International Society of Biomechanics Newsletter

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AFFILIATE SOCIETIES OF ISB:
American Society of Biomechanics; British Association of Sports Science; Canadian Society of Biomechanics; China Sports Biomechanics Association; Czechoslovak Committee on Biomechanics; French Société de Biomécanique; Japanese Society of Biomechanics; Korean Society of Biomechanics; Polish Society of Biomechanics; Sports Commission of the Soviet Union.

ISB news

FROM OUR PRESIDENT: Aurelio Cappozzo

Dear Members,

In Perth, during the XIIIth Congress of our Society, we had the confirmation that the ISB is a very lively and strong institution. Twenty years of activity and the very many outstanding colleagues who have worked for it have made the Society the leading organisation worldwide in the field of Biomechanics. Cultural tradition and technical organisation are its strengths.

This carries a potential which calls for exploitation. The Executive Council has sensed this and has decided on a number of actions which will make our Society even more visible and effective in rendering services to its members and thus to Biomechanics.

Recruiting Campaign

A member recruiting campaign will be launched with renewed impact. This started in Perth and the result was that 50 colleagues joined us. Council members are of course committed to this effort. However, we shall be successful only in the event that each of you will contribute to the cause. So, please distribute copies of the enclosed Application Form to your colleagues and exhort them to become members of ISB.

A New Discounted Journal Subscription

As you can see in this Newsletter, we have obtained from Butterworth-Heinemann a significant discount to the subscription to *Clinical Biomechanics*. This adds to the member benefits !

ISB Book Series

Another important enterprise is being undertaken and this is the production of an ISB Book Series. The first volume, as already announced, will be "Biolocomotion: a century of research using moving pictures" (A.Cappozzo, M.Marchetti and V.Tosi - Eds.). Following titles depend on you. I solicit your collaboration. Please do suggest titles to the Executive Council and we will be very pleased to consider them.

Study Institutes, Symposia, Workshops

The ISB is happy to grant patronage and collaboration in the organisation of both educational and scientific meetings on specific topics within the field of Biomechanics. Any organiser of such events is asked to send proposals to me.

Sponsorship

The Society will be seeking financial contributions from commercial, industrial and philanthropic sources to support its mission. Such support must be understood by to be an underwriting of the scientific and educational activities of the ISB and they do not imply any role for the sponsor in Society policy or decision making.

Election Results

Several members were newly elected to Executive Council positions as a result the recent elections. The full list of Officers and Executive Council members is as follows:

Officers

Dr. Aurelio Cappozzo (Italy) President
Dr. Ronald Zernicke (Canada) President-Elect
Dr. Robert W. Norman (Canada) Past President
Dr. Peter R. Cavanagh (USA) Secretary-General
Dr. Graeme A. Wood (Australia) Treasurer and Newsletter Editor

Executive Council Members

Dr. Micheline Gagnon (Canada)
Dr. Mont Hubbard (USA)
Dr. Krzysztof Kedzior (Poland)
Dr. Minayori Kumamoto (Japan)
Dr. Kurt Oberg (Sweden)
Dr. Sandra J. Olney (Canada)
Dr. Rients Rozendal (The Netherlands)
Dr. Richard B. Stein (Canada)
Dr. Kit Vaughan (USA)
Dr. Savio Woo (USA)

CONSTITUTIONAL CHANGES

The changes and additions to the ISB Constitution proposed via this Newsletter (Issue No. 42) were all passed by majority vote. Copies of the new Constitution are available from the General-Secretary, Dr. Peter Cavanagh, upon request (see address on front cover).

CALL FOR HOST FOR XVth ISB CONGRESS

Expressions of interest to host the XVth International Congress on Biomechanics have already been received from Japan and Finland. However, no decision will be made until Council meets next in Rome in June of this year, and other applications will be given every consideration at that time.

Report on the XIIIth INTERNATIONAL CONGRESS ON BIOMECHANICS

The XIIIth Congress of ISB was held in Perth, Western Australia during December 9-13, 1991. The University of Western Australia and its Department of Human Movement Studies provided a most hospitable atmosphere for what has been acclaimed to be the most successful yet of ISB Congresses. Over 400 delegates from 30 different countries attended and between them

delivered 360 presentations of original research. Eight keynote lectures were given together with the Wartenweiler Memorial Lecture, details of which are listed below. The scientific contributions of these people were complemented by an excellent trade exhibit and social programme.

The Young Investigator and Clinical Biomechanics awards were again keenly contested. The finalists in each award category and the ultimate winners were:

Competitive Award Finalists

Young Investigator Award - Best Podium Presentation:
Finalists: E.Edmonstone, C.Hamrick, R.Hughes, T.Kirk, A.Kuo, L.Walker, G.Wilson. *Winner:* A.Kuo.

Young Investigator Award - Best Poster Presentation
Finalists: Y.Kawakami, A.Younger, T.Koh, J.Zhou
Winner: T.Koh.

Clinical Biomechanics Award - Best Presentation
Finalists: R.Deusinger, A.Penn, P.McNair, M.Muller-Gerbl, R.Zernicke. *Winner:* P.McNair.

Keynote and Award-Winning Presentation Titles

Wartenweiler Memorial Lecture:
Citius, Altius, Longius (Faster, Higher, Longer): The Biomechanics of Jumping for Distance - **James G. Hay** (University of Iowa, USA)

Muybridge Award:
Optimisation of the Structure and Movement of the Legs of Animals - **R. McNeill Alexander** (University of Leeds, UK)

Keynote Lectures:
Unsteadiness, Uncertainty and Ulceration: The Biomechanical Consequences of Diabetes - **Peter R. Cavanagh** (Penn. State University, USA)

Computer Simulation and Optimisation in Sport and Activity/Industry - **Mont Hubbard** (University of California, USA)

Human Morphology: Its Role in the Mechanics of Movement - **Robert K. Jensen** (Laurentian University, Canada)

Neuromuscular Adaptations During the Acquisition of Muscle Strength, Power and Motor Tasks - **Toshio Moritani** (Kyoto University, Japan)

Architecture and Stress in Hard Tissue - **Charles Oxnard** (University of Western Australia)

Sequential Motions of Body Segments in Striking and Throwing Skills: Descriptions and Explanations - **Carol Putnam** (Dalhousie University, Canada)

The Energetics of Running and Running Shoes - **Martyn Shorten** (Portland, USA)

Muscle Co-ordination in Movement: Modelling and Insights - **Felix E. Zajac** (Stanford University, USA)

Young Investigator Awards:
A Biomechanical Analysis of Muscle Strength as a Limiting Factor in Standing Posture - **Arthur D. Kuo** (Stanford University, USA)

Cross Talk in Surface Electromyograms of Hamstring Muscles - **Timothy J. Koh** (Cleveland Clinic Foundation, USA)

Clinical Biomechanics Award:
Stiffness of Hamstring Muscles in Anterior Cruciate Ligament (ACL) Deficient Subjects - **Peter J. McNair** (The University of Western Australia)

To Publish or ... ?

The abstracts of papers presented at the XIIIth International Congress on Biomechanics were prepared in book form by the Congress organisers for distribution to congress attendees. This *Book of Abstracts* is not a formally *edited* publication in that the material contained therein was not subjected to critical peer review and should therefore not be cited as the definitive work of the contributors. Furthermore it is not the official ISB *Proceedings* of the Congress insofar as that title is reserved for the Special Supplement of the Journal of Biomechanics which contains the full-length keynote and award-winning papers listed above. Those papers undergo the Journal of Biomechanics normal review process and will appear in revised form later this year. So for those who gave free communications of their research in Perth - don't rest on your laurels; submit the full treatise of your work to one of the excellent journals who publish biomechanics research and thereby have your contributions to the field of biomechanics available to all in an authoritative and archival form.

Availability of the Book of Abstracts

This volume contains over 600 pages of the extended (two-page) abstracts of all free communications given at the XIIIth Congress of the ISB.

Summary of Contents:

Muscle Mechanics - 25 papers
Sports Biomechanics - 77 papers
Special Populations - 26 papers
Occupational Biomechanics - 27 papers
EMG & Motor Control - 44 papers
Instrumentation & Methods - 50 papers
Computer Modelling - 17 papers

Gait Analysis - 21 papers
Anthropometry - 10 papers
Orthopaedics & Tissues - 69 papers

Purchase Details:

Price: **$40.00** (Australian) plus postage and handling as follows:
$25 surface mail (8-10 weeks)
$40 air mail (10-20 days)

Payment must be in Australian dollars by Bank Draft drawn on an Australian Bank, and made payable to the **XIIIth Congress on Biomechanics**.

Ordering Form:

To:
XIIIth ISB Congress Secretariat
c/. Department of Human Movement Studies
The University of Western Australia
Nedlands, WA 6009
AUSTRALIA

Please send me one copy of the **Book of Abstracts** of the XIIIth International Congress on Biomechanics.

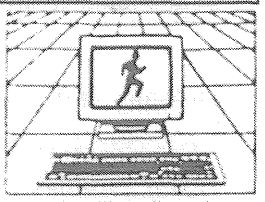
I enclose payment in Australian dollars of $AUS ____ for purchase and delivery by air/surface mail (delete which does not apply).

Name:_____

Address:_____

_____

Country:_____ Postcode:_____



Technical Group on Computer Simulation

Report on the
Third International Symposium on Computer Simulation in Biomechanics

The 3rd Symposium was hosted by the Departments of Human Movement and Mathematics at The University of Western Australia, Perth, Australia on December 5 and 6, 1991. There were 19 presentations and 60 participants from 15 countries. An interesting, entertaining and provocative Keynote Lecture was given by James Trevelyan of the Mechanical Engineering Department at The University of Western Australia entitled "Reality in Mechabionics", where James discussed relationships, potential pitfalls and integrity in robotics and biomechanics.

As at previous Symposiums, presenters were encouraged to demonstrate their software where possible. This format again provided an informal setting where Symposium participants could see and discuss specific details of programs and techniques. It also provided the participants with some superb graphics and interactive displays. Several presenters showed videotapes of the output from their programs, another useful way to illustrate results and demonstrate options. Following a session where factors in boomerang flight were displayed in a computer simulation, Symposium participants were treated by a local boomerang exporter to a practical demonstration of boomerang throwing and the opportunity to try it for themselves.

A Young Investigator Award was made available by the organisers of the previous conference, and was won by Qian Jingguang of the Jiangsu Research Institute, Nanjing, P.R. China, for his presentation "The computer simulation and experimental training of the innovative movement - backward swing and backward somersault then regrasp on horizontal bar". Copies of the 2 page abstracts are available from Bob Marshall at the address below for AUD 12.

The third general meeting of the Working Group on Computer Simulation was held during the ISB Congress. At that meeting, ISB President Aurelio Cappozzo talked briefly about changes to the ISB constitution which affected the structure of groups such as ours. It was seen to be to our advantage to become a Technical Group, with an elected Executive Council, to formalise our relationship with the ISB. The meeting voted in favour of this, and the first Council of the ISB Technical Group on Computer Simulation are:

President:	Dr. Fred Yeadon, Loughborough University of Technology, U.K.
Secretary-General:	Dr. Bob Marshall, University of Western Australia, Australia
Committee:	Dr. Mont Hubbard, University of California, Davis, U.S.A.
	Dr. Ton van den Bogert, University of Calgary, Canada
	Dr. Kit Vaughan, University of Virginia, U.S.A.
	Dr. Federico Casolo, Politechnico di Milano, Italy
	Dr. Herman Woltring, Biomechanics Consultant, The Netherlands

The Fourth Symposium on Computer Simulation in Biomechanics will be organised by Dr. B. Landjerit and co-workers, from the Laboratoire de Biomechanique, Ecole Nationale Superieure d'Arts et Metiers, Paris, France, just prior to the XIVth ISB Congress.

Membership of the ISB Technical Group on Computer Simulation is free. If you wish to join please copy the from below, fill in appropriate information and send to R.N. Marshall at the address below.

ISB Technical Group on Computer Simulation

MEMBERSHIP FORM

Last Name _____

First Name _____

Title _____

Institution _____

Position _____

Mailing Address _____

_____

_____

Telephone _____

Faxsimile _____

E-Mail _____

Main Field of Interest and Scientific Activity:

Main Simulation Application(s):

Computers and Operating Systems Used:

Main Commercial Software Used:

Own Simulation Software Developed:

Send Completed form to:

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Tel: + 61 9 380 2361; Fax: + 61 9 380 1039
E-mail: r_marshall@fennel.cc.uwa.oz.au

Report from the ISB Committee for Standardization and Terminology

RECOMMENDATIONS FOR STANDARDIZATION IN THE REPORTING OF KINEMATIC DATA

DRAFT Version 4.0
March 23, 1992

The Standardization and Terminology Committee of the International Society of Biomechanics has been charged by the Society with the development of standards for use in the field of kinematic and kinetic analyses of human and animal movement.

Many other efforts of this nature are in progress and the committee has received input in its deliberations from a number of groups and individuals. At the First International Symposium on Three Dimensional Motion Analysis in Montreal, Canada in July 1991, a round table was held to discuss the topic of standardization. An apparent consensus of panel members and meeting participants was that each investigator should be free to collect and process their data according to the conventions and methods of their choice, but that a standard set of conventions for the presentation of data in the refereed literature would be welcomed by most workers. A major effort towards standardization of protocols for gait analysis is also underway by a European Community group (CAMARC). Clearly standardization is a topic for the 1990's and the ISB intends to take a leadership position in this area.

The committee has decided to make its first task the definition of a series of reference frames and conventions for the description of the absolute and relative orientations of body segments. In the future, we intend to address the issue of terminology extending the work of Winter (1987) and Vaughan, Davis and O'Connor (1992).

This first step, described below, leans heavily on the work of biomechanists such as Chao, Grood, Suntay, Sommer and Buczek and employs the 4 x 4 matrix notation for the description of segment position and orientation. An ad hoc committee of ISB members has already provided input on early drafts of this document and suggestions have been incorporated from a number of other individuals. We would stress that this is still a consultative document and represents a first foundation on which an eventual standard can be built.

Each section is organized in the form of the need for the standard, a recommendation, a suggested notation, and notes concerning implementation.

PART 1. DEFINITION OF A GLOBAL REFERENCE FRAME

Need: A global inertial reference frame with the direction of the global axes being consistent, no matter which activities or subjects are being studied, or which investigator is conducting the experiment.

Notation: Xg,Yg,Zg

Recommendation: A right handed orthogonal triad fixed in the ground (assuming performer is on level ground) with the +Xg axis forward and horizontal, +Yg axis upward, the +Zg axis to the right and horizontal (see figure 1). All directions are given for the subject facing in the direction of working or travel that is of most interest to the particular activity. If forces are being measured, it is recommended that the origin of the XgYgZg reference frame be located at the center of the top surface of one of the force platforms being used. A ground reaction force convention (not forces applied to the platform) should be used such that ground reaction force components acting along the respective axes are designated with the same conventions i.e. positive Fx is acting in the forward horizontal direction, positive Fy in the upward vertical, and positive Fz in the right lateral direction.

FIGURE 1

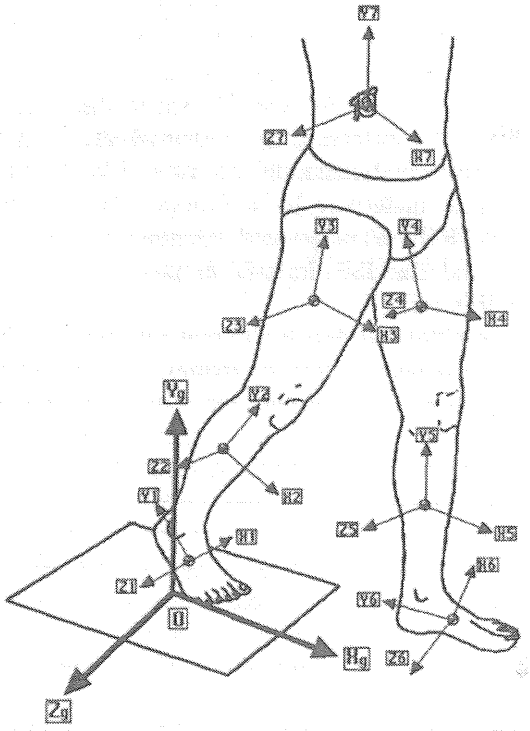


Figure 1: Conventions for global reference frame

Notes: a. The directions have been chosen so that for those conducting two dimensional studies, Xg,Yg will be the sagittal plane. This will be consistent with the three dimensional convention.

b. In tasks such as exercise in zero gravity, the Xg axis should be defined according to some arbitrary but visible surface in the environment and in a direction that is meaningful to the task.

c. Where there is no clear direction of travel or working for the definition of positive Xg (as is the case for insect flight) one should be defined by the investigator.

In cases of locomotion on inclined planes, the Yg axis will remain vertical and the Xg and Zg axes will be in the same horizontal plane.

d. We acknowledge that there may be situations where non-Cartesian axes are more appropriate to the task being studied (for example cylindrical coordinates are useful for the study of asymmetric manual exertion). Since the majority of studies use a Cartesian approach, it will be left to individual investigators to devise systems for the reporting of more unique situations.

PART 2: DEFINITION OF SEGMENTAL LOCAL CENTER OF MASS REFERENCE FRAMES

Need: A coherent system to describe segment pose (position and attitude) with respect to global.

Recommendation: A series of right handed orthogonal triads fixed at the segmental centers of mass with two of the axes defined relative to anatomically identifiable reference points. The third is automatically defined by being mutually perpendicular to the other two. The positive Yi should be in a proximal direction, and the positive Zi should be to the right of the subject.

Notation: Xi,Yi,Zi

Notes: Sub groups of specialists in each region of the body will be recruited by the ISB Standardization Committee to formulate the appropriate anatomical landmarks to be used in the orientation of the axes for each segment of the body.

The convention that the positive Zi direction is to the right implies that positive movements and moments about the Xi and Yi axes of a segment on the left side of the body will have the opposite effects of movements and moments of similar sign on the right side of the body (figure 2). This difference will be accounted for by describing the movements and moments in their anatomical terms in any presentation of the data (see below). This convention has been chosen to avoid the use of both left and right handed coordinate systems.

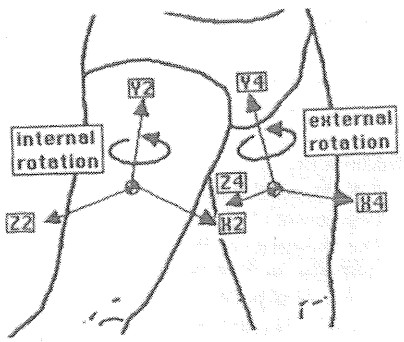


Figure 2: Segmental local center of mass reference frame

PART 3: GLOBAL DISPLACEMENTS

Need: Specification of displacements relative to the Global Reference Frame

Recommendation: Report the coordinates of local center of mass reference frame origins with respect to the global origin in meters. The position of the local origin will represent the first column of the 4 x 4 matrix in the local to global transformation matrix (see below).

Notation: xi,yi,zi

PART 4: GLOBAL ATTITUDES

Need: To express the orientation of a segment with respect to the global reference frame.

Recommendation: A standard ZYX decomposition of the lower right 3x3 rotation submatrix of the 4 x 4 matrix defining the local to global transformation.

$$\{X\}g = [Tlg]\ \{x\}l$$

where $\{X\}g = [1\ Xi\ Yi\ Zi]\ T$

$\{x\}l = [1\ xl\ yl\ zl]\ T$

where [Tlg] is the local to global coordinate transformation describing the pose of the local coordinate frame with respect to the global frame.

and $[Tlg] = \begin{matrix} 1 & 0 & 0 & 0 \\ Xi & c11i & c12i & c13i \\ Yi & c21i & c22i & c23i \\ Zi & c31i & c32i & c33i \end{matrix}$

Xi,Yi,Zi is the location of the origin of the ith local center of mass reference frame with respect to the global frame, xl,yl,zl are the coordinates of a point with respect to the local origin and cij are the direction cosines expressing the orientation of the local axes with respect to global. c11i, c21i, c31i are the direction cosines of the local xi axis with respect to Xg,Yg, and Zg respectively.

Notation: If α, β, γ are ordered series of rotations about z, y and x axes respectively then:

1	0	0	0
X	$c\alpha c\beta$	$c\alpha s\beta s\gamma - s\alpha c\gamma$	$c\alpha s\beta c\gamma + s\alpha s\gamma$
Y	$s\alpha c\beta$	$s\alpha s\beta s\gamma + c\alpha c\gamma$	$s\alpha s\beta c\gamma - c\alpha s\gamma$
Z	$-s\beta$	$c\beta s\gamma$	$c\beta c\gamma$

Where $s\alpha$ = sine α and $c\alpha$ = cosine α etc. The individual Euler angles can be found as follows:

$\beta i = \arcsin(-c31i)$

$\alpha i = \arcsin(c21i/\cos\beta i)$
$\alpha i = \arccos(c11i/\cos\beta i)$

$\gamma i = \arcsin(c32i/\cos\beta i)$
$\gamma i = \arccos(c33i/\cos\beta i)$

PART 5: RELATIVE ATTITUDES

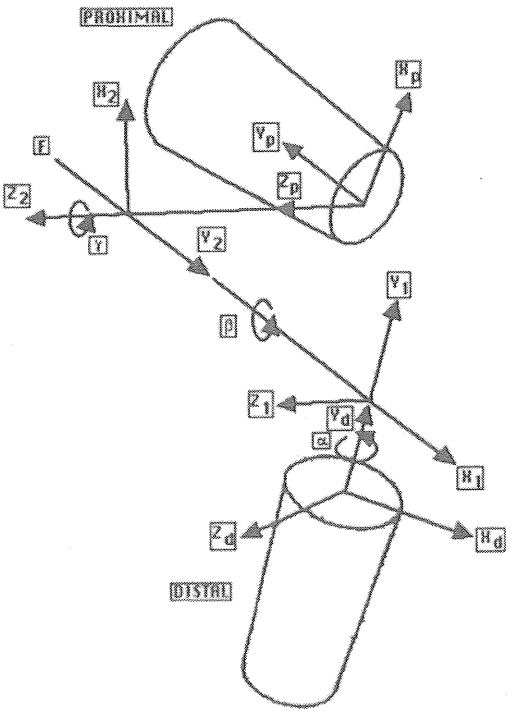
Need: A system to express the relative orientation of the body segments with respect to each other.

Recommendation: Joint coordinate systems (which might better be called Joint Rotation Conventions) defined for each joint individually. This system allows sequence independent rotations about axes which can be anatomically meaningful at the sacrifice of establishing a reference frame with non-orthogonal axes. As long as force and moments are not resolved along these non-orthogonal axes, this odes not present a problem. This approach allows the preservation of an important linkage with clinical medicine where the use of independent paired rotations (ad/ab, internal/external etc.) is common usage.

We further propose that no particular system of symbolic nomènclature be adopted for the description of joint motion but that accepted anatomical nomenclature be used in presentations.

The most well known example of such systems are those developed for the knee by Grood and Suntay (1983) and Chao (1986) (figure 3). Two body fixed axes are established relative to anatomical landmarks, one in each body on opposing sides of the joint. The third axes, called the floating axis, is defined as being perpendicular to each of the two body fixed axes.

FIGURE 3



If you need me to check the galleys once they are out I would be happy to do it. Just FAX me the relevant pages and I will respond ASAP.

Figure 3: A joint coordinate system for the knee joint

Notation:

α=rotation about the proximal body fixed axis
γ=rotation about the distal body fixed axis
β=rotation about floating axis

Notes:

We propose that Sub groups of specialists in each region of the body will be recruited by the ISB Standardization Committee to formulate the appropriate joint rotation conventions for each joint of the body. These groups might also address the issue of accuracy (which no doubt varies between joints) and the question of the relationship between the (usually) surface markers and the actual anatomical arrangement.

In order to determine these angles from conventional segment pose data, the following points are important:

a. The orientation of the proximal and distal axes must be carefully specified.

b. The choice of the location of the origins drastically affects the distraction displacement terms.

c. The Euler angle set in part 4 (Global attitudes) should match the angle decomposition for joints as closely as possible.

Woltring (1990, 1991) and others have supported the use of helical axes for the description of joint motion since it avoids some problems - such as gimbal lock - inherent in Euler angle representations. More recently, Woltring suggests the use of: "an attitude vector standard". At present, we are not proposing a standard for this approach as debate continues on its clinical application. Should there be widespread support for such a representation we would certainly consider a recommendation for standardization of helical axis representation.

PART 6: JOINT MOMENTS

Need: A system to report net joint moments that will avoid confusion concerning the anatomical actions being represented. Such a system needs to be consistent across joints and across sides of the body.

Recommendation: Net joint moments should be reported according to the conventions described by Winter (1987) such that net moments tending to cause extension, internal rotation, and abduction are positive.

Notation: Mfe, Mie, Mbd for moments tending to cause flexion/extension, internal/external rotation, and abduction/adduction respectively.

Notes: Any definition of joint moments assumes a definition of joint axis system. See Part 5 Relative Attitudes above for the recommended approach.

PART 7: MINORITY REPORT

Professor John Paul, a member of the ISB Standardization and Terminology Committee made two recommendations that have not been incorporated into the present version due to divided opinion from those who have reviewed these initial standards. They are reproduced here so that members will have a chance to comment on these views.

With reference to Part 1:

Many equipment manufacturers already format data according to their own XYZ system. I feel that we should avoid the awkward transposition exemplified by Yisb = Z kister etc. I suggest that ISB could avoid these problems by using hitherto not generally used symbols which do not suggest an anatomical part (e.g. avoid A H K). What about RST?

With reference to Part 2:

All humans and animals have left and right sides. Why standardize on a right handed system of axes? The only difference between the two is a minor matter of signs before some terms in mathematics which can easily be incorporated into the software! International Standards Organization Technical Committee 168 Working Group 3 - Prosthetics and Orthotics Testing specifies the "Forward, Outward, Upwards" system which is right handed or left handed as appropriate. It has the advantage exemplified by having the same sign for the moment produced at the left hip by the left gluteus medius as the moment produced by the right hip by right gluteus medius.

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A Project of the ISB Standardization and Terminology Committee.

Prof D.W. Grieve
Prof J.P. Paul
Prof D.A. Winter
Prof P.R. Cavanagh, Chair

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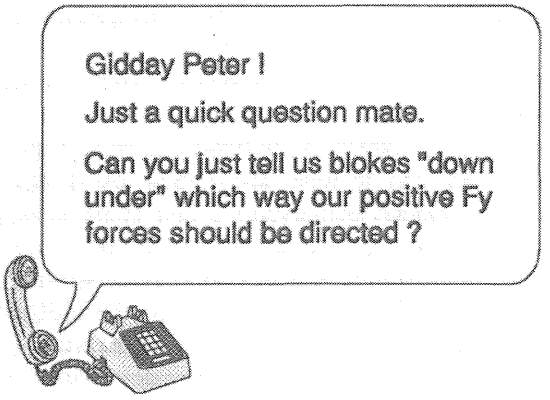

AFFILIATE SOCIETY NEWS

Report on the Activities of the Polish Society of Biomechanics (Polskie Towarzstwo Biomechaniki)

The idea of creating our own scientific association had been growing among Polish biomechanicians for many years. Initially they were mostly representatives of biomechanics of sport who were members of the Biomechanics Section of the Polish Scientific Society of Physical Culture. However, in 1960's, 1970's and, particularly, in 1980's research in biomechanics developed in Poland also into areas of other sciences, especially technical and medical. Therefore the then existing organizational form started to be insufficient for all Polish biomechanicians. On June 21st 1987 at a meeting of representatives of Polish centers of biomechanics held in the Academy of Physical Education in Gdańsk there was put forward an initiative of creating Polish Society of Biomechanics (PSB). A temporary Board of the Society was established which prepared a founding convention held on 22nd October 1987 in Warsaw. The convention ratified the PSB statute saying that:

> "PSB objective is promulgating and promoting the development of biomechanics as well as aiding its propagation in technology, medicine and sports".

On 10th April 1988 PSB was registered according to the Polish law as a non-profit organization obtaining a legally registered name and legal personality. On 4th May 1989 PSB was listed among associations affiliated at the Polish Academy of Sciences which in Poland equals to being counted among scientific organizations.

At present PSB has 106 members, most of whom are scientists representing all major university centers in Poland. Among the members there are also biomechanics practitioners - mainly operating in sport, rehabilitation and ergonomy. Authorities of the Society (elected every 4 years) consist of Executive Council, Supervisory Commission and Arbitration Board. During the first tenure of authorities of the Society which will last until September 1992 the Arbitration Board has not had any occasion to present its operation because as yet there has not been presented any case for consideration.

The main form of operation of the Society is patronizing scientific events. Every year there is organized (usually by the Wrocław Academy of Physical Education) the so called School of Biomechanics which is a scientific-educational event. This year it is to take place in Wrocław 22nd through 24th of September. Every four years instead of the School there is organized another scientific event - Polish Conference of Biomechanics (the last one took place in April 1991 in Zakopane). Foreign lecturers are invited to participate in both events. Reviewed materials are printed in Polish.

An important operation area of the Society is lobbying for funds for scientific research. At present, in the period of transformation of the economic system in Poland, also the system of financing science is changing - there has been introduced a system of "grants". PSB follows the situation and actively reacts, directly or through its members and sympathizers, in all points where decisions concerning financing research in biomechanics are taken.

PSB stimulates and aids scientific publications in biomechanics. Lately, for example, there has been published a monograph "Biomechanika" (in Polish, Wydawnictwa Komunikacji i Łączności, Warszawa 1990, 444 pages). It is a collective work --- authors of its 26 chapters discussing the state of art of Polish biomechanics are members of PSB, and the editorial committee has been headed by the President of the Society --- Prof. Adam Morecki from the Warsaw University of Technology. PSB is a co-publisher of a scientific quarterly "Biology of Sport" (in English with abstracts in Polish --- main publisher: Institute of Sport in Warsaw). Latest news of PSB life are published in Newsletter (quarterly in Polish and English --- editor Dr. W.S. Erdman, Academy of Physical Education in Gdańsk).

PSB propagates in Poland activities of ISB. On 24th June 1989 in Los Angeles the General Assembly of ISB took up the decision to affiliate PSB at ISB. Few members of PSB are simultaneously members of ISB. It is due to the fact that ISB membership fee is, in relation to Polish wages, rather high. Despite that, however, in all Congresses of ISB, and particularly those held in Europe, quite numerous Polish delegation always takes part. At the XIII-th Congress of ISB in Perth there have been only two delegates from Poland (they have been also the only two delegates representing the European post-soc countries). There is, however, no doubt that at the XIV-th Congress of ISB in Paris Polish delegation will be numerous.

Krzysztof Kedzior
Warsaw, 15 February 1992

Bulgarian Society of Biomechanics

The Bulgarian Society of Biomechanics (BSB) was founded on September 24, 1991 as an independent non-profit scientific organisation. The constitutive members (38 scientists) elected Dr Yuli Toshev as their first President. The possibility for the foundation of this Society appeared after the first democratic steps in East Europe, and we look forward to their formal affiliation with ISB in the future.

Thesis abstract corner

DYNAMIC AND STATIC STRENGTHS OF THE HUMAN IN WHOLE BODY EXERTIONS

by

David Mark Fothergill

Human Performance Laboratory
Department of Anatomy
Royal Free Hospital School of Medicine
London, NW3

A thesis submitted in partial fulfilment of the requirements of the requirements for the degree Doctor of Philosophy in the University of London

December 1991

Supervisor : Prof. D.W. Grieve

The characteristics of whole body manual exertions were investigated in both males and females under a wide range of conditions of posture, hand height, direction of exertion and task resistance. Many of the conditions in which whole body strength was measured had not previously been investigated.
The various factors which influence force exertion were reviewed and a computerized bibliography on human strength was prepared. Two experimental studies investigated the influence and interrelationships of hand/handle interface, gravitational and musculo-skeletal limitations on the ability to produce maximal static forces. A third study introduced novel strength testing equipment, protocol, data processing and display techniques in order to extend the measurement and analysis of whole body strength to all directions in three dimensions. A final study compared static lifting strength with maximal one and two-handed dynamic lifting performance against a range of resistances on an isoresistive hydrodynamometer.

A good association was found between dynamic and static measures of whole body strength. However, different relationships between the two were observed in one and two-handed, and in male and female exertions. It was further concluded that dynamic and static measures of whole body strength cannot reliably be predicted on the basis of body weight and stature alone when the exerted force is directed along the line joining the foot and hand centroids. In other directions of exertion, where gravitational limitations play a more dominant role in the strength of exertion, reasonable predictions of whole body

static strength may be obtained using a simple linear regression model with body weight and stature as independent variables.
Extension of the *Postural Stability Diagram* (Grieve, Ergonomics, **10**, 1979, 1155-1164) into three dimensions and dynamic models of lifting strength based on the results are discussed as possible aids for task analysis in manual materials handling.

ENHANCED ANALYSIS OF HUMAN LOCOMOTION

by

Dwight A. Meglan*

Department of Mechanical Engineering
The Ohio State University, Columbus, OH 43210
Degree: Doctor of Philosophy

Advisor: Professor Necip Berme

Several techniques were developed to enhance the quantitative evaluation of human locomotion. These included a mathematical model of the foot, a numerical technique to perform forward dynamics simulations of general human locomotion, and an evaluation of the coupling of body motions.

A three dimensional, passive mechanical model of the foot was used to simulate foot-ground contact interaction. This model consisted of a rigid frame to which were attached a sole, composed of a number of nonlinear viscoelastic spheres, and rigid, hinged toes having nonlinear joint stiffness and damping. The deformable sphere properties were determined by applying a number of passive physical models to a set of experimental data of the time histories of displacement and force during impact of a mass upon human heel pads *invivo*. Numerical optimization methods were combined with dynamic simulation to find a nonlinear equation describing the heel pad mechanical behavior. Mathematical methods were developed and programmed so that the reaction forces between the individual spheres and a general planar frictional surface (ground) and the toes and ground could be calculated and their resultant determined. Both motion and load driven simulation approaches were applied to a number of foot model geometries using a single subjects measured ground reaction loads and foot motions during gait. The ground reaction loads and center of pressure time histories were successfully reproduced with this model.

A general technique for numerically producing the dynamic equations representing the whole human body was developed and realized as a computer program. The technique was based on extensions of the Newton-Euler dynamic simulation method including: multiple branching kinematic chains, a floating reference link, 1 to 3 DOFs rotational joints, nonlinear passive mechanical joint rotation limits, and passive mechanical models of the feet. The method allowed simulations to be driven by either joint torques or muscle forces. The technique and program were verified and then applied to the forward dynamics simulation of several human full body motion tasks, including normal gait, using a 34 DOF, 13 segment body model. These simulations were driven by predefined time sequences of joint torques, i.e., under open loop control. Lastly, the influence of several of the nonlinear parameters within the model definition were studied to observe their effect upon the numerical integrators used to evaluate the nonlinear dynamics differential equations.

Lastly, using dynamic equations generated by the same technique used for simulating locomotion, a method was developed to evaluate the coupling between the net joint moments and/or muscle forces in the body, as well as coriolis, gravitational, and ground reaction loads, and the motion of all the degrees of freedom of the body as modeled. The coupling between the joint moments and segment motions of a set of experimentally measured normal clinical gait data was evaluated. An algorithmic technique was used to scan the resulting large number of motion components to determine the significant contributors to each joints observed kinematic behavior. These results were analyzed to investigate the possibilities and limitations of this technique in application to clinical gait.

*Present Address:
Orthopaedic Biomechanics Laboratory
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SUMMER SESSION

Massuchusetts Institute of Technology

The M.I.T. Summer Session will be offering a program entitled "Biomechanics of Human Movement in Orthopaedics, Rehabilitation, Neurosciences and Sports", August 3-7, 1992. Further details can be obtained from:

Maria Muollo
Assistant Director
M.I.T. Office of the Summer Session
Cambridge, MA 02139, U.S.A.
Phone: (617) 253 2101; Fax: (617) 253 8042

Conference news

SECOND INTERNATIONAL CONFERENCE ON BIOMATHEMATICS

The 2nd International Conference on Biomathematics will be held in The Republica di San Marino, 5-7 October, 1992. Submitted abstracts of work are to be A4 format with a 2 cm margin, and must be sent by June 1. There is no limit to the number of pages, but each page must bear on the reverse side the page number and author(s). Abstracts are to be sent to:

Professor Giovanni Pallotti
Department of Physics
Faculty of Medicine and Surgery
Univeristy of Bologna
Via Irnerio 46
40126 Bologna, ITALY

BIOMECHANIK IM TURNEN - BIOMECHANICS IN GYMNASTICS

First International Conference

Institute for Athletics and Gymnastics
German Sports University Cologne
Germany
8-10 September, 1992

The purpose of this conference is to provide a forum for the presentation of applied biomechanical research related to gymnastics, tumbling and trampolining. The focus will be on the relationship of these investigations to the optimisation of the gymnast's technique and mechanical load. In other words, the Conference will seek to bridge the gap between biomechanical research and the application of its results in practise.

The Conference will include invited lectures and free communication sessions. The primary aim will be to bring researchers and coaches to a mutual level of knowledge concerning gymnastic technique. On such a basis, future investigations can be planned. Prior to the main Conference a satellite Workshop on scientific methods for the study of gymnastic performance will be held for coaches and other non-scientific coaching support personnel. Further details can be obtained from:

BIG Conference Secretariat
Institut fur Leichtathletik und Turnen
Deutche Sporthochschule Koln
Carl-Diem-Weg 6
D-5000 Koln 41
GERMANY
Tel: 49-221-4982418; Fax: 49-221-4973454

Announcements

BIOMECHANICS POSITIONS

*Assistant Professor**
Department of Exercise Sciences
The University of Southern California

Applications and nominations are invited for an assistant professor position in the Department of Exercise Sciences, one of seven departments in the Division of Natural Sciences and Mathematics. Applicants should have an earned doctorate and an adequate research and publication record in one of the following areas: Muscle physiology, muscle metabolism, muscle dynamics, biomechanics and/or any specialization area that would be relevant to the main research thrust in the exercise sciences. The responsibilities of this position include the ability to develop a vigorous research program, teach in both the graduate and undergraduate curriculum and provide student advisement.

Applicants should forward a statement of interest, a current curriculum vitae, and at least three current letters of recommendation to:

Casey M. Donovan, PhD
Chair, Search Committee
Department of Exercise Sciences
University of Southern California
Los Angeles, CA 90089-0652, USA

* This Position is contingent upon a February 1992 decision. The University of Southern California is an Equal Opportunity, Affirmative Action Employer

Sports Biomechanist

The Sports Science Division of the United States Olympic Committee in Colorado Springs, CO is seeking applications for a sports biomechanist. Responsibilities include: 1) disseminating scientific information to coaches and athletes, 2) providing testing and consulting services, 3) conducting applied research, 4) contributing to the multidisciplinary activities of the division. An earned doctorate in biomechanics or related area is required. Salary commensurate with experience. Submit letter of interest, resume and list of professional references to Mary L. Watkins, Personnel Manager, U.S. Olympic Committee, 1750 East Boulder Street, Colorado Springs, CO 80909. EOE

PENN STATE UNIVERSITY
DEPARTMENT OF EXERCISE AND SPORT SCIENCE

Position: Associate / Full Professor of Biomechanics in the Department of Exercise and Sport Science.

Applicants must possess a strong research and publication record including generation of external research grant funds. The appointee will be expected to teach at the undergraduate and graduate levels and advise M.S. and Ph.D. students. Research activities will be conducted in the existing Biomechanics Laboratory in collaboration with current faculty members. Joint research with other exercise scientists in the Department and University will be expected and encouraged.

Qualifications:

Applicants must possess a Ph.D. degree in biomechanics or a closely related field. Research competence, as demonstrated in publications and external grant fund generation, and experience in graduate teaching and advising are required.

Rank and Salary:

Rank of Associate or Full Professor and salary commensurate with background and experience.

General Information:

The Department of Exercise and Sport Science is an academic unit in the College of Health and Human Development offering B.S., M.S., and Ph.D. degrees.Graduate degrees are offered in four areas: Biomechanics and Locomotion Studies; Exercise Physiology; Motor Behavior; and Sport Studies. Geographically, University Park is located in the municipality of State College in Central Pennsylvania. It is the largest of the Penn State campuses with an enrolment of approximately 39,000 students and offers more than 100 programs of graduate study.

Application:

Submit a cover letter describing interests and qualifications for the position, curriculum vitae, copies of three recent research publications along with name, address, and phone number of three individuals whom you have asked to submit letters of recommendation. Direct all correspondence to:

Dr. Virginia Fortney, Chair
Search Committee - Biomechanics
200 Biomechanics Laboratory - Box 700
Penn State University
University Park, PA 16802-3408
U.S.A.
BITNET: VLF1@PSUVM
Tel: (814) 865-3445

Deadline:

Completed applications will be reviewed beginning March 20, 1992 and continue to be reviewed until the position is filled.

Penn State is an Affirmative Action / Equal Opportunity Employer Women and Minorities are Encouraged to Apply

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM DEPARTMENTS OF BIOMEDICAL AND MECHANICAL ENGINEERING

The School of Engineering invites applications for a Research Assistant Professor faculty position in rehabilitation engineering beginning as soon as possible and no later than the fall of 1992. Candidates should have at least 1 year of experience managing a gait laboratory. Preference will be given to candidates who have experience with the VICON or similar analysis systems. Duties will include developing and managing the UAB Gait Laboratory as well as collaborating with faculty and graduate students in rehabilitation engineering research. The primary appointment will be made in either the Department of Biomedical Engineering, or the Department of Mechanical Engineering, as appropriate. Secondary appointments are available in the Departments of Surgery and/or Physical Therapy.

The Department of Biomedical Engineering at the University of Alabama at Birmingham offers programs leading to the M.S. and Ph.D. degrees. Examples of research areas in biomedical engineering are biomaterials, biomechanics, bioinstrumentation, biotechnology, and medical imaging. The Department of Mechanical Engineering offers programs leading to the B.S., M.S., and Ph.D. degrees. Examples of research areas in mechanical engineering include rotating equipment, turbomachinery, manufacturing automation, hard and soft tissue biomechanics, and fluid dynamics.

UAB is an autonomous campus within the University of Alabama system. UAB faculty currently are involved in over $100 million of externally funded grants and contracts. The School of Engineering has on-line access to a Cray XMP/24 supercomputer through the Alabama Supercomputer Network. The UAB environment offers an excellent opportunity for engineers to pursue research and educational activities in collaboration with outstanding scientists
in a variety of disciplines.

Applicants for this non-tenure track position must be U.S. citizens or have permanent U.S. residency, and must have an earned doctorate in biomedical engineering, mechanical engineering, or a related suitable discipline.

Interested persons should send an application letter, a current vita, copies of important publications (if applicable), and research interests, and the names of three references to:

Terry Wright, Ph.D.
Mechanical Engineering Dept.
Ernest M. Stokely, PhD
Biomedical Engineering Dept.
University of Alabama at Birmingham
UAB Station, Birmingham, AL 35294, USA

Applications will be accepted until the position is filled. The University of Alabama at Birmingham is an equal opportunity, affirmative action employer, and encourages applications from qualified women and minorities.

UNIVERSITY OF SOUTHERN CALIFORNIA

There is a Junior Level Faculty Position open in the Department of Exercise Science University of Southern California, Los Angeles, CA 90089-0652,USA. Interested applicants in the areas of biomechanics or exercise physiology should contact Dr. Casey Donovan at 213-740-2492.

Calendar of scientific events

May 7-8, 1992
International Biomechanics Seminar, Centre for Biomechanics, Göteborg, Sweden. Contact: Gunilla Ekman, Centre for Biomechanics, Chalmers University of Technology, S-412 96 Göteborg, Sweden. Tel: +46-31-721515; Fax: +46-31-721192.

May 12-14, 1992
International Scientific Conference on Prevention of Work-Related Musculoskeletal Disorders, Stockholm, Sweden. Conference Secretariat: Ms Gun Carlsson, National Institute of Occupational Health, S-17184 Solna, Sweden. Tel: +46-8-730-9100: Fax: +46-8-730-1967.

May 18-19, 1992
European Conference on Joint Replacement in the 1990's, East Midlands Conference Centre, Nottingham, UK. Contact: Ms Alison Elgar, Conference Department C441, Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1H 9JJ. Tel: (071) 973-1281; Fax: (071) 222-9881.

May 21-24, 1992
Meeting of the International Society for the Study of the Lumbar Spine, Chicago, IL, USA. Contact: Prof. Alf Nachemson, Department of Orthopaedics, Sahlgren Hospital, S - 413 45 Gothenborg, Sweden, Tel:+46(0)31.601000

May 23-27, 1992
XIth International Symposium on Posture and Gait: Control Mechanisms, Yvonne Miller-Ross, Good Samaritan Hospital and Medical Center, 1015 N.W. 22nd Avenue, N300 Portland, OR 97210 USA, Tel: (503) 229-7348; Fax: (503) 790-1201.

June 7-10, 1992
Canadian Medical and Biological Engineering Society (CMBEC), CMBEC Secretariat, Room 305, Building M-50, National Research Council of Canada, Montreal Rd., Ontario, Canada K1A 0RO.

June 10-14, 1992
Annual International Industrial Ergonomics and Safety Conference '92, Denver, Colorado, USA. Contact: Dr S. Kumar, Conference Chair, Dept. of Phys. Therapy, University of Alberta, Edmonton, Alberta, T6G 2O4 Canada. Tel: (403) 492-5979; Fax: (403) 492-1626.

June 21-24, 1992
Eighth Meeting of the European Society of Biomechanics, in association with the European Society of Biomaterials. Conference Secretariat: ESB92, Istituto di Fisiologia Umana, Università 'La Sapienza', Piazzale Aldo Moro 5, 00185 Rome, Italy. Tel: 39-6-490673; Fax: 39-6-4452824.

June 28-July 2, 1992
9th International Congress of ISEK, Florence, Italy. Contact: CE.S.P.RI, Fondazione Pro Gnocchi, Via Imprunetana 124-50020 Monte Oriolo, Florence, Italy. Tel: 39-055-208322/208426; Fax: 39-055-2084428.

August 3-8, 1992
Eighth International Congress of Biorheology, Yokohama, Japan. Executive Secretary: Dr. Takuo Yokose, 3rd Dept. of Internal Medicine, Jikei University School of Medicine, 3-25-8 Nishi-Shinbashi, Minato-ku, Tokyo 105, Japan. Fax: +81-3-3578-9753.

August, 18-21, 1992
3rd International Symposium on Sport Surfaces, University of Calgary, Canada. Conference Office: Faculty of Continuing Education, The University of Calgary, 2500 University Drive N.W., Calgary, Alberta T2N 1N4, Canada. Tel: (403) 220-5051; Fax: (403) 289-7287.

August 24-28, 1992
Second North American Congress on Biomechanics, combining the 16th Annual Meeting of the American Society of Biomechanics (ASB) and the 7th Biennial Conference of the Canadian Society for Biomechanics/Société Canadienne de Biomécanique (CSB/SCB), at the McCormick Center Hotel, Chicago, USA. Conference Co-Chairman: Dr Louis Draganich, Dept. of Surgery, University of Chicago, 5841 South Maryland Avenue, Box 421, Chicago, IL 60637, U.S.A. Tel: +1-312-702-6839.

August 31 - September 5, 1992
12th International Symposium on Biotelemetry, Contact: Secretary-General: Dr. Sandro Fioretti, Department of Electronics and Automatics Faculty of Engineering, University of Ancona Via Brecce Biance (Monte d'Ago) I - 60 131 ANCONA, Italy.
Tel: +39(71)2204 843; Fax: +39(71)898 246;
E-mail: ISOB@ANVAX2.CINECA.IT (EUnet/Internet)
ANVAX2::ISOB (CINECA-DECnet)

September 4-5, 1992
International Conference on Experimental Mechanics: Technology Transfer Between High Tech. Engineering & Biomechanics, University of Limerick, Ireland. Conference Secretariat: BSSM'92, Dept. Mech. Eng., University of Limerick, Plassey Technological Park, Limerick, Ireland. Fax: 353-61-330316 (Ireland, Eire) or e-mail at LittleT@ul.ie

November 2-6, 1992
The Fifth International Conference on Environmental Ergonomics, Maastricht, The Netherlands. Contact: George Havenith/Wouter Lotens, Fifth Int. Conf. on Environmental Ergonomics, TNO-Institute for Perception, P.O.Box 23, 3769 ZG Soesterberg. Tel:+31-3463-56211; Fax:+31-3463-53977
E-mail: fifth-ee@izf.tno.nl

December 2-4, 1992
Seventh International Conference on Biomedical Engineering, National University of Singapore. Secretary: 7th ICBME 1992, Dept. Orthopaedic Surgery, National Hospital, Lower Kent Ridge Road, Singapore 0511. Tel: (65) 772 4424; Fax: (65) 778 0720.

ISB membership news

NEW MEMBERS

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