

HIGH PERFORMANCE

Gymnastics



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High Performance Gymnastics

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Foreword by Ivan Čuk**Editor-in-Chief of Science of Gymnastics Journal**

SIGARC symposium in Brazil was up to now hold three times. For 2012, experts from all over the world were invited who prepared scientific presentations as well as book chapters from the field of their expertise. In this book there are eleven chapters of excellent readings for coaches, gymnasts, judges, physical education teachers, students, and even parents of gymnasts, and of course, scientists, who will continue to improve and extend gymnastics knowledge. Whether authors are dealing with artistic or rhythmic gymnastics, from my point of view, both sides are interesting since they are focusing on general aspects, which are always of high interests for all gymnastics disciplines.

The first chapter was prepared by the FIG's scientific commission president Keith Russell, dealing with a mostly philosophical overview of half a century development of gymnastics. The most important medical conclusion was that gymnastics does not hamper gymnast's growth, which is something that envy sport researchers and

medicine people claimed for decades and thus made a lot of negative propaganda against gymnastics. Márcia Regina Aversani Lourenço and Ieda Parra Barbosa Rinaldi prepared the second chapter, covering their expertise on group exercises in rhythmic gymnastics, where the most important topics are different changes of formations (collaboration and communication between gymnasts), without losing individual object manipulation technique mastery. Myrian Nunomura and Mauricio Santos Oliveira were exploring profiles and the motivation of artistic gymnastics coaches in Brazil. Their most valuable conclusion is that universities can be of great support for coaches, thus making the coaching process in gymnastics friendly, injury safe and with high achievements. Thomas Heinen, Pia Vinken and Konstantinos Velentzas discuss the contribution of sport psychology to competitive gymnastics. They stated that experienced gymnasts are far from being ‘machines’ that produce the same pattern of movement in every trial. It was concluded, that in order to make every trial as stable as possible, psychologists can assist them. Lurdes Ávila-Carvalho, Catarina Leandro and Eunice Lebre were researching the content of competition routines in rhythmic gymnastics. According to their analysis of articles they suggest new studies in the area of execution, and some changes in the Code of Points. Marco Antonio Coelho Bortoleto and César Jose Peixoto Duarte made a review of qualitative video analysis as a pedagogical tool in artistic gymnastics. The important conclusion thereby is that operating video hardware and software should also be a part of the knowledge offered in coaches’ education programs, perhaps as a first step prior to discussing biomechanical studies. Jean-François Robin made a philosophical approach towards gymnastics whilst defining gymnastics as a game of rules. Among these rules are “difficulty” and “execution”, like Jing and Jang, which generate

basic strategies how to win at competition. Eliana de Toledo and Kizzy Fernandes Antualpa present an in-detail overview of high performance rhythmic gymnastics in Brazil, thereby discussing aspects such as Brazilian participation in the Olympic Games, and also highlighting potential aspects that could help to develop rhythmic gymnastics in the future. Gareth Irwin, Geneviève Williams, and David Kerwin refer to gymnastics coaches and biomechanics perspectives, where highly complex skills demand extra knowledge from coaches in order to prepare proper conditioning, proper skill development, and learning. Mélix Ilisástigui Avilés, Yolaini Govea Díaz, and Nelly Ochoa Borrás deal with planning of sport training in rhythmic gymnastics. The authors discuss some interesting limits when the training was efficient according to coaches plans. The last chapter was written by Laurita Marconi Schiavon on psychological aspects in the sport preparation of female Brazilian gymnasts participating in the Olympic Games. Her work shows the importance of interviews with gymnasts, and how important it is to analyze past work in a frame of future activities.

Brazil is preparing for the Olympic Games in Rio de Janeiro in 2016; they are improving not only facilities for the games, but what is most important, they are maintaining and developing 'know how' in order to work with athletes to be successful. Results at the 2012 Olympic Games and the 2013 World Championships speak for themselves. This book will have -after Rio 2016- still important knowledge from which all participants in gymnastics can gain.

Ljubljana, October 2013.

Ivan Čuk

Foreword by Hardy Fink

Director, FIG Education & Academy Programs



These proceedings from the 2012 SIGARC symposium encompasses a broad range of historical, empirical, and scientific articles presented by some of the world's leading practitioners and researchers in the area of gymnastics. This symposium featured presentations about the various gymnastics sports, and with focused research on rhythmic-, men's- and women's-gymnastics from biomechanical, psychological, planning, and methodological perspectives.

The introductory presentation by Russell takes a critical and enlightening look at all of the gymnastics sports from the insights he gained over a lifetime of coaching and teaching gymnastics. He also dispels forcefully the suggestion that gymnastics participation “re-tards” growth.

Four papers discuss aspects of rhythmic gymnastics. The beauty and the challenges related to group rhythmic performances from the experiences of the Brazil group are presented by Lourenço et al. The content of rhythmic gymnastics routines are analyzed with reference

to Code of Points requirements by Ávila-Carvalho et al. A third paper, this one by Avilés et al, studies the principles of periodization, planning, and pedagogy applied to training in rhythmic gymnastics. The fourth paper by Toledo and Antualpa deals with the development of high performance rhythmic gymnastics in Brazil as well as Brazilian participation in international competitions.

Psychology applied to gymnastics training is also presented in three different papers. Nunomura and Oliveira look at the difficult and essential tasks of coaches in artistic gymnastics by presenting data on coaches' profiles and motivation. Heinen et al. outline how sport psychology can contribute to gymnastics performances from the analysis of the performance demands, psychological profiles, and psychological interventions. Schiavon takes a fascinating look at psychological aspects of preparing gymnastics teams and specifically the Brazilian women's team for the Olympics.

Other sport sciences are not ignored. Irwin et al. look at biomechanical analysis and how this science can enhance the effectiveness of gymnastics coaches. Bortoleto and Duarte take a different but equally enlightening approach. It is that of qualitative video analysis that can be quickly and easily meaningful to a coach instead of the sometimes more difficult to understand biomechanical and quantitative analysis.

Finally, no overview of gymnastics would be complete without the regulations that attempt to direct and guide its direction. Robin presents the influence of the Code of Points on gymnasts, coaches, and judges.

The totality of these proceedings from the 2012 SIGARC symposium provides a large amount of scientific, pedagogical, methodological, empirical and experiential information that can be of benefit to

every gymnastics coach. Even the best or most successful of coaches can improve – can be better – by knowing and incorporating the information provided.

Moreover, every book that presents the content and philosophy of the systematic, careful, and informed coaching of athletes is a welcome addition to gymnastics. And for this reason, I very much appreciate that this book will help improve our sports for all participants, but most especially for the gymnasts.

Canada/Switzerland, December 2013.

Hardy Fink

Preface by the Editors

Laurita Marconi Schiavon, Thomas Heinen, Marco Antonio Coelho Bortoleto, Myrian Nunomura & Eliana de Toledo



The book “High Performance Gymnastics” arises from a partnership among the three State Universities of São Paulo (UNICAMP, UNESP, USP), and the University of Hildesheim (Germany). This experience has arisen due to the interest of many students, professionals, and researchers in gymnastics, who are looking for new scientific and pedagogical approaches that would contribute to its development. After three editions of the International Seminar on Competitive Artistic and Rhythmic Gymnastics (SIGARC), we have seen an opportunity to collaborate in producing the book presented herein.

Among the many issues addressed directly and indirectly in this book, biomechanics of gymnastics is the core theme of the chapter

of Gareth Irwin, Geneviève Williams, and David Kerwin (Cardiff Metropolitan University), as well as the chapter of Marco A. C. Bortoleto and César Peixoto, which is the outcome of a partnership between Brazil (UNICAMP) and Portugal (Lisbon Technical University).

Psychological aspects in dealing with gymnasts are addressed in two chapters. The first one was authored by Thomas Heinen (University of Hildesheim), Pia Vinken (Leibniz University Hanover) and Konstantinos Velentzas (Bielefeld University). The other chapter was written by Laurita Marconi Schiavon (UNESP), presenting proposals for intervention and the experiences from major Brazilian Olympic gymnasts.

The Brazilian context in the field of rhythmic gymnastics is analyzed by Eliana de Toledo (UNICAMP) and Kizzy Antualpa (Metrocamp), revealing the scenario of the rhythmic gymnastics; and also by Myrian Nunomura (USP) and Mauricio Oliveira (UFES), discussing the profile, motivations and challenges of artistic gymnastics coaches in the country.

The routines composition analysis, planning and training control of rhythmic gymnasts are also topics covered by Márcia Aversani Lourenço (UNOPAR) and Ieda Parra Barbosa Rinaldi (UEM), focusing on the particularities of “group”. Lurdes Ávila-Carvalho (UP), Catarina Leandro (ULP) and Eunice Lebre (UP) discuss on the competitive exercises in the rhythmic gymnastics routines. Mélix Avilés, Yolaini Diaz, and Nelly Borrás (UCCFD) address the periodization and training control in rhythmic gymnastics.

In a broader approach, the process and the principles of high performance training in gymnastics are discussed by Keith Russell (University of Saskatchewan) in the first chapter of this book, covering the

outcome of more than 50 years' experience in this sport. This comprehensive look on gymnastics guides the analysis of Jean François Robin (INSEP), who proposes a reflection on the social history that surrounds the rules of gymnastics, as well as their consequences for the better understanding of this phenomenon.

We believe that the contributions presented in this book stand for important advancements in the academic and scientific environment of our field. In this context, this book aims to build a new space for reflection, sharing knowledge, disseminating innovation, and technology, as well as joining authors from eight different nationalities, thus becoming an important source of knowledge in competitive gymnastics.

Finally, dear fellow academics, coaches, gymnasts, judges, researchers, and others involved with gymnastics, we hope you all enjoy the reading! - Gymnastics greetings!

Brazil/Germany, February 2014.

Laurita Marconi Schiavon

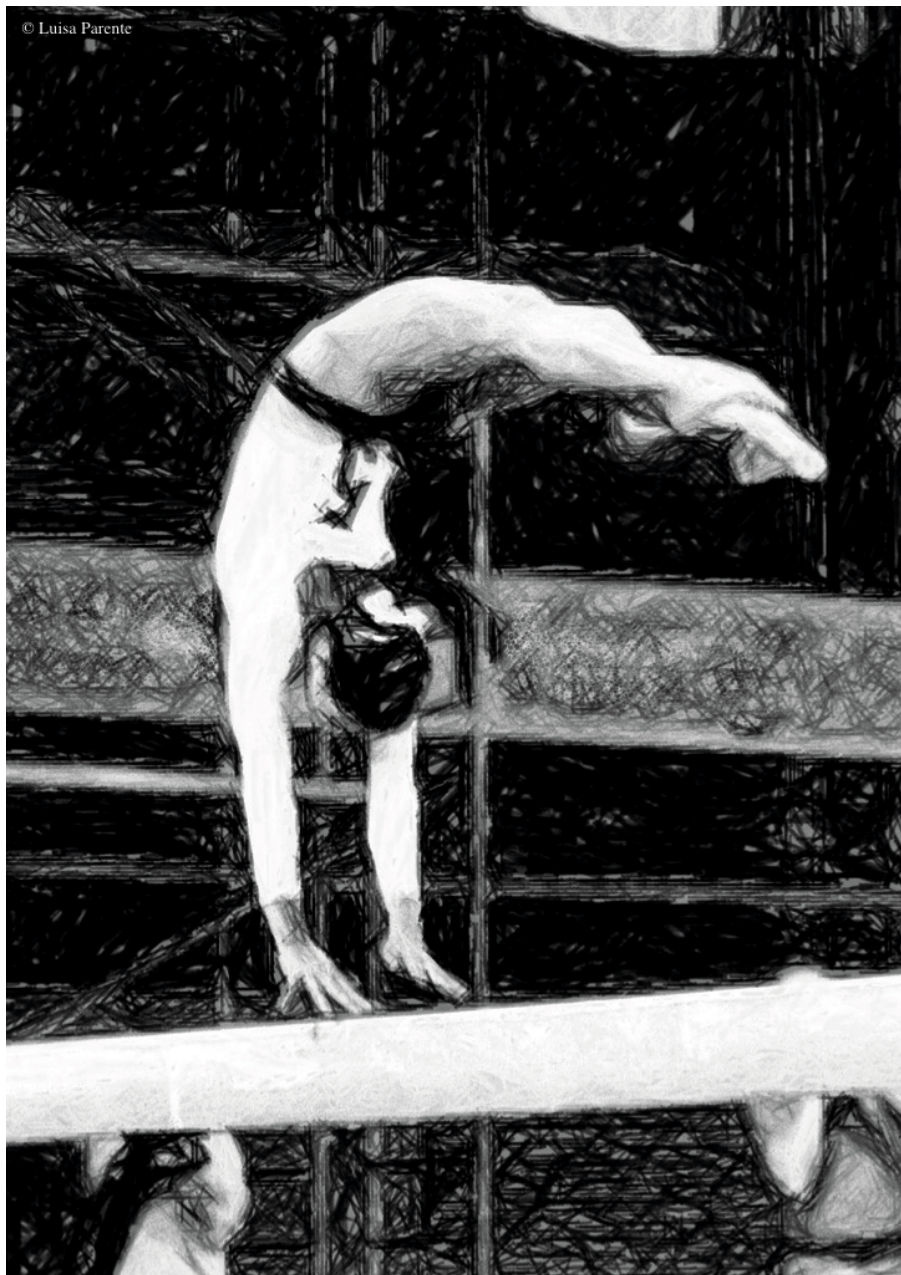
Thomas Heinen

Marco Antonio Coelho Bortoleto

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CHAPTER 1

GYMNASTICS CHALLENGES - A VIEW FROM 50 YEARS OF COACHING AND TEACHING



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1.1 Introduction

While watching the recent Olympics I continued to marvel at the extremely high level of athletic prowess shown by gymnasts. They are surely the most superb athletes. Their power, strength and flexibility set the world standards, and the complexity and number of skills they must perform surpass what most other athletes must attempt. In addition, gymnasts must overcome fear while, at the same time, they must satisfy the requirements for artistry. The Olympic family of gymnastics sports (artistic gymnastics, trampoline gymnastics, rhythmic gymnastics) is certainly at the very cutting edge of athletic achievement. This is, of course, also true for the non-Olympic gymnastics sports of acrobatic gymnastics and aerobic gymnastics.

My first intention with this brief essay is to recognize these amazing achievements and marvel at the journey gymnastics is taking. Gymnastics sports appear to be evolving much faster than other sports. The skills that are currently being performed by pre-teen gymnasts all over the world are more difficult and more complex than those done by Olympic champions only a few years ago. Almost every apparatus has had radical structural enhancements resulting in profound changes in the skills performed (think of sprung floors, padded beams, sprung and padded vault tables, coil springs on vaulting boards, smaller rails on asymmetric and parallel bars that are now made of hollow, springy fiberglass). If you look at other sports, you will see slow incremental changes over time rather than the rapid, multiple and significant changes in gymnastics sports (the notable exception of the fiberglass pole in athletics produced a similar revolutionary change in that sport).

The family of gymnastics sports is also rapidly evolving into new variants. Trampoline gained Olympic inclusion at a very young age and the quickly expanding sport of aerobic gymnastics is evolving with brand new forms being competed at World Championships. Popularity and growth brings new challenges and thus the second intention of this article is to highlight some of these new challenges and openly posit some possible solutions.

1.2 Challenges from outside: circuses and new sports related to gymnastics

Recently gymnasts from several sports have gained new opportunities to continue in a performance role after retirement from their sport. This is due to the expanding popularity of circuses around the world. Indeed, these opportunities have put considerable pressure on several gymnastics sports whose coaches and athletes are migrating out of the sports and into the circus as performers or coaches. In my country alone more than 30 top coaches have left gymnastics jobs for circus jobs. Acrobatic gymnastics, in particular, has been adversely affected by this trend and it is only recently that the circus community has begun to realize that without coaches in gymnastics clubs, their supply of acrobats will dry up. There are now several initiatives addressing this problem but the challenge remains to keep coaches and athletes in the sports, when there is pressure to leave and join the circus.

There is also the emerging challenge of how to accommodate and cooperate with other forms of gymnastics and acrobatic activities such as ‘TeamGym’ and ‘cheerleading’ which are also thriving and expanding and are putting pressures on the established gymnastics sports for athletes, coaches and facilities. Federations that embrace

these emerging sports can find themselves overwhelmed with new members and the subsequent political pressure to share resources. While this is not an unhealthy trend, it compounds the challenge to attract and keep gymnasts in the Olympic sports.

1.3 Challenges from outside: the changing opinions about gymnastics

As part of my professional functions within the FIG I have the privilege of presenting lectures to the Coach Education Academies and to various special topic seminars and conferences. On several occasions I have given a lecture entitled “From Paragon to Pariah” in which I trace the changes in perceptions that the scientific and medical community has towards competitive gymnastics over the past 50 years. I relate that when I was a young coach / science student, the dominant view was that gymnastics was the paragon of sports. It was healthy, artistic, wholesome, and the foundation of physical education. That is no longer the dominant opinion in the scientific, educational or medical community.

Instead of the paragon, gymnastics is becoming more of a pariah sport. Now it is just as often considered to be an example of excessive (even abusive) coaching practices, cheating judges, and catastrophic accidents. Books such as *Little Girls in Pretty Boxes* (1995, 2000, Joan Ryan), *Off Balance • A Memoir* (2012, Dominique Moceanu), or *The Unfree Exercise* (2013, Simone Heitinga & Stasja Kohler) have added grist for the mill of discontent. Issues raised in these books are also discussed in the FIG Coach Education Academies as well as in the inner circles of gymnastics leadership, but there remains much to do about solving some of the problems.

So what has changed in the journey from paragon to pariah? Obviously, the sports of gymnastics have changed. The following are some of the concerns that I think have to be addressed to return gymnastics to its paragon status.

1.4 Challenges from inside: safety and injuries

With regard to the safety of gymnastics sports, there is a dearth of comprehensive data available on injury epidemiology. There are many single-case studies and case-series studies published but there are very few broadly based studies that allow comparison to other sports. To add to the confusion, different studies report a wide range of results from gymnastics sports (often the specific sport is not even identified) having high injuries per thousand hours of training to having low injury rates per thousand hours of training (this is known as incidence rate). What is needed is a systematic study, or series of studies, comparing high performance gymnasts from several countries and from several gymnastics sports, to determine injury incidence rates and patterns of injuries. Similarly, the incidence rates of catastrophic injuries in gymnastics sports is virtually unknown. There is no central database to track any types of injuries and to determine how prevalent they are relative to other sports.

This vacuum of data is particularly shameful with respect to injuries that have occurred in major international competitions and exhibitions under the auspices of the international governing body. The scientific and medical communities do not even know the prevalence (total numbers) of injuries sustained in training before competition, or during major competitions. Do certain apparatus, or certain skills, or certain sports, account for more injuries? Do certain skill combinations endanger athletes more than others? Do certain ages or mor-

phologies suffer more injuries or different types of injuries? Do new innovations in apparatus design increase or decrease injury prevalence, incidence, and severity? Are there different injury patterns for males and females? Many questions need answering and the collection, analysis and publication of medical injury data from both competitions and training is long, long overdue.

1.5 Challenges from inside: rules and judging

In general, gymnastics sports have both the privilege and the curse of being subjectively evaluated. In addition to technical subjectivity, there is also the slippery issue of subjectively evaluating artistic merit. In order to decrease the subjectivity, the sports try to objectify their evaluation, and the more they try, the more complex become the rules. Yet without objective evaluation we can easily have nationalistic biases that are very difficult to contain. To add to the problem - those who judge are different from those who coach. It has been my experience over 50 years that the subsets of 'judges' and 'coaches' are very different. The more mathematical approach of many judges differs from the more technical, artistic approach of many coaches. But, those who judge determine the rules.

It has long been the case that a small cadre of judges has dictated rules in gymnastic sports. Indeed it was only recently that FIG mandated that coaches, or at least judges educated as coaches, be part of their international technical committees. This occurred as a result of the FIG coach education academies being developed and rules put in place ensuring that all judges wanting to be elected to technical committees must have passed their level 3 FIG coach education licence in that sport. This is a good step in the right direction and hopefully, over time, this will result in more gymnast / coach centered rules and reg-

ulations. Now two things need to happen: simplified rules / scoring that the public can easily comprehend, and rules that more closely align with the opinions of the coaches and the scientific / medical community.

The FIG has recently initiated a series of seminars in an attempt to standardize the Code of Points of the various sports. There were large differences in how the various sports evaluated their athletes and these differences were becoming ever more disparate. Hopefully there will soon be greater unanimity between sports. But the following trends remain to be dealt with:

1. The rules / codes are too complex, too deductive, too mathematical.
2. The requirements and rewards for creativity / artistry have been sacrificed for the more easily measured acrobatic elements. This has led to complexity in acrobatic content that is often impossible for spectators (and some judges) to differentiate. Can spectators differentiate between double twisting double somersault and a triple twisting double somersault, or Endo circles done in el grip versus under grip?
3. In an attempt to offset the inherent biases in subjective evaluations, the size of officials' panels in several gymnastics sports has increased in size to comically large numbers.

1.6 Changes needed from inside: artistic gymnastics

Artistic gymnasts are the most superbly conditioned of all Olympic athletes and demonstrate the highest level of skilled human movement. The magnitude of biological loads experienced in artistic gym-