exercise being used does not correspond to these details, then in sports practice, we will always come up against a negative transfer of motor skills. To escape the unwanted consequences is very hard and sometimes impossible. The latter conclusion relates to those cases, when in the process of learning, a non-rational sequence of specific body links is included in the work. The negative transfer is maybe even deeper in those cases, when in the process of learning, there is a definite "feel for the implement" or "feel for the hurdle" or "feel for the movement" etc., is being worked out. They play a more significant role in over-learning than effective means of training.

The athlete always "collates" new sensations with the "old". The latter are so stable and "comfortable" to the body, that even if they appear non-rational, it is not always possible

to avoid them in the process of establishing and improving effective technique. Changing the non-rational technique to rational is always a painful process and in most cases, is ineffective the first times. Note that on every level of technical mastery there should be a corresponding level of development of the physical abilities. Here there is evidence of the disharmony between form (technique) and content (physical abilities). As a consequence there is a decrease or stabilization of sports results. Harmony appears after several periods of sports form development.

The developed "feel for the implement" "feel for the hurdle" and others is deeply specialized and appears as a result of long term adaptational restructurings. Such specialization requires precise selection of the exercises used both in the process of learning technique as in its improvement. For example, we can use the learning of hammer throw technique. Here many specialists have come to the following fact: effective technique is more easily learned by novices than high level throwers who first specialized in other forms of throwing. Thus if the athlete threw the discus earlier, then in learning the hammer throw technique, he will most certainly execute the entry into the first and following turns with leg rotation, leaving the hammer off to the right. Effective hammer throw technique entails a different sequence of inclusion of specific body links in the work. Here the movement begins with active actions of the arms, shoulder girdle and trunk, as a consequence of which the implement is moved to the right—forward left, and only after this does the work of the legs begin.

Methods of Learning and Improving Motor Skills

Three methods for learning and improving technical mastery exist: part, whole and mixed (whole-part). The basis for the first one lies in the development of all the movements by part, each of which duplicates a definite element of one or another part of the entire exercise. The whole method is characterized by the learning and improvement of technique by means of constantly repeating the whole exercise. In the mixed method, both the part as well as the whole method are used.

In using the **part method,** a positive transfer of motor skills is observed only when first beginning to form the skill [143]. In the training of high level athletes, we come up with neutral or negative transfer. In the first case, the learned movement cannot be transferred to the whole movement because the consecutiveness of inclusion into the work of separate body links, when executing specialized developmental exercises, most often is different from what is seen in execution of the competitive exercise.

For example, in the discus throw, javelin and shot put from place, the specific movement after the swing movement or starting position begins with active work of the right leg (right handed individual). When using the whole throw in the first part of the final effort, the right leg executes the role of a preliminary link. In effective throwing technique, it begins to extend only at the end of the final effort. Trying to execute the final effort in the process of executing the entire throw, using the same consecutiveness of including specific body links as are seen in throws from place, in the best cases remain only "good tries" and at worst, appear as the reason for many gross errors. Because of this, high level athletes are distinguished by their throws from place, but do not always repeat this movement in the process of executing the whole throw.

We should also add that the kinematic characteristics of throws from place are distinguished from throws when executing the whole movement. As a result of using only the part method athletes frequently learn to execute, separate elements and joint parts that are separate from one another relatively well. They then often encounter

difficulty in executing them within the structure of the entire movement mainly because in learning one or another of its parts, the athlete executes the part with a definite speed which can be greater or lesser than that required when executing the entire movement.

For example, it is possible to execute the basic elements of the hurdle run very well from a walk (approaching the hurdle, coming down from the hurdle) but poorly in the run. A positive transfer is made more difficult by the fact that in the process of executing the entire movement, inertial forces arise that are distinguished greatly from those experienced during execution of their separate parts. These forces are created from the static (initial) position where speed of the implement or body begins to increase from zero. A different rhythm tempo structure is worked out here.

The part breakdown method (of the entire skill) is used in the training of highly qualified athletes mainly to learn the correct changes needed in technique of the entire movement, if it is needed. Its use in complex-technical events does not give a positive effect because what is learned with total movement parts, is not always realized to a full extent in the process of executing the full exercise. Exceptions to this are those events that are composed of several simple elements, where in the process of executing the first of them, speed of body movement is developed and the rhythmic structure of the movement is repeated, both of which are necessary for execution of the entire exercise.

The **whole method** of learning and improving serves to produce a positive transfer of motor skills mainly in the training of qualified (high level) athletes. Most frequently, they begin to use this method for sports improvement after they have learned separate elements of the entire exercise. Usually when using the whole method in training, competitive exercises or their training forms are used.

The **mixed method** of learning and improving technique is more progressive than the part or whole methods used separately. Its use on any level of sports improvement makes it possible to work on both separate elements of the competitive exercise as well as the entire movement as a whole. With an increase in the qualifications of the athletes, the

importance of the training work executed with the use of the part breakdown method decreases all the time. Thus, if in the process of learning technique, the ratio between the breakdown and whole methods is 3:1, then in qualified athletes it changes and becomes 1:3. Definite proportions of these methods depend not only on the qualifications of the athletes but on the situations that arise in the training process that have a direct relationship to their technical mastery.

In sports practice, the training sessions are constructed so that the athletes execute the competitive movement with the parts of which it is composed at the beginning and only after this, the entire movement. A variant is also possible in which over the duration of a single session, individual elements of technique are improved and in another, all the movements as a whole.

The Influence of Different Training Load Intensities on Learning and Improving Technical Mastery

Training loads having different intensities show different influences on learning and improving technique in the track and field events. When first acquiring motor skills, weak to moderate intensity training loads are mainly used. Their positive influence is explained by the fact that the strength of the effect of a specific intensity zone, allows one to control execution of the movement elements according to their parts, or to control it as a whole [25, 26, 191].

With maximum speeds, sensory corrections are made more difficult when the exercise is executed, since there is insufficient time to work out the sensory loop [26]. It has been shown that intense running worsens the athletes attention, changes the movement structure, and interferes with the already established differentiations because of the stronger excitation in specific zones of the brain motor analyzer [9, 151]. Large loads serve to worsen the conditioned reflex activity [71, 210], and shorten the time of the motor reactions.

Weak and moderate intensity training loads improve attention stability [210], allow for better reproduction of earlier acquired information [26], help to more fully master the rhythm of the movement execution [34, 81], and to control speed of the motor acts [80, 81].

The influence of training loads having different intensities in explained by their physiological characteristics. Thus, execution of any movement with maximum effort is accompanied with strong irradiation of the excitatory-inhibitory processes in the brain. Weak irritants bring about weak irradiation of these processes and moderate concentration [170].

The use of weak and moderate intensity training loads on the stage of acquiring motor skills has a negative influence on the reproduction of the already learned skills with maximum effort [34]. Similar consequences are seen in the training of highly qualified throwers. Thus athletes who used only weak and moderate intensity training loads were not able to reproduce the learned technique when using maximum effort when appearing in competitions. Those who used only maximum and near maximum loads (95-100% of maximum) were not able to throw well technically when using weak and moderate effort. In both examples, the negative consequences related to not only execution of these or other movement elements, or the entire movement as a whole, but also reproduction of the rhythm.

Similar consequences are encountered by specialists in all track and field events having complex coordination patterns. In order to escape the negative influences, they recommend the use of all zone intensities beginning with the first stage of learning. However, the number of training loads with maximum intensity should be limited because the reproduction of information depends upon the conditions of its acquisition. The conditions should be as close as possible to those which were put into memory [3, 117].

Considering these facts, which are evidence of the negative influence of high intensity training loads used in the process of learning and improving skill, it should not be forgotten that the use of high intensity zones have an effective influence on the development of physical abilities [49, 57, 92], and help in the reproduction of the learned activity in competitive conditions [154]. In long term adaptational restructuring of the body systems involved, training work of maximum intensity creates conditions for improving the mechanisms of attention switching [45], customization to the given muscle work regime [65, 117], and improving the ability to concentrate [22].

According to V.M. Dyachkov, in the training of novices transitioning to the use of high intensity zones should be gradual. At the beginning it is necessary to master the 90% of maximum zone and only after this switch over to higher zones (95-100%). Attention

should be focused mainly on the 90% of maximum zone and consider it to be the optimal and most controllable [81].

The portion of maximum intensity training loads used in the process of mastering technique should be about 10%. This amount can change depending upon the individual characteristics of the athlete and the task to be resolved.

In the process of improving technical mastery, weak intensity training loads are used mainly for carrying out specialized warm-up [34]. The main work is carried out with moderate and maximum effort. However, the amount of maximum intensity loads should not go above 10-30% of the total volume [34]. The use of moderate and maximum effort makes it possible to systematically form movement technique that approximates the parameters of speed, tempo and the degree of effort that are needed to demonstrate the planned result [34, 81].

Rhythm of Competitive Movements

It is correctly considered, that the formation and optimization of the competitive movement rhythm appears as a central problem in all technical preparation of athletes. *Rhythm* is the basis of movement technique. It characterizes the movement action as a whole, regulating the timely order of combining all of its composed parts [154]. All movements are executed with constant or changing speeds, which in turn determines their rhythm.

However, the total amount of time taken in executing all of its parts, does not fully characterize the movement since it does not show the structure of the rhythm in each separate element. Rhythm does not characterize the total amount of time taken for execution of one or another movement but its dynamics. In studying the dynamics, we can formulate and control rhythm. For determining the rhythmic structure of motor actions it is necessary to measure time and not effort [79, 80], even though the results of biomechanical studies show that in track and field throws, rhythm can be also be judged according to the dynamics of the different strength characteristics [20].

In each whole movement there is rhythm, in as much as it has parts of the whole motor action. In sports practice each part is differentiated by a definite duration which is called non-rhythmical movement. In biomechanics it is evaluated as the rhythm of non-rational movement or non-observance of a given rhythm [79, 80].

The formation of movement rhythm, especially in speed-strength events even in the process of learning technique, has a sharply expressed individual direction. Its structure is worked out in correspondence to the level of development of definite physical abilities that the athlete possesses. Further on, it is improved and maintained over the duration of many years of sports training.

Representatives of the cyclical disciplines requiring the display of endurance, appear to be excluded here since the endurance is displayed in relation to the selected tactics of the

competitive activity, i.e., the changes in speed over a certain distance within different parts of the competitive distance. But even here, a definite rhythm is worked out in training sessions which can model the competitive activity facing the athlete. This is done by selecting a tactical scheme for conducting the sporting activity over the distance. In one case the athlete is given a setting in which he repeatedly covers a certain distance or segment at a constant tempo or, goes above the average competitive speed. In separate training sessions they can be made to resolve the task standing before the athlete for the duration of the sports form development cycles. In the second case, they cover the second part of the training segment faster than the first.

By taking into consideration the specifics of the distances that require the display of endurance, the formation of competitive rhythm takes place in parts, that is, in the training, athletes can repeat the necessary competitive speed or exceed it with the use of shorter distance segments. Here, the greatest transfer will be seen in those instances where the training "parts" will not be substantially different from the competitive activity [84].

What appears to be a constant in rhythm is the alternation of the parts of which it is composed. Maintained is the whole rhythm, the order of including the main muscle groups into the work [20], and the dynamics of speed from one part of the movement to the following. For example, in the training of throwers, this is observed not only when throwing implements of different weights but in throws with weak, moderate and maximum effort [34]. The movement structure is repeated when using different training load intensities and in other speed-strength events in track and field. This occurs regardless of the fact that in each training session, a somewhat unsteady physiological state is observed in the systems included; or in other systems of the body which depend on many other factors.

The rhythmic structure is always determined by the individual characteristics of the athlete. They are displayed over the entire sports life of the individual. The individual dynamics of an increase in effort (speed) from one part of the movement to another, or to

the competitive distance, is maintained even in those cases, when the athlete shows different sports results (tables 110-126).

TABLE 110
Structure of Rhythm in the Men's 100m Run of the Strongest Sprinters in the World During the 1997 Season [290]

Distance segment, m	Time of overcoming the segment, sec.					
	Green	Bailey	Montgomery	Fredericks	Volden	Enzima
0-10	1.71	1.78	1.73	1.73	1.72	1.78
10-20	1.04	1.03	1.03	1.04	1.05	1.05
20-30	0.92	0.91	0.93	0.93	0.93	0.94
30-40	0.88	0.87	0.88	0.89	0.89	0.89
40-50	0.87	0.85	0.86	0.87	0.87	0.87
50-60	0.85	0.85	0.86	0.86	0.87	0.87
60-70	0.85	0.85	0.86	0.86	0.87	0.87
70-80	0.86	0.86	0.87	0.87	0.88	0.88
80-90	0.87	0.87	0.88	0.88	0.90	0.89
90-100	0.88	0.90	0.90	0.89	0.92	0.93

TABLE 111
Rhythm Structure in the 110m Hurdles of the Finalists in the World Championships in 1997 (According to the Data of H. Hammel, 1997)

Hurdle distance segment	Time of overcoming the segment, sec.					
	A. Johnson	K. Jackson	I. Kovach	F. Schwarzdorff	D. Filbert	T. Rizi
First	2.56	2.58	2.62	2.58	2.62	2.66
Second	1.00	1.04	1.06	1.06	1.08	1.06
Third	0.98	1.00	1.02	1.00	1.00	1.02
Fourth	1.00	1.00	1.02	1.02	1.00	1.00
Fifth	0.98	1.00	1.00	1.02	1.00	1.02
Sixth	1.02	1.00	1.02	1.02	1.02	1.02
Seventh	0.98	1.00	1.04	1.02	1.02	1.02
Eighth	1.05	1.02	1.00	1.02	1.02	1.02
Ninth	1.02	1.04	1.04	1.04	1.06	1.06
Tenth	1.03	1.04	1.04	1.06	1.04	1.10
Final portion	1.31	1.31	1.32	1.36	1.40	1.30

TABLE 112

Rhythm Structure in the 100m Hurdle by Olympic Champion I. Donkova and Bronze Medal Winner in the World Championships in Helsinki G. Zagorcheva [74]

Distance segment (hurdle)	Time of overcoming the segment, sec.	
	I. Donkova	G. Zagorcheva
First	2.50	2.49
Second	3.50	3.47
Third	4.46	4.42
Fourth	5.40	5.39
Fifth	6.36	6.33
Sixth	7.30	7.26
Seventh	8.26	8.17
Eighth	9.24	9.15
Ninth	10.20	10.15
Tenth	11.20	11.17
Final portion	12.25	12.25

TABLE 113

Rhythm Structure in the 100m by Finalist in the Seoul Olympics K. Jackson and V. Torrens (According to the Data of V. M. Kuhno, 1998)

Distance segment	Time of overcoming the segment, sec.	
	K. Jackson	V. Torrens
10	2.04	2.01
20	3.17	3.12
30	4.20	4.15
40	5.17	5.13
50	6.14	6.10
60	7.11	7.05
70	8.07	8.01
80	9.04	8.99
90	10.00	9.98
100	10.97	10.97

TABLE 114

Rhythm Structure in the 400m Hurdle by Seoul Olympic Champion D. Phillips and Silver Medal Winner Di A. Ba (According to the Data of V. M. Kuhno) 1998

Distance segment (hurdle)	Time of overcoming the segment, sec.	
	D. Phillips	Di A. Ba
First	5.80	5.96
Second	9.36	9.60
Third	13.13	13.33
Fourth	16.97	17.10
Fifth	20.93	21.10
Sixth	24.98	25.06
Seventh	29.14	29.26
Eighth	33.18	33.44
Ninth	37.45	37.83
Tenth	41.99	42.27
Final portion	47.19	47.23

TABLE 115

Rhythm Structure in the 110m Hurdle Run by Olympic Champion C. Jackson and World Champion A. Johnson (According to the Data of H. Hammel, 1997 and V. M. Kuhno, 1998)

Distance segment (hurdle)	Time of overcoming the segment, sec.	
	C. Jackson	A. Johnson
First	2.56	2.56
Second	3.57	3.56
Third	4.55	4.54
Fourth	5.56	5.54
Fifth	6.54	6.52
Sixth	7.56	7.54
Seventh	8.54	8.52
Eighth	9.58	9.57
Ninth	10.58	10.59
Tenth	11.61	11.62
Final portion	12.93	12.93

TABLE 116

Rhythm Structure in the 100m Run by Olympic Champion L. Christie and Finalist in the Seoul Olympics M. Smith (According to the Data by V. M. Kuhno, 1998)

Distance segment, m	Time of overcoming the segment, sec.	
	L. Christie	M. Smith
10	1.92	1.92
20	2.97	2.97
30	3.92	3.90
40	4.81	4.79
50	5.66	5.65
60	6.50	6.50
70	7.36	7.36
80	8.22	8.23
90	9.02	9.10
100	9.99	9.99

TABLE 117

Rhythm Structure in the 200m Run by Olympic Champion S. L. Deloucha and C. Lewis (According to the Data by V.M. Kuhno, 1998)

Distance segment, m	Time of overcoming the segment, sec.	
	L. Deloucha	C. Lewis
50	5.84	5.76
100	10.35	10.31
150	14.97	14.97
200	19.78	19.79

TABLE 118

Rhythm Structure in the Triple Jump by 1997 World Champions (Women) in the Final Segment [268]

Athlete	Distance, m		
	Hop	Step	Jump
Kasparkova	4.61	4.20	5.64
Matiesky	5.70	4.19	5.54
Govorova	5.57	4.09	5.16

TABLE 119

Rhythm Structure in the Triple Jump by 1997 World Champions (Men) in the Final Segment of the Movement [268]

Athlete	Distance, m		
	Hop	Step	Jump
Kiesada	6.68	5.21	6.19
Edwards	6.34	5.21	6.35
Uratiya	6.54	5.47	5.76

TABLE 120

Rhythm Structure in the 400m by Olympic Champions M. Cox and O. Brizgina [75]

Athlete	Result, sec.	Time of overcoming 100m segments, sec.			
		First	Second	Third	Fourth
M. Cox	48.16	8.48	9.23	8.30	7.40
O. Brizgina	48.16	8.46	8.63	8.10	7.25

TABLE 121

Rhythm Structure in the 400m Hurdle Run by D. Sherwood and G. Vanderstock [41]

Athlete	Result, sec.	Time of overcoming the 100m segments, sec.			
		First	Second	Third	Fourth
D. Sherwood	49.0	11.9	11.6	12.4	13.1
G. Vanderstock	49.0	11.9	11.5	12.2	13.4

TABLE 122

Rhythm Structure in the 400m Run By Olympic Champion M. Johnson and Silver Medalist in the World Championships in 1997 D. Camody [290, 295]

Athlete	Result, sec.	Time of overcoming the 100m segments, sec.			
		First	Second	Third	Fourth
M. Johnson	44.37	11.09	10.66	10.75	11.87
D. Camody	44.37	11.27	10.06	10.70	12.12

TABLE 123

Rhythm Structure in the Triple Jump by 1997 World Champions (Women) in the Main Part of the Competitive Event [268]

Athlete	Speed of movement, sec.				
	Penultimate step	Last step	Hop	Step	Jump
Kasparkova	9.4	9.2	8.3	7.7	6.8
Matiesky	9.9	9.6	8.8	7.9	6.7
Govorova	9.2	9.2	8.3	7.5	6.2

TABLE 124

Rhythm Structure in the Triple Jump by 1997 Olympic Champions (Men) in the Main Part of the Competitive Event [268]

Athlete	Speed of movement, sec.				
	Penultimate step	Last step	Hop	Step	Jump
Kiesada	10.1	10.3	9.7	8.5	7.3
Edwards	9.9	9.6	10.1	9.0	7.6
Uratiya	10.1	10.6	9.8	9.6	6.8

TABLE 125

Rhythm Structure in the Long Jump by 1997 World Champions (Women) in the Final Part of the Approach Run [291]

Women athlete	Stride length, m		
	Third before the final step	Second before the final step	Last
Galkina	2.18	2.41	2.07
Han Hu	2.61	2.12	2.27
Mei	2.30	2.29	2.25

TABLE 126

Rhythm Structure in the Long Jump by 1997 World Champions (Men) in the Final Part of the Approach Run [291]

Athletes	Stride length, m		
	Third before the final step	Second before the final step	Last
Pedroco	2.28	2.43	2.16
Weider	2.34	2.43	2.27
Sasunov	2.30	2.50	2.40

One and the same level of sports achievements is demonstrated by athletes who have different rhythmic structures (see tables 110-126). In many cases even though the dynamics of speed increases from one portion of the movement to the following, each athlete taken separately, is substantially different. Thus, in the training of throwers, athletes can be divided into three groups distinguished from one another by the structure of the throwing rhythm. For athletes in the first group the following structure of rhythm is characteristic: they execute the beginning movement at a relatively slow speed, and after this it sharply increases. Athletes in the second group begin the movement very quickly but further on, the increase in speed is insignificant. Throwers typical of the third group gradually increase speed of movement from one portion of the throw to the other.

The individual structure of rhythm should be improved constantly. It can be modeled when using training loads of different intensities, as well as when executing the competitive movement or its parts, in more difficult or lightened conditions.

In conclusion, we should take note of still one more surprising essential of the body---its ability to remember the rhythm of movement which is repeated in the process of learning and mastering technique. In the process of learning rhythm in the sprints and hurdles,

most frequently they fix the time of overcoming separate segments (or hurdles) over the competitive distance. In the throws, they fix the dynamics of speed increases from one portion of the movement (double and single leg support) to the following. In the jumps, rhythm is related to the increase in speed in the process of executing the entire movement or its main parts. Of the latter, we take note of the last steps before take-off (from two-three to five steps), as well as the dynamics of the very jump.

Several authors have noted the relative stabilization of the means of training used in the process of learning and improving technique, and consequently movement rhythm, that makes possible the positive transfer of motor skills and abilities. If not, the extraneous, frequently changing irritants can negatively effect what was learned earlier [38].

The Duration of Technical Preparation During Individual Training Sessions

The understanding of "duration" of the training effect in the theory and methods of physical education means a definite "volume" of training loads executed over the span of definite periods of time. In this case, discussion is of the total amount of the technical preparation means used over the duration of the training sessions.

At the present time, in each track and field event, there are definite recommendations for using one or another amount of "technical" means of training in relation to the qualifications of the athletes, individual characteristics, age and so on. They determine not as much of the theoretical methods/pathway as much as they do the experimental. In the 1970's and in the first half of the 1980's, the volume of training loads increased several times in comparison to the 1950-1960 years. In the cyclic events, requiring the display of endurance, this was apparently justified by their specificity, while in the speed-strength events, a search started for new means of sports improvement.

In the second half of the 1980's, the volume of training loads using means of technical preparation over the span of individual training sessions, began to gradually decrease in the sprint events, the hurdle run, the jumps, throws, decathlon and pentathlon. Decreasing the volume of these exercises in the speed-strength events is explained by the fact that specialists, through experimental studies, came to the conclusion that there are "norms" for effectively mastering "technical" work. Going above this amount showed up negatively on the learning and improving of technique and consequently, made positive transfer more difficult. The norm was determined by the number of segments run in the sprints, and in the jumps and throws by the number of jumps and throws using competitive exercises, and in the hurdle run, the number of segments run with hurdles. There is an optimal "norm" for mastery as well when using separate parts of the competitive exercise.

It has been noted that highly qualified athletes can execute "technical" work several times longer than beginners or low level athletes. In the latter, technical "marriage" begins to show up after 8-10 trials in jumpers, 10-12 trials in throwers and 5-8 runs by sprinters and hurdlers. Deviations from these average amounts can move from one side to the other. They depend first of all on the individual characteristics of the athlete and the state of the body systems during one or another training session. Thus in the cholerics, fatigue of the coordinational processes begin significantly earlier than those who are sanguine or phlegmatic. It is interesting to note that this fatigue does not appear gradually but suddenly.

The beginning of the appearance of the technical "marriage" serves as a signal for ceasing execution of the given training work. Using it longer, shows up negatively on the process of learning and improving technical mastery. This happens because coordination is disrupted, as a result of which, the athlete begins to execute all the movements as a whole, as well as the separate parts, with significant errors. The athlete begins to lose the feel of the "implement" in the throws, "hurdles" in the hurdle run, "take off board" in the jumps and so on. This immediately shows up on movement rhythm.

Restoration of the optimal level of coordination capabilities is made possible by alternating "technical" training sessions or their parts with others as for example, "strength" ones. With the normal means of constructing separate trainings using similar types of exercises, "technical" training sessions are alternated with "strength" ones, "throwing" ones, "running" ones and others. When using a complex of "technical" means, and their parts, and there can be several of these, once again the previous so-called "strength" "throwing" etc. sessions are used. Such alternation of different types of training sessions frequently serves to increase the effectiveness of the learning and improvement of technical mastery of different level athletes.

Essentials of Learning and Improvement of Technique with the Use of Ordinary and Complex Training Sessions

In classic physiology it has long been considered a given, that the amount of response seen depends on the functional state of specific body systems at the moment a stimulus produces an action. The response, according to how strongly it is needed, is essential when the discussion is of training in speed-strength events. Here, an increase in the sports result depends on the corresponding changes first of all, at the brain level and only after this, in the heart-circulatory, respiratory and other body systems, that have the ability to rework or modify the strength of the functioning agents [7, 115, 170]. This virtue helps the body live on in the process of evolution, maintain a succession of the population, and as a defense from extreme adaptational changes, appearing within the limits of each separate genotype [210, 253, 254].

The ability to convert a strong irritant into a weak or moderate one or to make a strong one out of a weak and moderate one and if necessary, to not allow them to enter on the level of the brain is an outstanding property of the body, acquired over many millions of years of evolution of living systems. We can only be delighted by them, but never is it possible to escape them in the process of sports improvement. The body always corrects the strength of the training influences so that each has a prescribed individualized program of development, and to go beyond the allowed level of adaptation is practically impossible. We can only adapt to the regularities of the functional systems of the body, which at the same time, make easier the very process of adaptational restructuring. But there are no cases in which is it possible to ignore them, or to function against them. If we do, we will curtail increases in sports results and in every way, hold back the process of learning and improving technique.

In light of this, we will explore several of the regularities of the functional systems of the body when using differently structured training sessions (ordinary, complex) different

exercises (general preparatory, specialized-preparatory), executed with weak, moderate and maximum effort, and explain their influence on the process of motor skill transfer.

First we will look at different training load intensities used in the introductory portion of ordinary and complex training sessions. It is well known that weak and moderate intensity warm-ups bring the body systems into a state of long duration high level activity. In an intense warm-up, there is more powerful activation of the corresponding body systems but this state is not maintained very long. Immediately after it, there is a decrease in workability, a loss of sharp sensations, fatigue, disturbance of coordination and others.

It is natural that the use of weak and moderate intensity training loads in the introductory part of the training session has a more effective effect on the training process when learning and improving technique, than loads of near maximum and maximum intensity. Similar negative consequences were seen by us in the training of throwers when using the complex method of constructing separate training sessions.

In cases when the "throw" parts precede the "strength" portions during the first 20-30 minutes, an increased state of excitation of the body systems is always observed. It is accompanied with a poor "feel for the implement" and very mediocre coordination. It improves somewhat later on, but when continuing to use other implements, the athletes come up against the fact that there is a decrease of several percent from the level of best training results over the duration of the specific stage of sports training. As a rule, it is restored after the conclusion of one-two training sessions, but in conditions where in the "strength" parts, the athletes begin to use weak and moderate intensity training loads.

Similar consequences are seen with athletes who specialize in other speed-strength track and field events. It is especially so in complex-technical events such as the pole vault, high jump and hurdle run.

The effectiveness of the learning and improvement of technique processes depend to a great extent on the types of exercises used during the introductory portion (warm up) of ordinary and complex training sessions, as well as before the "technical" portions of the complex training sessions. The reason for this is that the nerve cells of the brain have the ability to assimilate definite parameters of the functioning stimuli and to maintain them in memory as a characteristic model of excitation [173, 177]. If in the following work the same groups (ensembles) of nerve centers participate which functioned earlier, then in such situations, the corresponding body systems immediately go into operation. In the opposite case, time is needed for the switching from one type of activity to another, mainly because each separately taken exercise is conditioned by the specificity of the assembled nerve centers in the motor area (analyzer).

The formation and tuning of the new system of emerging irritants (stimuli) comes about somewhat later, since in the process of their action, there is a redistribution of the nerve impulse mosaic, which, as an end to all ends, begins to work in its new aggregate [185, 197]. This is explained by the fact that the earlier functioning nerve centers of the brain, at the moment of switching their actions, maintain their activity [17, 174]. To a great extent their duration is determined by the dominant appearance expressed in the corresponding nerve centers of the brain group [176. 177]. The extent of the "passive" learning depends on the character of the following actions. When the functioning elements coincide, it switches because of the introduction of the new ensemble of nerve cells into the work or, the "close and far relatives" will work at the same time to strengthen one conditioned reflex with another [119, 121].

From here it follows that the use of specialized preparatory means in the introductory portion of ordinary and complex training sessions coincides with favorable conditions for the learning and improvement of technique. In both cases, there is activation of practically the same nerve structures, and as a consequence, the athlete does not lose much time and effort in switching activity from one group of nerve centers to another. Similar mechanisms of joint activation are seen during the time of using "strength" parts of the specialized preparation means.

The use of general preparation immediately before "technical" parts, in ordinary as in complex training sessions, makes the positive transfer of motor skills more difficult. It creates definite difficulties in the functioning body systems in the transition to the learning and improving of technique.

The transfer of motor skills is a more specific process than the transfer of physical abilities. If, in the transfer of physical abilities a positive influence on the main movement is shown by the specialized-preparatory and specialized-developmental exercises, then in the transfer of motor skills, a positive interaction is possible only between the specialized-developmental and competitive exercises. In this, the more the specialized-developmental exercises are similar according to form, structure of movement, and rhythm of execution, then the more significant is the transfer to the basic motor action.

In the future, the competitive exercise or its training forms will be the whole movement used in the training. They are favored more than local exercises as in this case, it will not be necessary to resolve the problem of combining into one system separately learned joint parts, the establishment of effective rhythm and working out the needed consecutiveness of including specific body links into the work. Preference for the whole method should be given to the training of qualified or high level athletes. What pertains to novices and what is very natural, is that it is necessary to learn movements according to the parts method, especially if the discussion is of complex coordination type movements. After their mastery they can be combined into a single whole.

In the training of low level athletes, a positive transfer of motor skills is observed when using either local or global specialized-developmental exercises. It is only when working out fine differentiations is it necessary to give more attention to whole exercises. The corresponding local and whole exercises can take various forms. They depend mainly on the individual characteristics of the athlete.

In the process of learning and improving motor skills, special attention should be given to the establishment of effective movement rhythm and the correct consecutiveness of including specific body links into the work. Resolution of these problems appears as the primary task of the entire process of transfer, since the presentation of technique and its improvement depends mainly on them. On the first stages they can be resolved even to the detriment of mastering several local movements. The latter are easy to correct if the athlete possesses effective rhythm and the correct consecutiveness of including them or other body links into the work.

The mechanisms of positive transfer of motor skills cannot be fully seen without considering factors that serve this process. This is related first of all to the use of intensity zones. Preference is given to moderate and steady intensity training loads that allow for full control of the process of learning and improving technique. Besides this, they have a positive influence on the state of different body systems and maintaining them for a long time.

When using maximum intensity training loads there is fast expenditure of life essential substrates as a consequence of which fatigue arises first of all to the central nervous system. This shows up negatively on the process of learning and improvement of technique. Such conditions make the correction of motor actions more difficult and the athlete cannot remain in a state of optimal preparation for long period of time.

The arguments carried out above must be considered in the process of learning and improving technique. This to a certain degree, does not mean that the training loads of maximum intensity should be completely excluded from the training. Definitely not. They should be used systematically in the training process but in small amounts expertly alternated with weak and moderate intensity training loads. Maximum intensity training loads are very effective in the process of developing physical abilities, since even competitive activity in most track and field events takes place with the display of maximum effort.

Ignoring the regularities of the body's functional systems that have a definite reaction to the actions taking place when using different training structures (ordinary and complex) leads to the fact that the display of positive transfer of motor skill can be made more difficult or brought to a minimum. This is related to the duration of using "technical" work over the span of separately taken trainings, and to the number of "technical" training sessions during the micro-, meso- and macro- cycles.

It is natural that with the appearance of fatigue, athletes begin to allow many errors in the process of executing "technical" work. In this case it follows to either cease the given form of loads or temporarily switch to another activity. What is pertinent to the number of training sessions with the use of "technical" work during the weekly cycles of sports form development periods, is that they should not be less than three. Only in these cases is it possible to maintain the training effect from the previous activity.

Conclusions

We are far from believing that we have fully looked at the problem of training transfer on the pages of this book. For the sake of correctness, it follows to take note that this problem has been first elucidated a very great extent in the theory of track and field. Before this, the main problems revolved around the search for effective means of training which we widened by increasing the number of effective means.

In the theory and methods of physical education, the process of training transfer is tightly tied in with the process of developing sports form. Without the developmental process it is not possible to discuss transfer. Earlier, no one looked at the interrelationship between separate training sessions, weekly cycles, the use of exercises etc., to such a great extent.

We were the first to examine the problem of standardization of training loads as well as revealing the true role of adaptation in sports improvement. In addition we have an explanation for a slow down in the tempo of increases on each consecutive level of sports improvement. It appears that adaptation is not responsible for this; instead it is use of the system of training effects over the duration of the development of sports form periods.

A slow down or cessation of sports result increases is explained to a great extent by the fact that the system of effects used did not serve to raise the body systems to a new higher quality level of adaptation. We should also note that we were the first in the theory and methods of physical education who made an attempt to elucidate the defense mechanisms of the body systems which hinder increases in achievements on each orderly level of sports improvement.

There is no doubt that in the future all questions of training transfer that were looked at in this book will be further studied. Most important of them will be those that were raised first in the theory and practice of physical education. Regardless, for understanding and raising the problem of training transfer to a new level, it will be necessary to first of all

study the mechanisms of the interrelationship between the separate exercises that are used over the duration of the training sessions, portions of the session and so on. Only in this case can we improve the process of correcting training transfer, activating those nerve centers of the brain (motor analyzers), which answer to the activity of the competitive exercises and those close to them.

This problem will be resolved in two stages. On the first stage it will be necessary to explain the strength of the training effect of the exercises, the volume of loads used, the zones of intensity used, the methods used, regimes of training used and so on. Second, will be the study of the mechanisms of the interrelationships between identical or different exercises, according to the strength of the training effect. In the end result, this will help us construct a training process in such a manner that, as for example, the strength portion of the complex training session will create conditions for increasing the sports results in the throws portion.

With such an understanding of the transfer of training mechanisms, we will free ourselves from naive and abstract types of conclusions: as for example, to throw the hammer to such and such distance it is necessary to do the barbell squat a certain number of times, the power clean a certain number of times and so on. The time of primitiveness has already passed and the time has come to look at the problem all the more seriously.

We will mention that at the present time, we discuss the strength of the training effect mainly from the point of view of the zones of intensity used and after this do we speak of the volume of training loads, methods, regimes and so on. According to our deep conviction, training loads in the zone of 95-100% are significantly stronger (we are not speaking of effectiveness) than 75-80% if we consider the strength of the training effect coming from the weight lifted in a barbell exercise, then this is without question, true. If however, we look at this from the point of view of the long term effectiveness of the 95-100% of max zone and the zones of 75-80% on the nervous-muscular system, then here it can be said that the second zone is somewhat stronger than the first.

We did not come to this conclusion by chance. We have accumulated a sufficient amount of experimental material showing that the duration of the training effect of the barbell exercises with the use of low zones of intensity can fully rival and even supersede the strength of the effect of the higher intensity zone. We have in view that the exercise executed, as for example, in the 75-80% zone where the number of repetitions in one set vary from 8-10 the strength of the effect can be higher than from those which are executed in the 95-100% zone, with the number of repetitions from 1-2. All of this once again indicates that the problem of training transfer should be looked at first of all on the neuro level, and only after this on the "functional".

We hope that the theoretical and experimental material put together in the book can be used by athletes having various sports qualifications but especially high level, in the training process. Besides this, we believe that it will bring about strong discussion among specialists which will not always end with a positive answer in addressing the author. We foresee this early on and in our justification we will say that we thought not of a positive evaluation but tried to show the way of our search over the last 20 years of experimental and scientific activity.

In our research we were not thinking of how our conclusions corresponded with what was written up in the theory and methods of physical education. Because of this, we once again recommend carefully reading our hypothetical discussions striving to find in them rational seeds and to question oneself: is there something or other that I did not understand or do not know?

According to our view, this book appears as the next step toward understanding the problem of training transfer. Its author will be fully satisfied if in time it will be shown that he has done his part in understanding it. Many thanks to the readers, who have read this multi-year work and with this, give consideration to the author.

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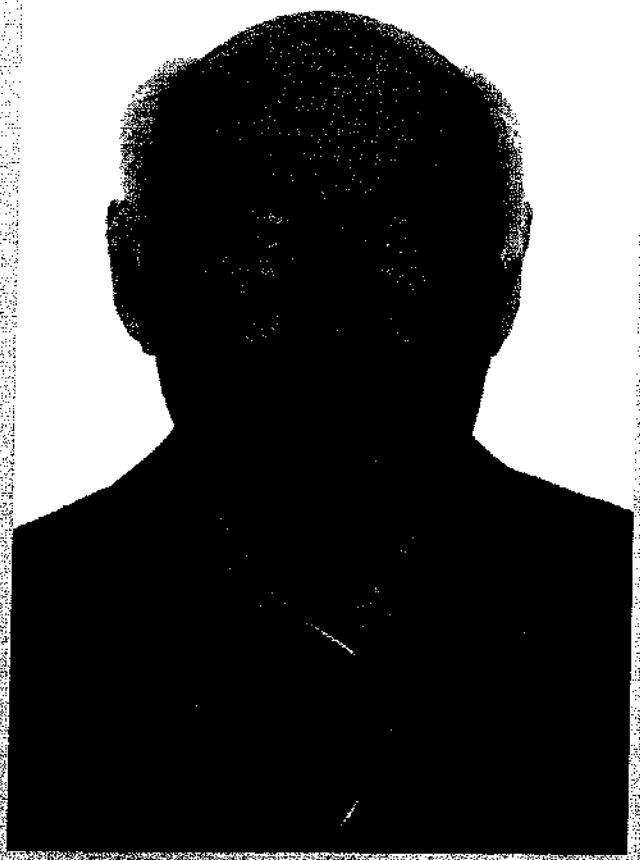

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