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Judging objectively the function of different jacket material

Martin Harnisch | **Hohenstein Institute**

Sports Performance Days | Munich | November 21st, 2011

COMPETENCE IN TEXTILES

Hohenstein Institute – at a glance

- Private institute for research, testing, consulting and inspections
- Non-profit research institute
- Technical academy offering vocational and advanced training
- 320 employees at the headquarters in Bönnigheim and a global network of branch offices in 24 different countries
- Family operated in third generation

Aerial view of the Hohenstein Institute

HOHENSTEIN

Serving textile business worldwide

Europe

Bulgaria
Hungary
Romania
Russia
Belarus

The Americas

USA
Mexico
Peru
Brazil
Dominican Republic
Guatemala
El Salvador
Colombia (2x)

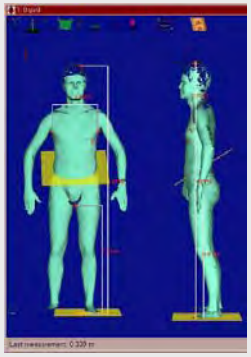
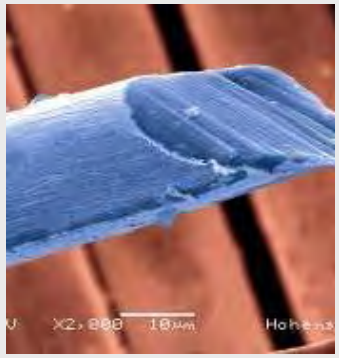
Asia

Turkey
Syria
Pakistan
India (4x)
Sri Lanka
Bangladesh
Thailand
Cambodia
Vietnam
China (2x)

Hohenstein Institute – History



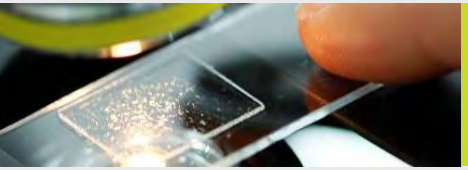

1946 ..... today



Operating ranges & areas of competence

Clothing Technology: Testing of fit and workmanship



Consumer Tests: Comparative product testing

Hygiene & Biotechnology: Attestation of efficiency and safety checks

Textile Testing: Material testing, quality control & inspection service

Function and Care:

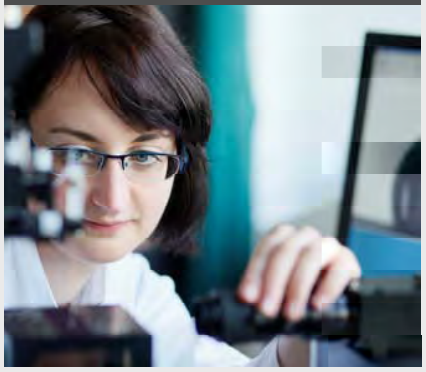
- Assessment/optimization of the wear comfort of textiles & clothing
- Development/testing of functionalized textiles and care methods
- Test centre for personal protective equipment

Function and Care – Fields of activity

Clothing Physiology

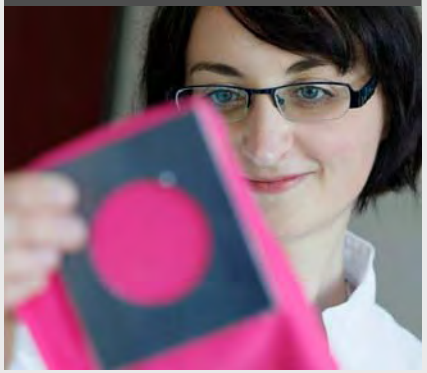
PPE – Test Centre and Certified Body

Functional Clothing



Colorimetry/White-ness Assessment

Textile UV Protection



Textile Reprocessing

Contract Research and Consultation

Advanced Training and Education

Function and Care

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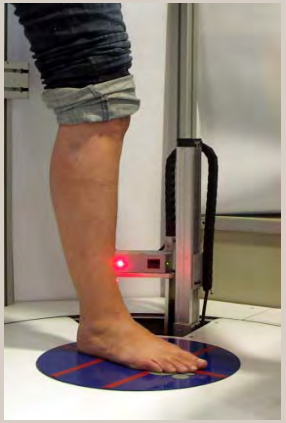
Clothing technology

Touchless measuerement with 3D Scanner during various serial measurements
Research projects

Project „Size Germany“

Project „Bold figures“

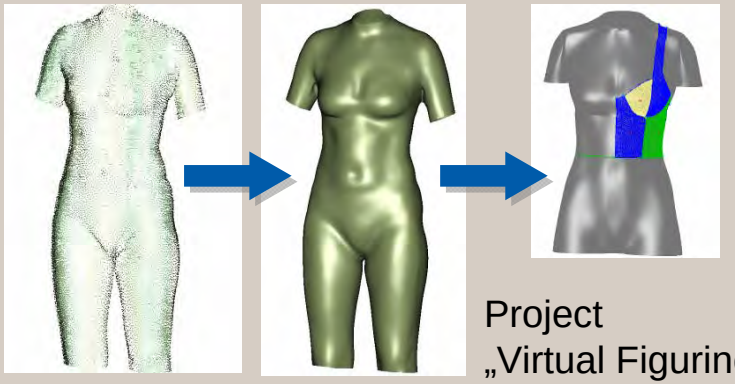


Develop-
ment of
grading
methods
for shoes
and
hosiery

Develop-
ment of a
language
database

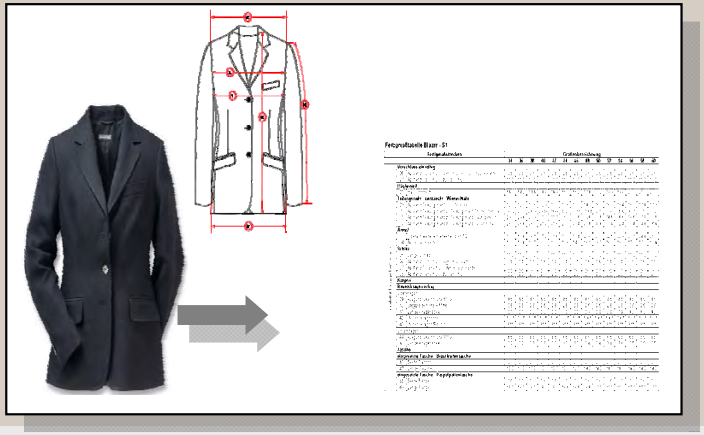
>>> Research

Sensor system for cut-protection trousers prevents accidents



Project
„Virtual Figurines“

Project „Measurements charts“



Function and Care

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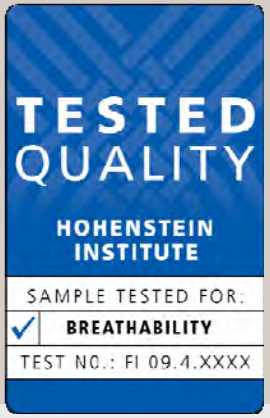
Clothing physiology

Optimized protective clothing



Functional sportswear


Optimized work clothing



Function and Care - **Clothing physiology**

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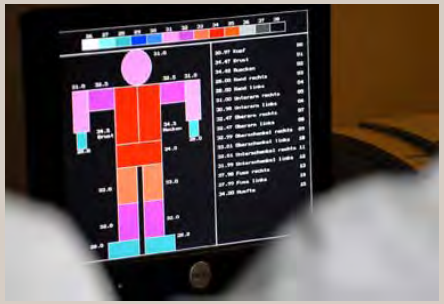
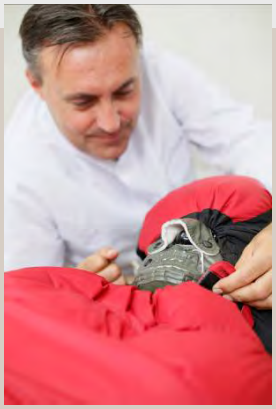
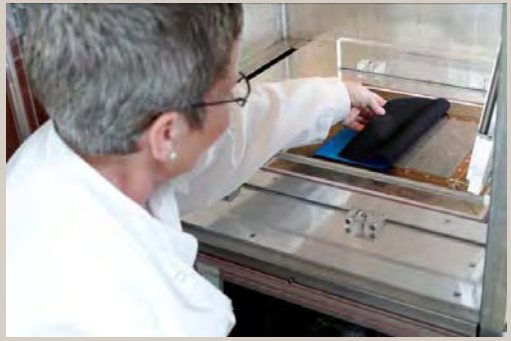
Sleep comfort



Sleeping bag test





Sleeping bag tests according to DIN EN 13537 and DIN EN 13538/1-3

Optimized car seats

Measurements of material composites and car seats
+ Thermal insulation
+ Water vapour volume resistance
+ Buffering capacity water vapour
+ Testing of the initial thermal sensation

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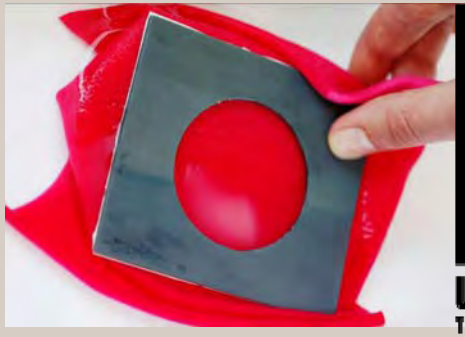
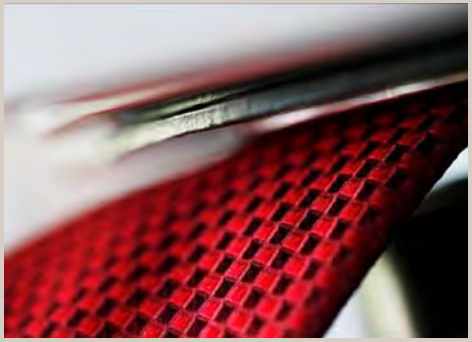
Functionalized textiles and optimized care methods

UV protective textiles



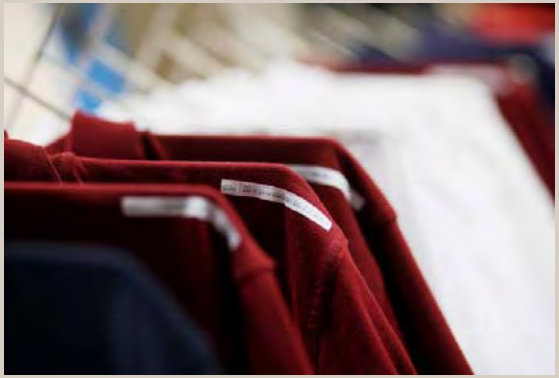
Color measurement and whiteness assessment



Functionalized textiles and optimized care methods

Textile leasing

Textile reprocessing



Function and Care

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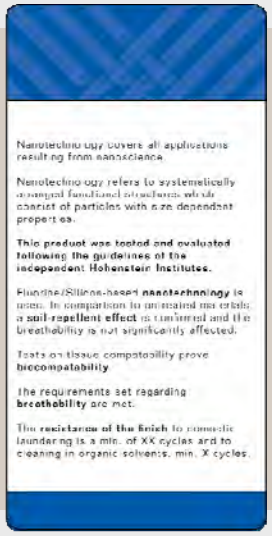
Functionalized textiles and optimized care methods

Nanotechnology



>>>Research

Optimizing of the care and durability of flame retardant textiles

Development of new structures to optimize anti-static textiles

Development of new finishes for water repellent surgical gowns/barrier textiles

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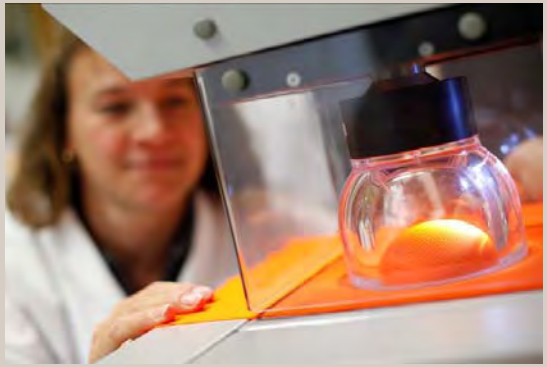
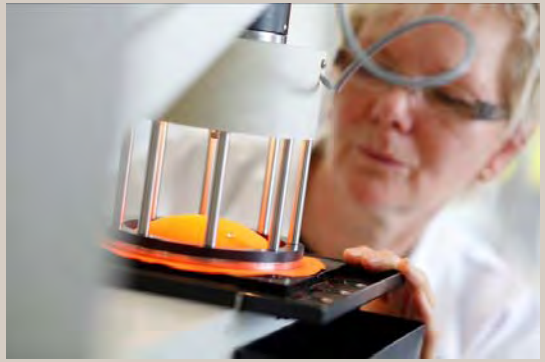
PPE – Test and certification centre for Personal Protective Equipment

Testing of color fastness, fastness to washing, fastness to light, fastness to rubbing, fastness to sweat and tensile strength



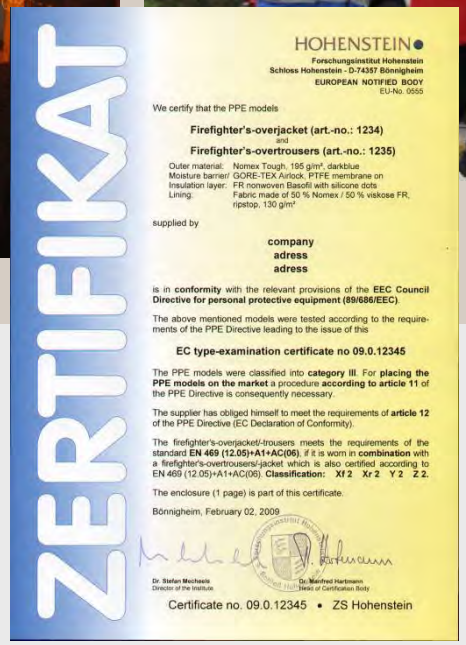







PPE – Test and certification centre for Personal Protective Equipment

Testing and certifcation of protective equipment for fire departments using „Thermoman“



ZERTIFIKAT

HOHENSTEIN

Forschungsinstitut Hohenstein
Schloss Hohenstein - D-74357 Bönnigheim
EUROPEAN NOTIFIED BODY
EU-No. 0555

We certify that the PPE models

Firefighter's-overjacket (art.-no.: 1234)
and
Firefighter's-overtrousers (art.-no.: 1235)

Outer material: Nomex Tough, 195 g/m², darkblue
Moisture barrier/ Insulation layer: GORE-TEX Airlock, PTFE membrane on FR nonwoven Bascifil with silicone dots
Lining: Fabric made of 50 % Nomex / 50 % viskose FR, ripstop, 130 g/m²

supplied by

company
adress
adress

is in **conformity** with the relevant provisions of the **EEC Council Directive for personal protective equipment (89/686/EEC)**.

The above mentioned models were tested according to the requirements of the PPE Directive leading to the issue of this

EC type-examination certificate no 09.0.12345

The PPE models were classified into **category III**. For **placing the PPE models on the market** a procedure **according to article 11** of the PPE Directive is consequently necessary.

The supplier has obliged himself to meet the requirements of **article 12** of the PPE Directive (EC Declaration of Conformity).

The firefighter's-overjacket/-trousers meets the requirements of the standard **EN 469 (12.05)+A1+AC(06)**. If it is worn in **combination** with a firefighter's-overtrousers/-jacket which is also certified according to EN 469 (12.05)+A1+AC(06). **Classification: Xf 2 Xr 2 Y 2 Z 2.**

The enclosure (1 page) is part of this certificate.

Bönnigheim, February 02, 2009

Dr. Stefan Mecheels
Director of the Institute

Dr. Manfred Hartmann
Head of Certification Body

Certificate no. 09.0.12345 • ZS Hohenstein

Why is wear comfort important?

- Support of physical and mental fitness by a good heat and moisture management
- Protection against external influences

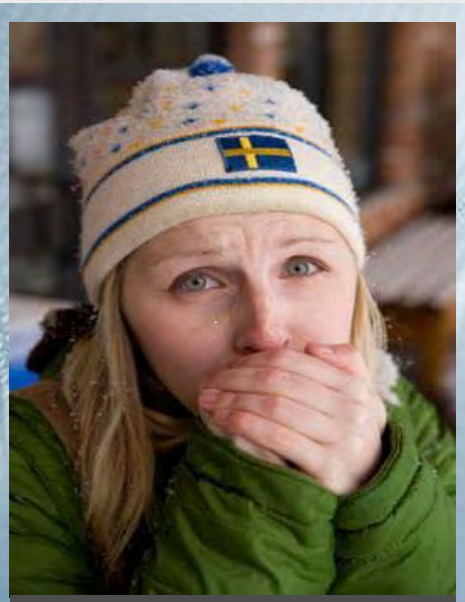
→ **Wear comfort is no luxury!**

Pictures: Löffler, Shutterstock



What do we feel while wearing clothing?

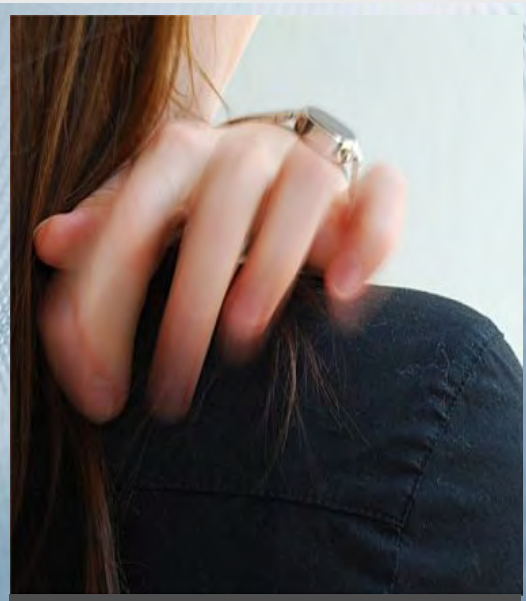
Thermophysiological discomfort



Freezing

Heavy sweating

Skin sensorial discomfort

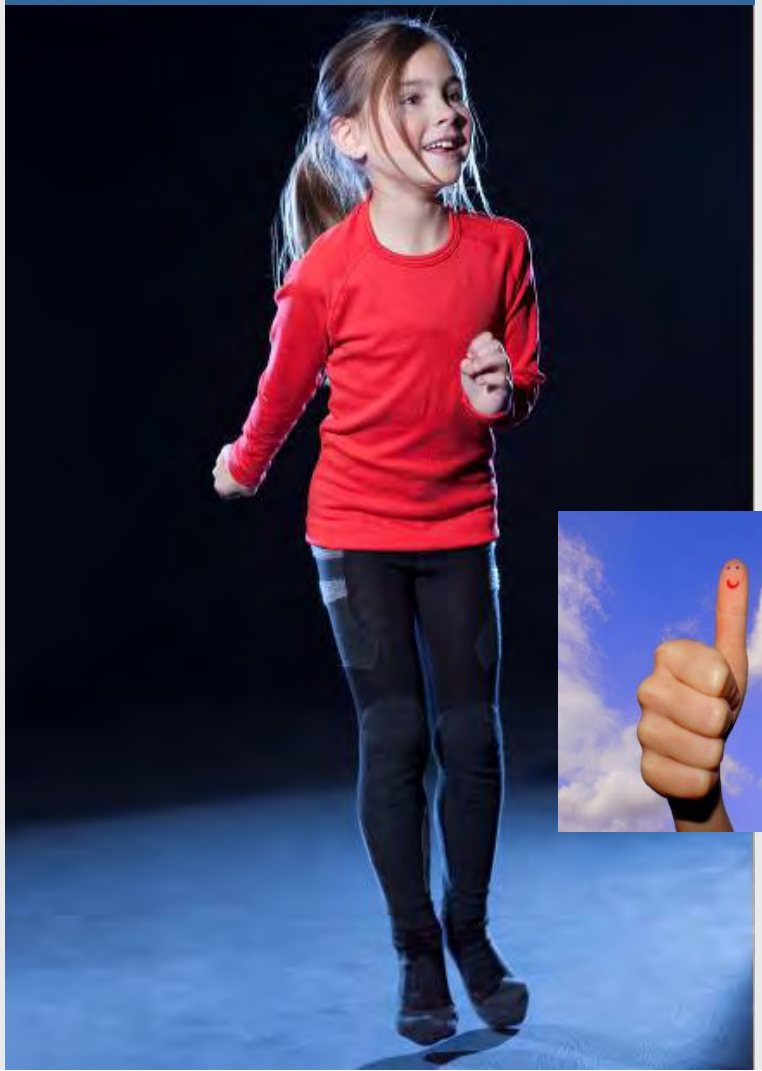


Scratching, clinging, etc.

No wear comfort

Aspects of wear comfort

Thermophysiological comfort



Wear comfort

Skin sensorial comfort

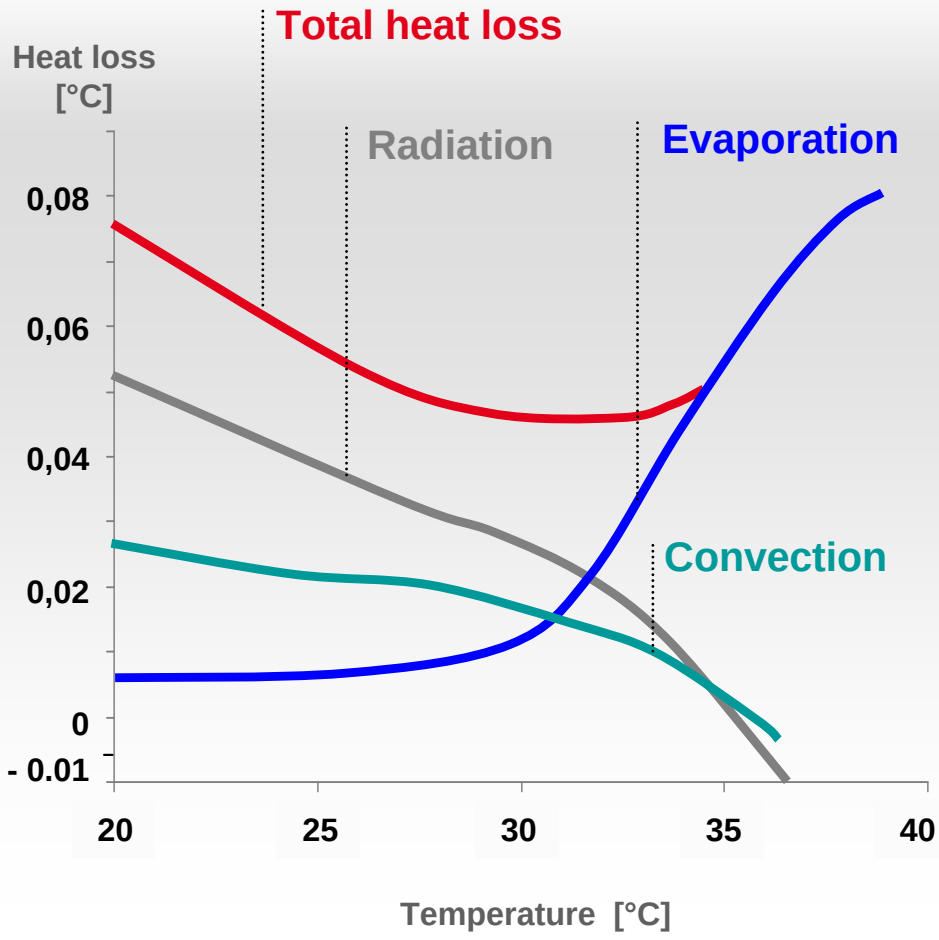
Pictures: Falke

Processes of heat and sweat production

Aim: Balanced relation between heat loss to heat production

metabolic heat + environmental heat

conduction + convection + evaporation + radiation



Wear comfort of clothing

Does not come automatically

Always only the result of elaborate product development

Never the result of just 1 construction parameter (e.g. fibre materials)

All construction parameters must be well adjusted to the climatic conditions and the range of application

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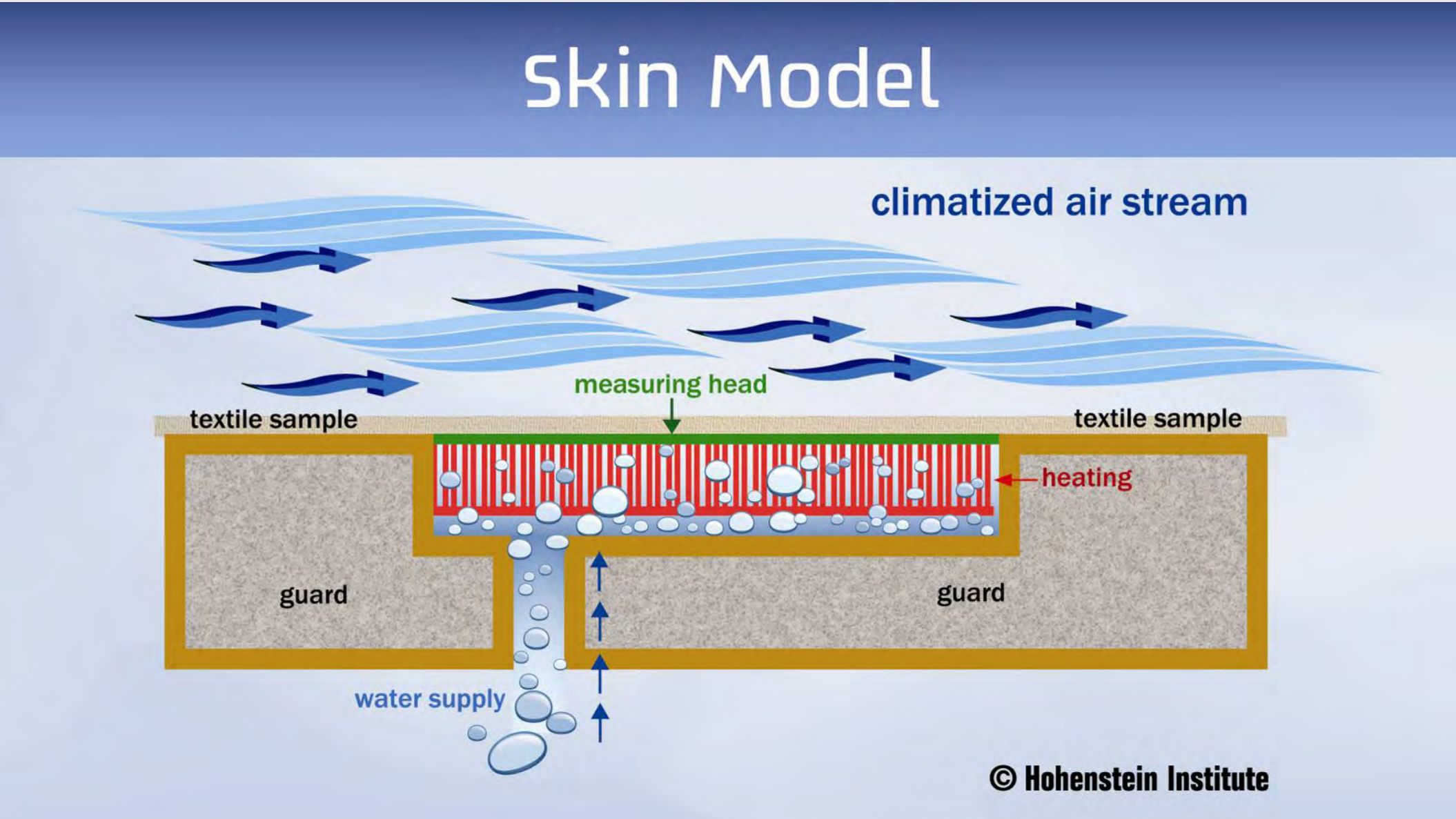
How can good wear comfort be assessed objectively already during product development?

Measurement of wear comfort - Skin Model



Wear situations and associated textile properties – It is not only about breathability !

Insensible sweating

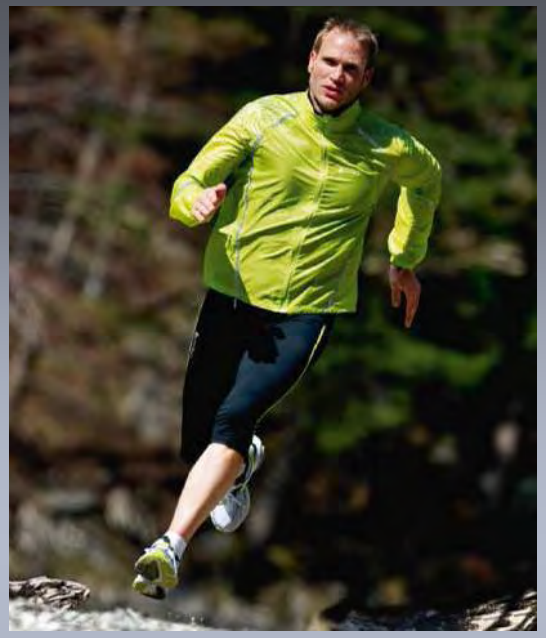
Water vapour resistance („breathability“)

Thermal insulation

Heavier sweating

Buffering of sweat

Pictures: Odlo



Heavy sweating

Sweat transport

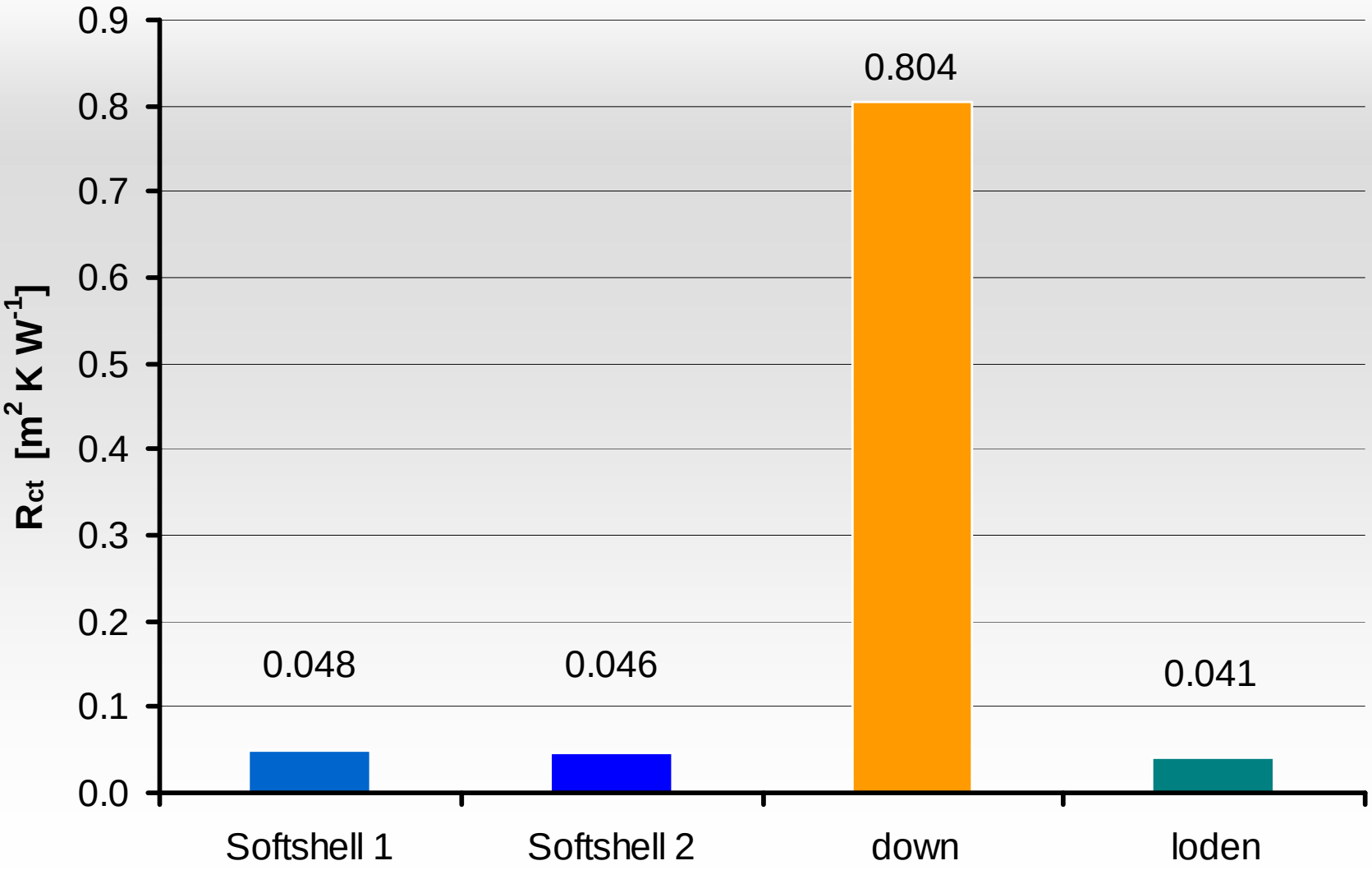
Sweat absorbency

Drying time

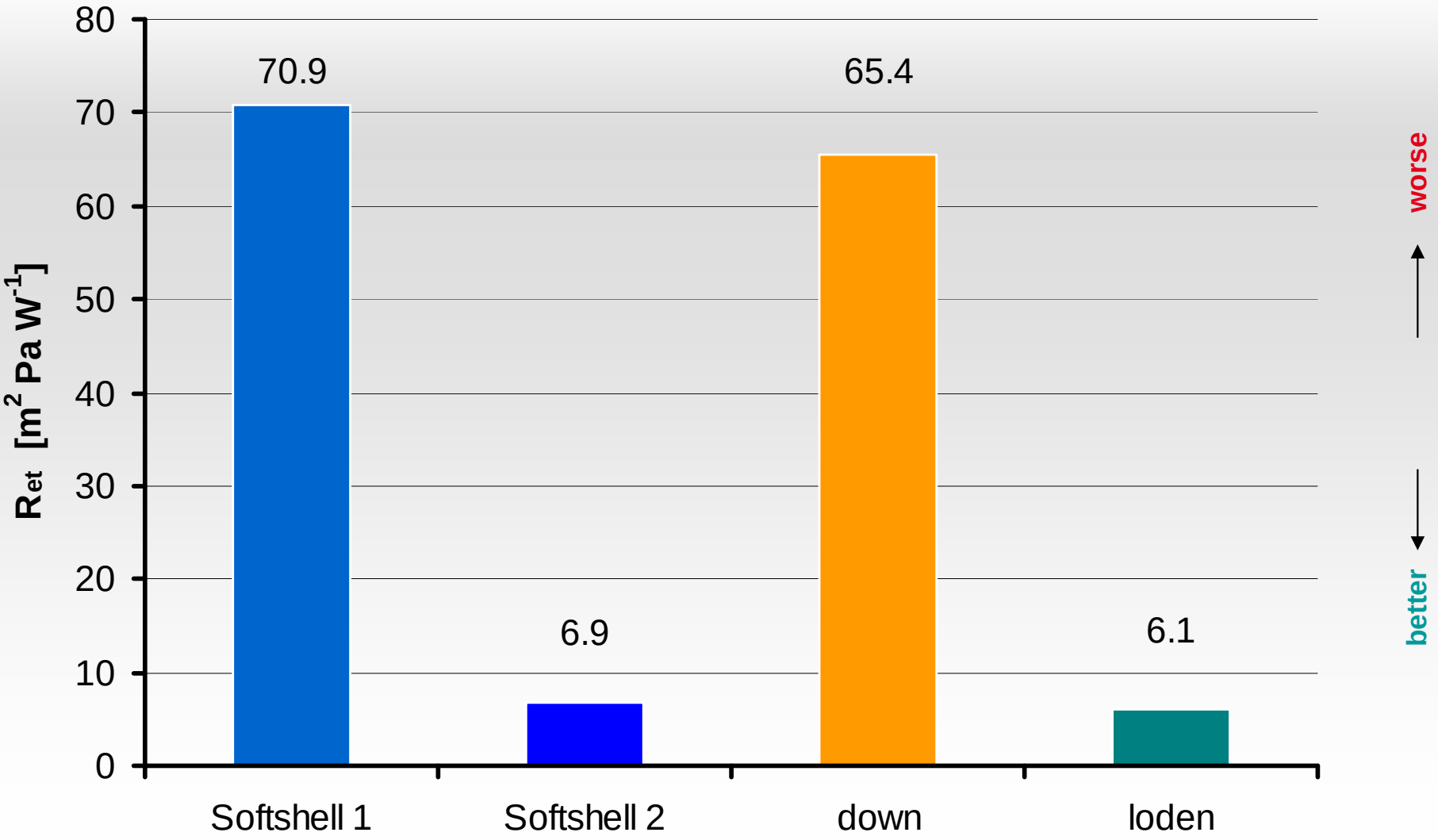
Wear comfort of different jacket constructions

	two Softshell jackets	down jacket	loden jacket
weight	app. 630 g	771 g	964 g
air permeability	app. 3 l /m² s	1.2 l /m² s	113 l /m² s

Thermal insulation – jackets (fabric)

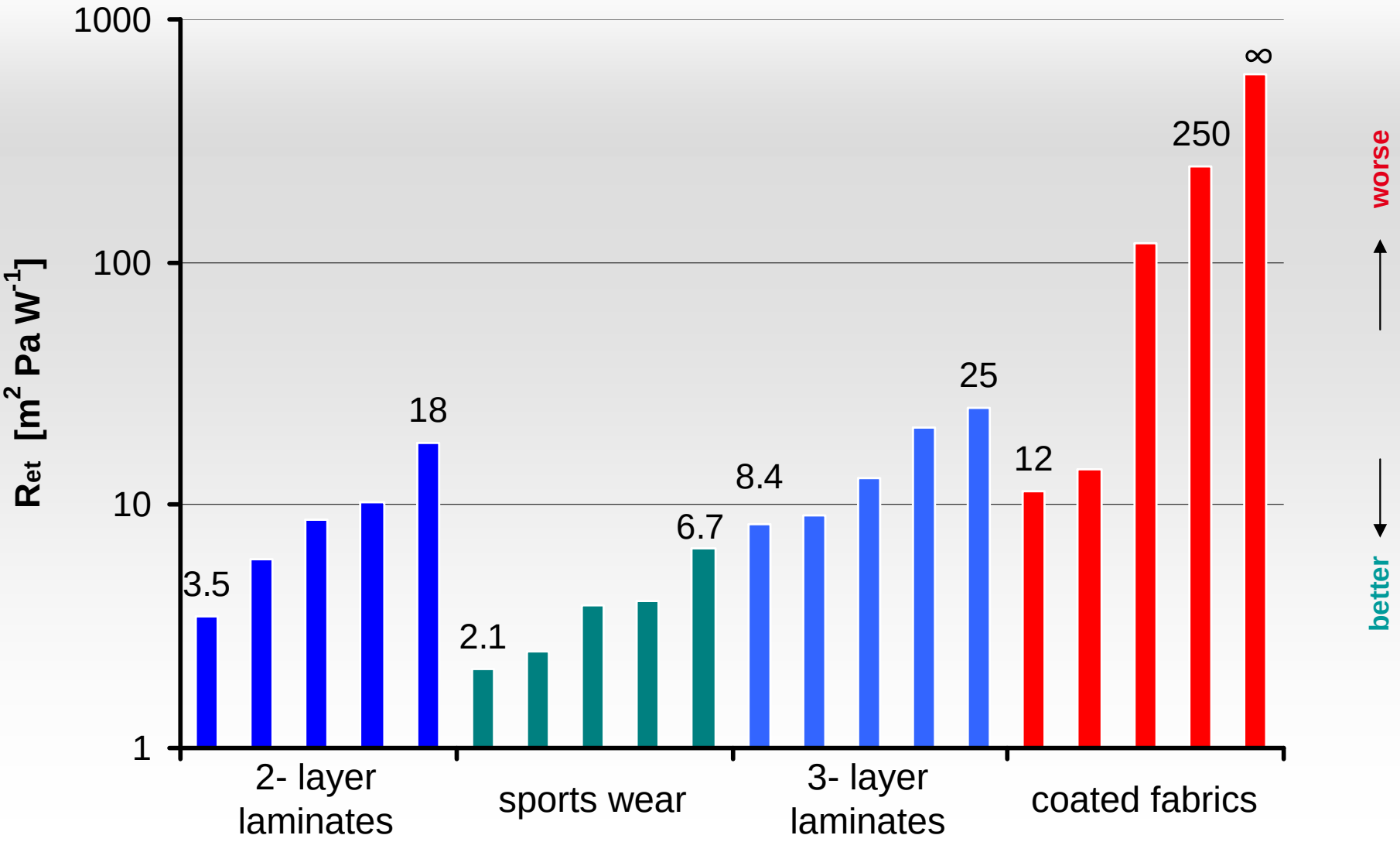


Water vapour resistance – jackets (fabric)



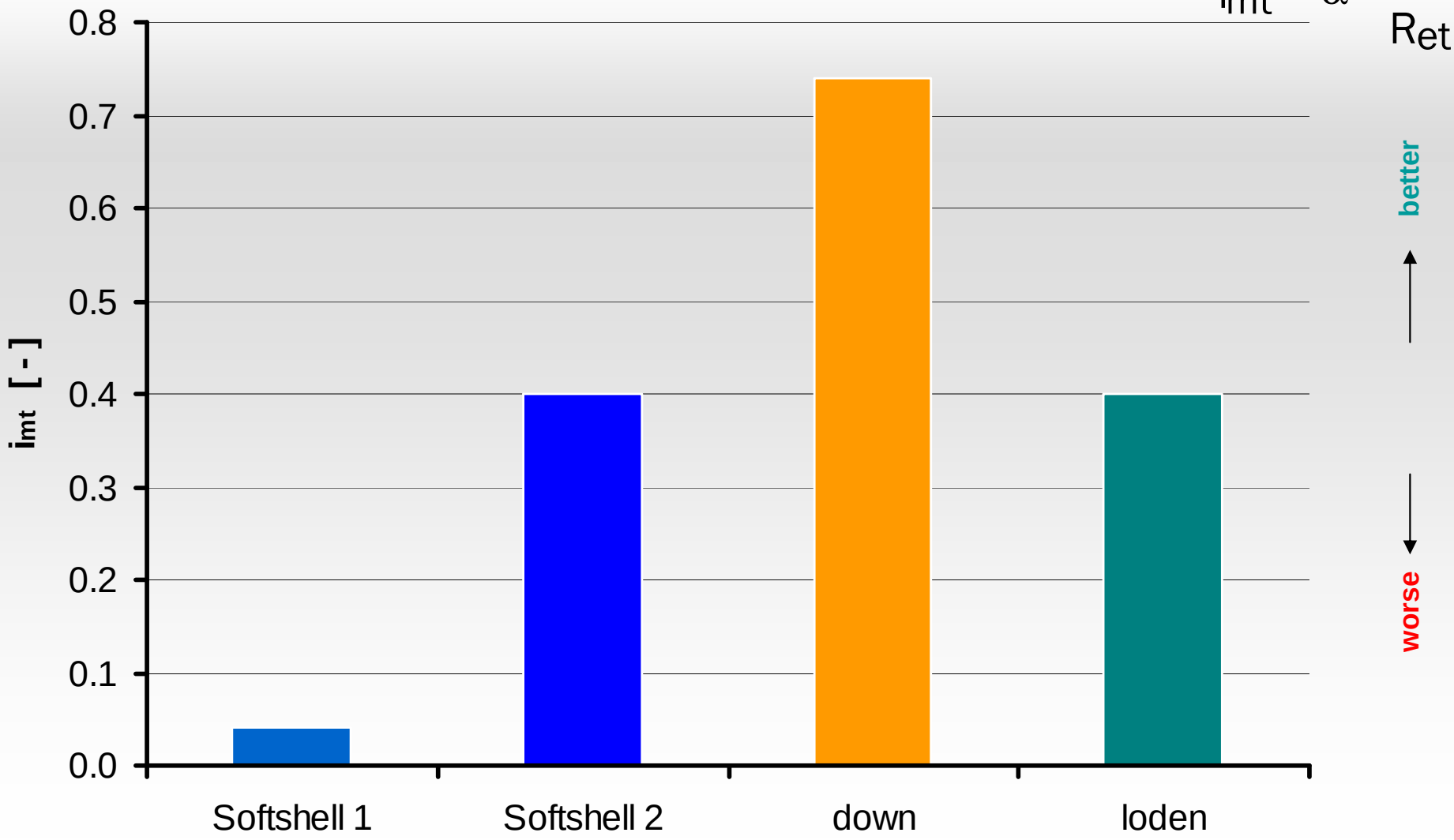
Water vapour resistance – different jackets materials

(fabric)

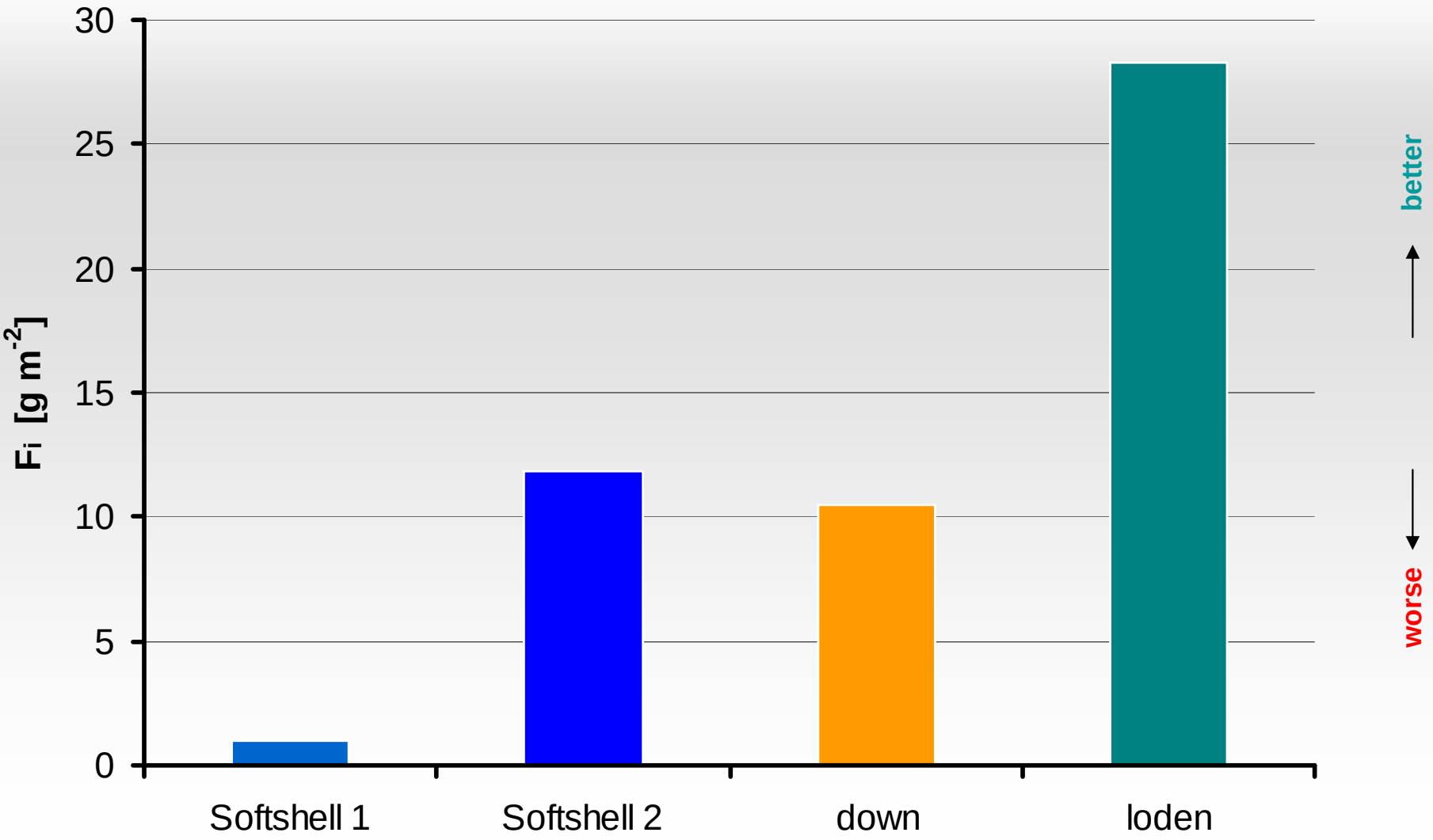


Water vapour permeability index – jackets (fabric)

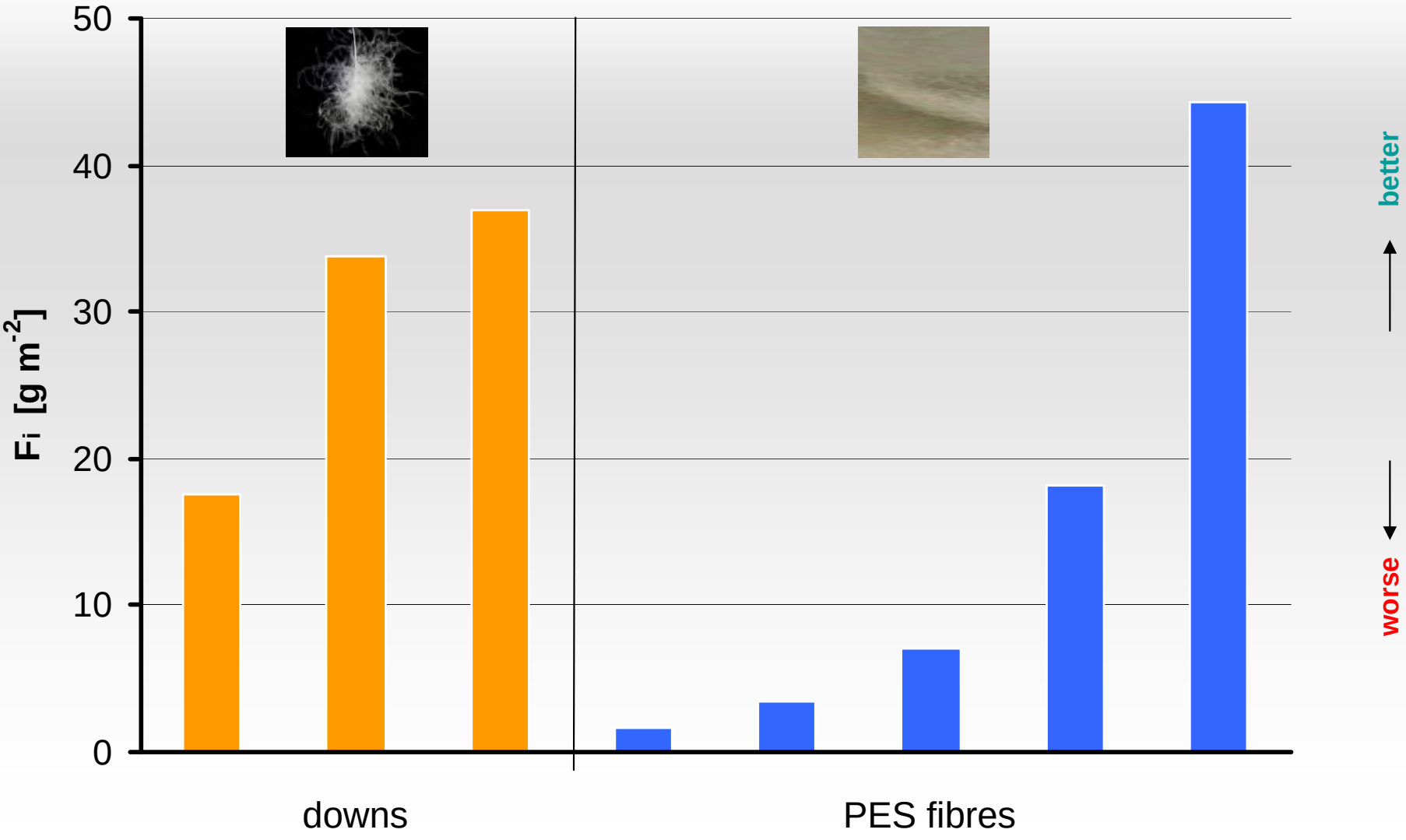
$$i_{mt} = \alpha * \frac{R_{ct}}{R_{et}}$$



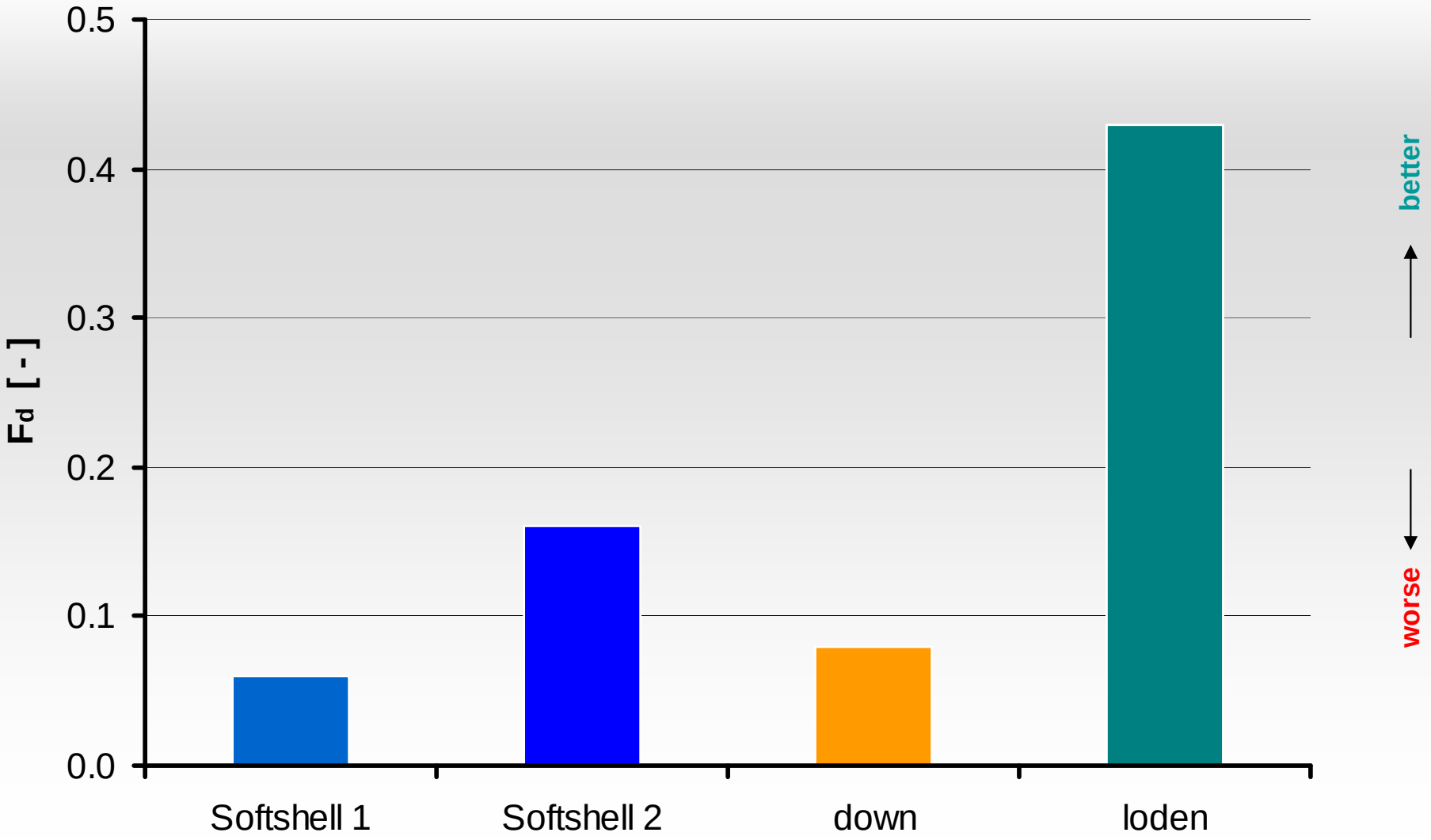
Water vapour absorbency – jackets (fabric)



Short term water vapour absorbency – insulating materials



Buffering capacity for vaporous sweat – jackets (fabric)



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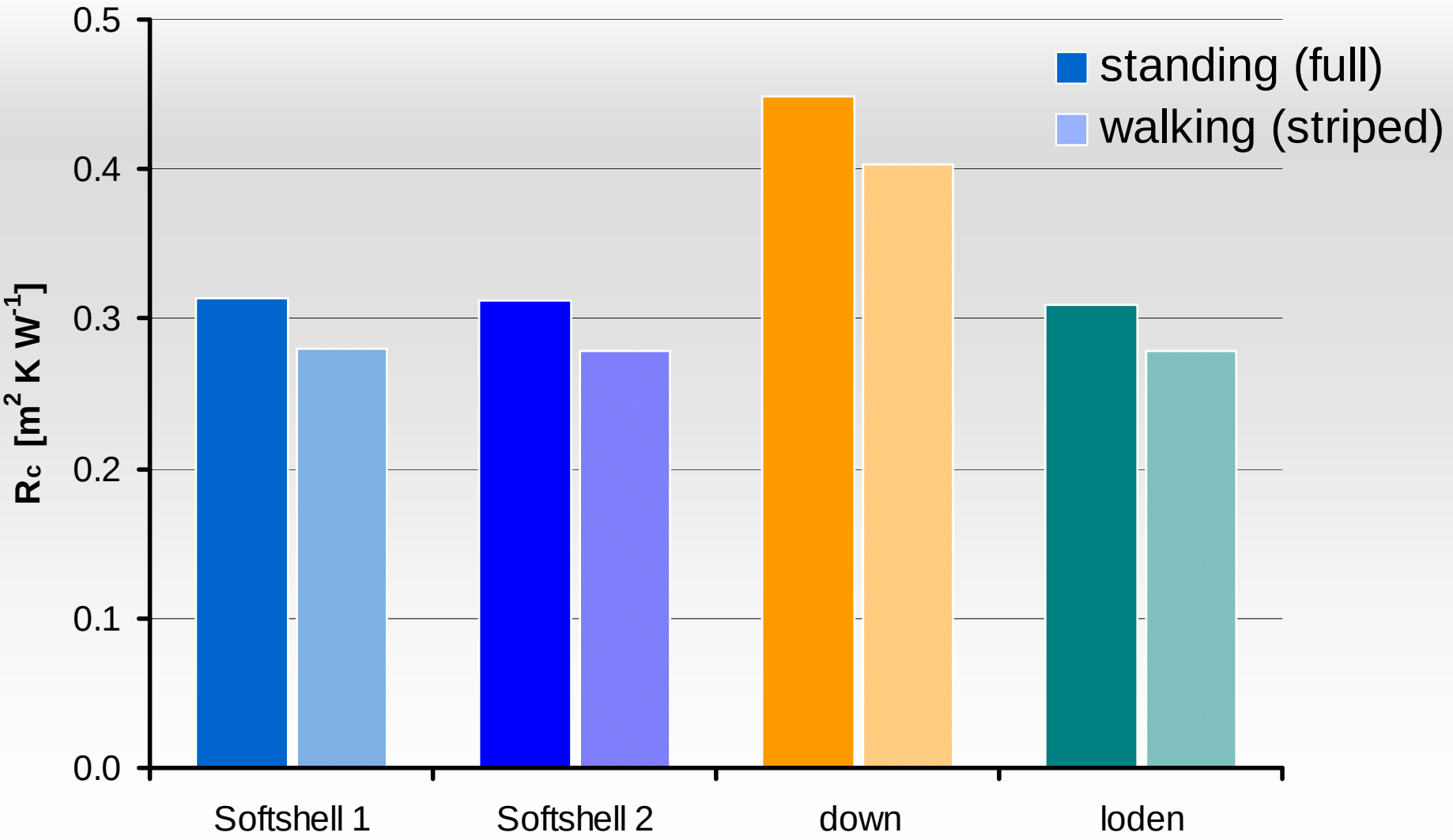
Measurement of wear comfort: Thermal Manikin Charlie

Wear comfort of different jacket constructions

Thermal insulation – jackets



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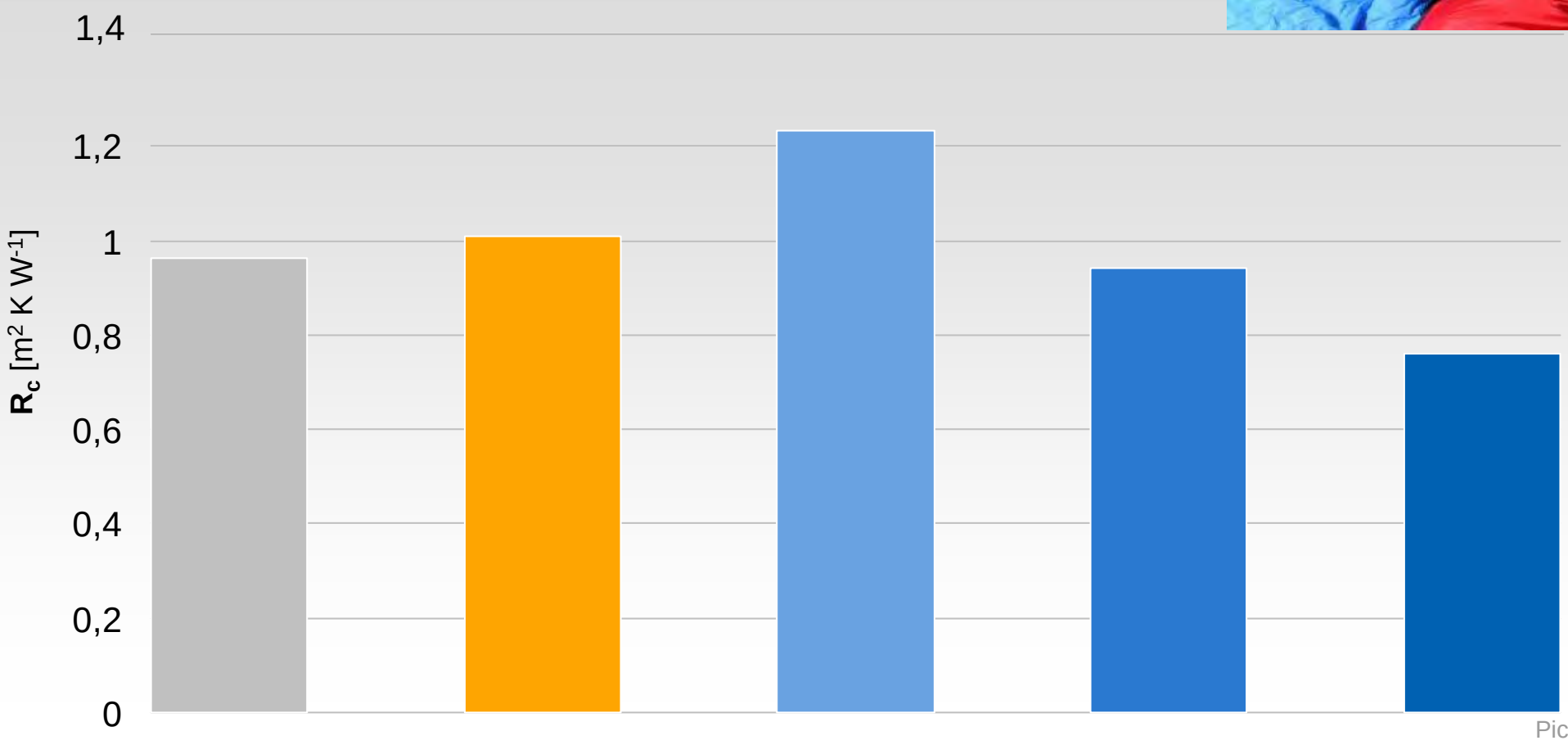
Exemplary results - Thermal insulation sleeping bags



Picture: iStock

Range of utility

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water vapour pressure [mbar]

65 60 55 50 45 40 35 30 25 20 15 10 5 0

relative humidity [% rh]

100% 90% 80% 70% 60% 50% 40% 30% 20% 10%

HEAT STRESS

SOFTSHELL 2

FREEZING

COMFORT

−20 −15 −10 −5 0 5 10 15 20 25 30

SOFTSHELL 1

temperature [°C]

SOFTSHELL 1

SOFTSHELL 2

Range of utility

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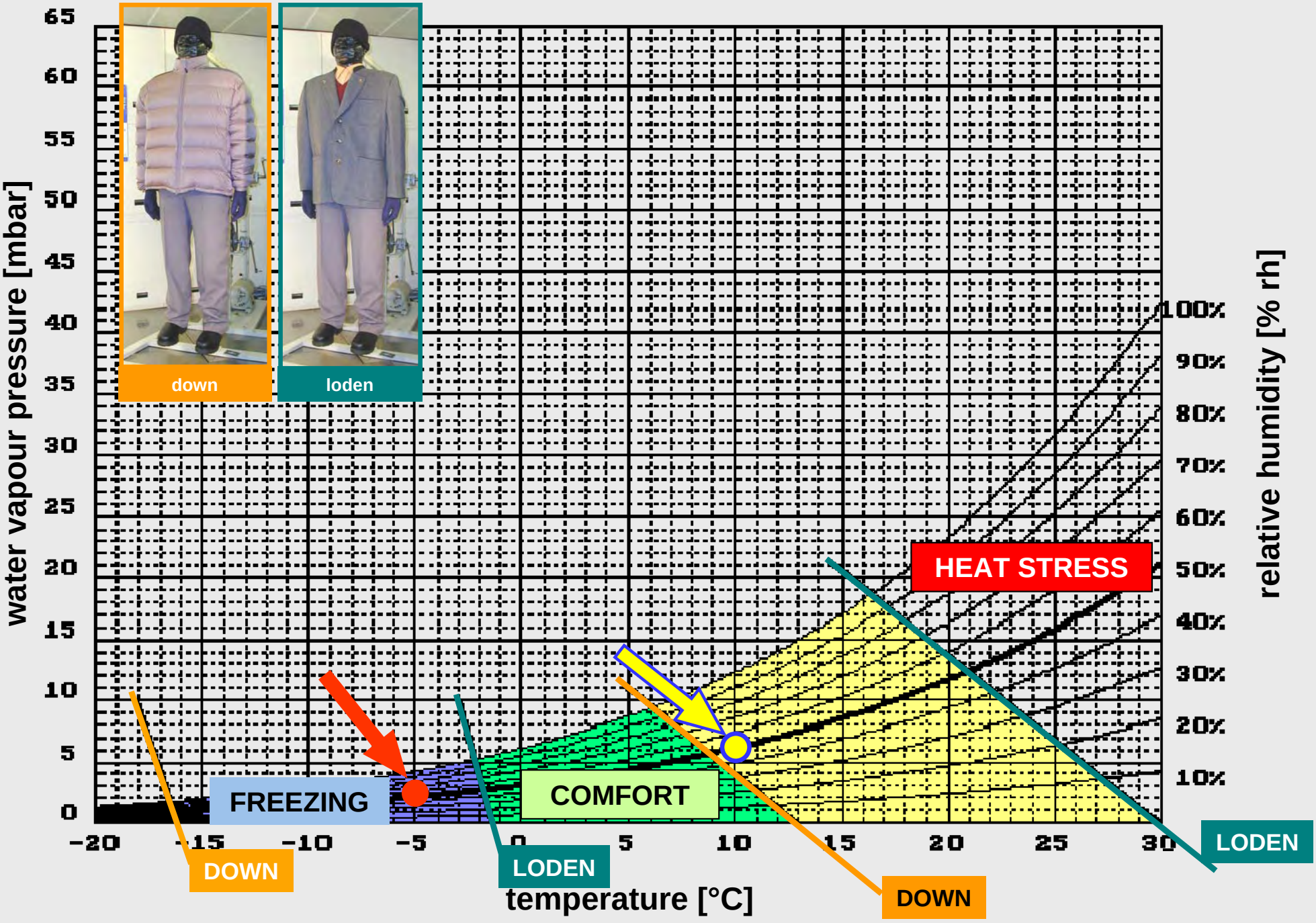

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Measurement of skin sensorial properties

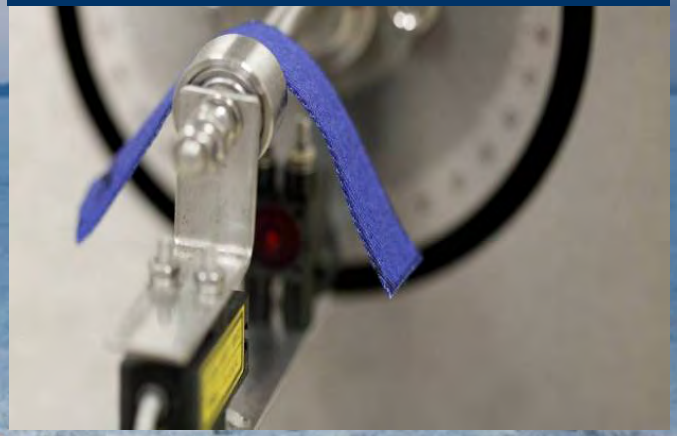
Wet cling index

Sorption index

Surface index

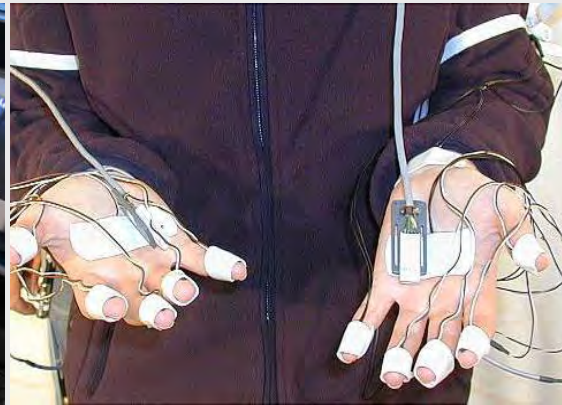
Contact points

Stiffness



Measurement of wear comfort – wearer trials

- Simulation of various weather conditions and activities in a climatic chamber
- Measurement of skin temperature and humidity by sensors
- Subjective judgement of comfort by the subjects



Determination of the Wear Comfort Vote for Textiles

Skin model measurements

Skin sensorial measurements

Prediction model

Wear comfort vote
1 “very good”
6 “insufficient”

Wear trials

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Objective and reliable:
The Hohenstein Wear Comfort Vote

Benefit for manufacturers / retailers / consumers

Support during development of new products

Improvement of physiological properties

Less reclamations

Product safety for the consumer

Publicly sponsored research projects for the textile industry

Customised test procedures for special issues

Thank you for your kind attention!

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