The psychological research concept for :envihab – „Digital Friend“ and „Recreation Room“ – medical-psychological support during long-term space missions beyond the earth orbit

BERND JOHANNES, UWE MITTAG
Institute of Aerospace Medicine (DLR), Cologne/Hamburg, Germany

DLR Deutsches Zentrum für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Agenda

Selected specificities in psychological understanding of the “target” personnel

Selected specificities in required psychological methods for diagnostics and support

Main part: Examples of single mosaic pieces of the psychological compartment for a “Digital Friend”

Concept for a Recreation Room

Long Duration Space Exploration Missions – Psychological Issues – our clients

Real life mission no „experiments“

Participants fulfill „life goals“ beside „mission goals“

Rigorous selection of the crew favors those who are tough, enduring, performance-oriented, and unaccustomed to “needing” the help of psychologists...

…even if open minded „right staff“
will mostly replace the „right stuff“.

However, possibly they will reach their edges and will need help.

Long Duration Space Exploration Missions – Psychological Issues – kind of methods

The longer a mission (including “studies”) lasts, help on demand:

Self-monitoring + recommendations

Methods, naturally and accepted as daily weight watching

Diagnostic analysis embedded in real mission actions and daily routines…

…no artificial situations or obviously academic or clinical testing

objective, non-obtrusive, computerized, network-linked

Expert System, acting as a Friend – a “Digital Friend”

Astrid - Astronauten Assistenz System aus Deutschland

Initiated early 2008 together with Thomas Reiter
Bremen, April 2008

Uwe Brauer, Jürgen Frank, Rüdiger Kledzig Februar 2008

Einrichtung Simulations- und Softwaretechnik
Institut für Luft- und Raumfahrtmedizin
Institut für Flugführung

All the space you need

MECA
Mission Execution
Crew Assistant
http://www.CrewAssistant.com

AMHA
Automatic Mental
Health Assistant
http://www.amha.id.tue.nl/

Mars520

Mid-term meeting

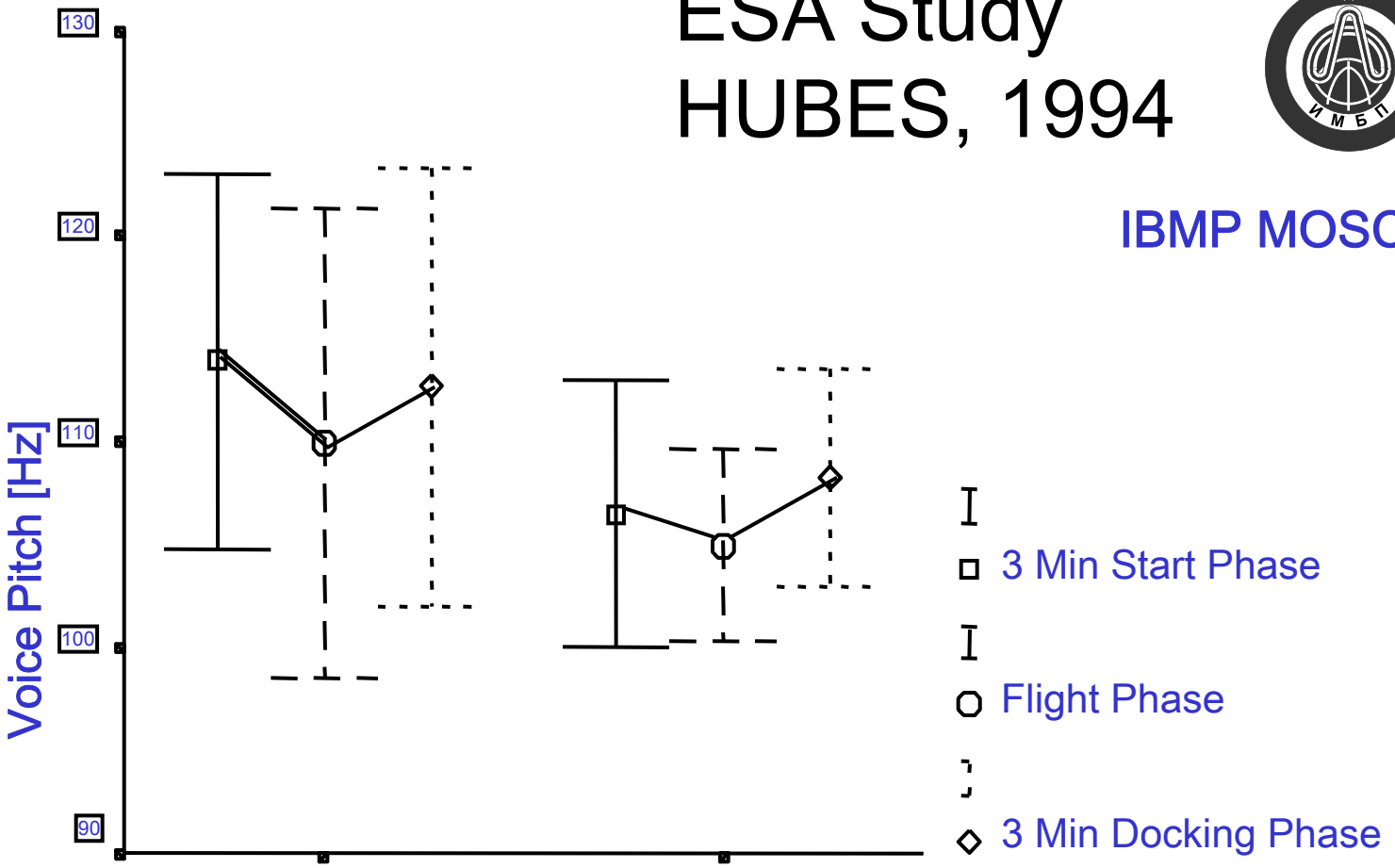
Mark Neerincx (TNO) 05-04-2011

Effect of 72 Hours Sleep Deprivation on Voice Pitch

(MIR-Docking Training, Subject 02)

ESA Study
HUBES, 1994

IBMP MOSCOW



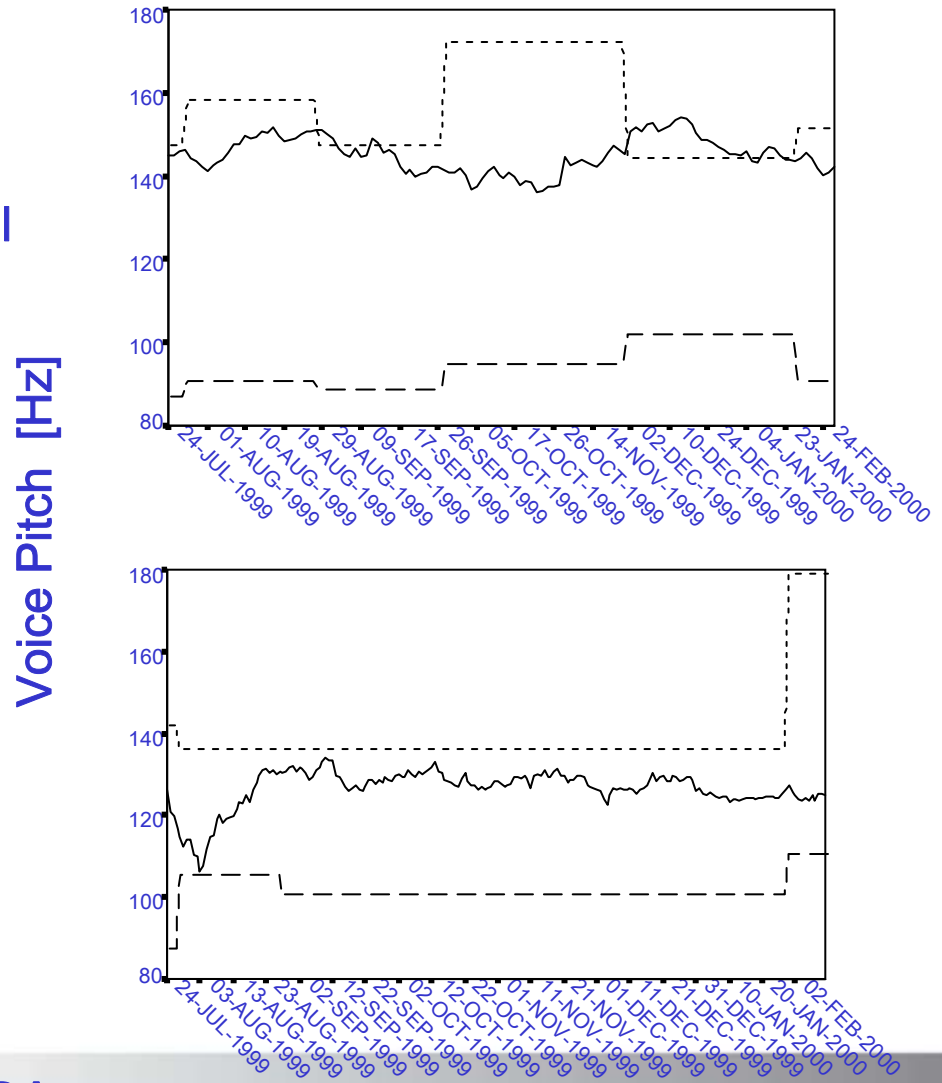
240 days Isolation

Continous voice pitch monitoring of in-out oral communication

Subjects

214

213



Phone-F0m

Test-upper F0m

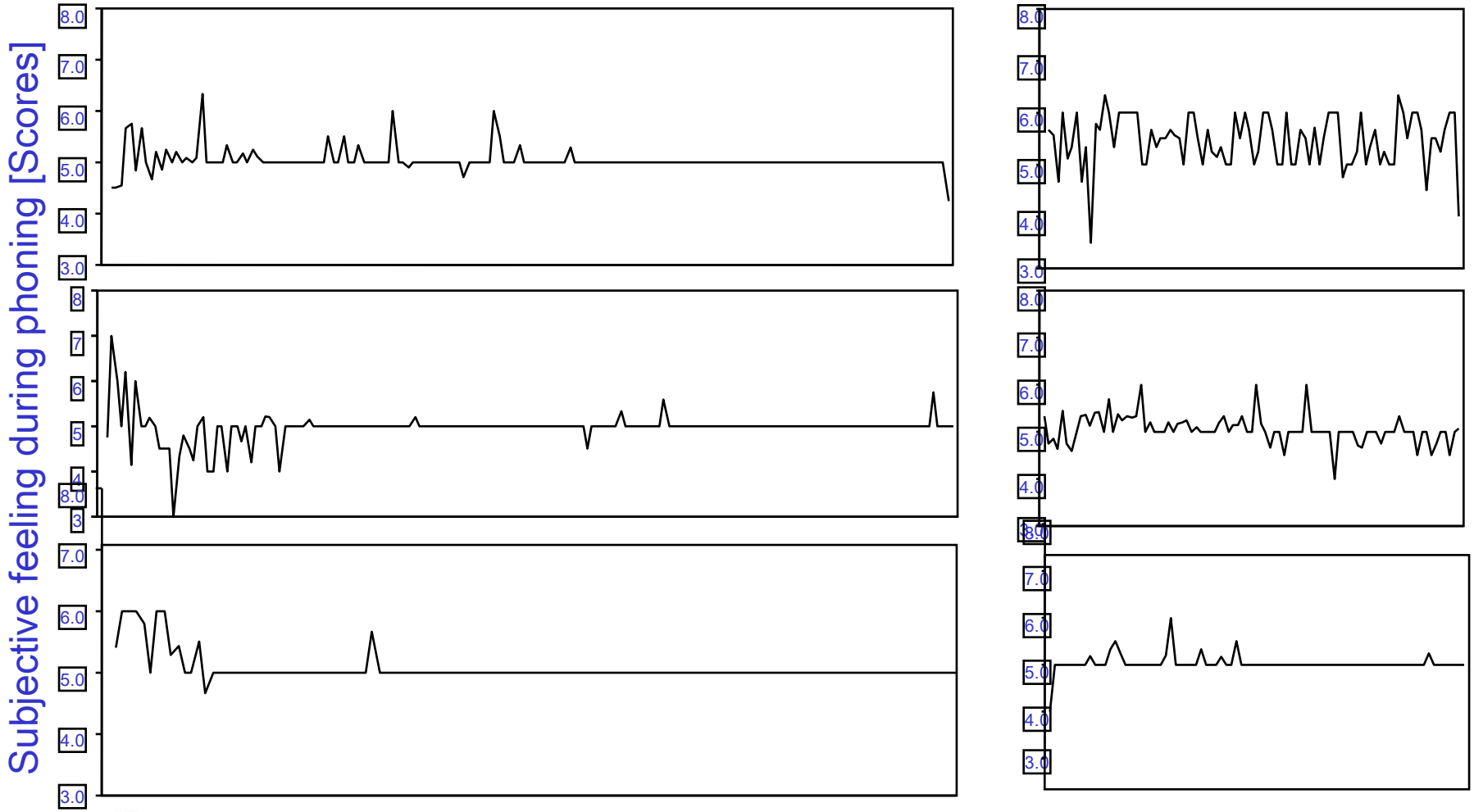
Test-lower F0m

ИМБП МОСКВА

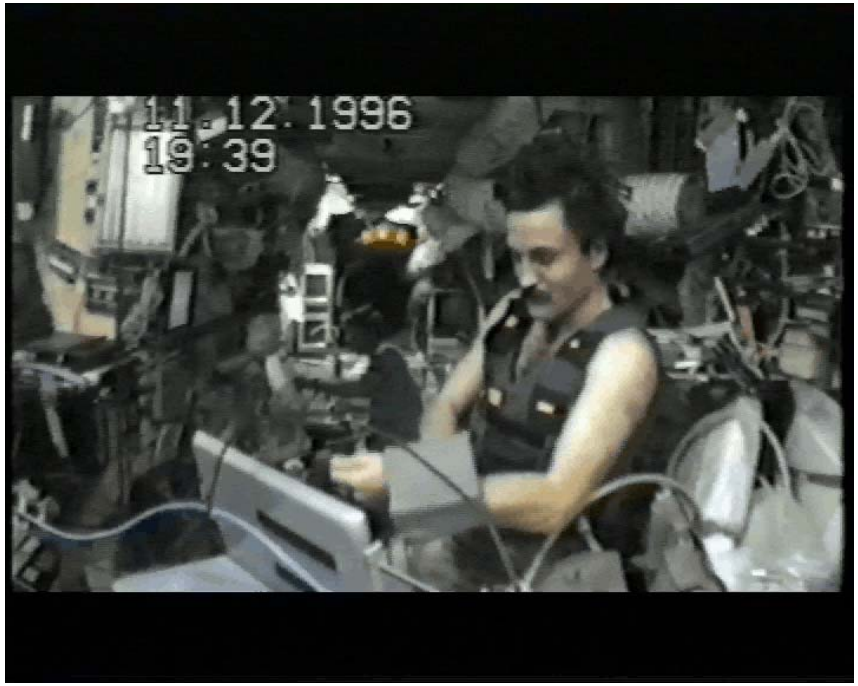
Decrease of variability in subjective responses

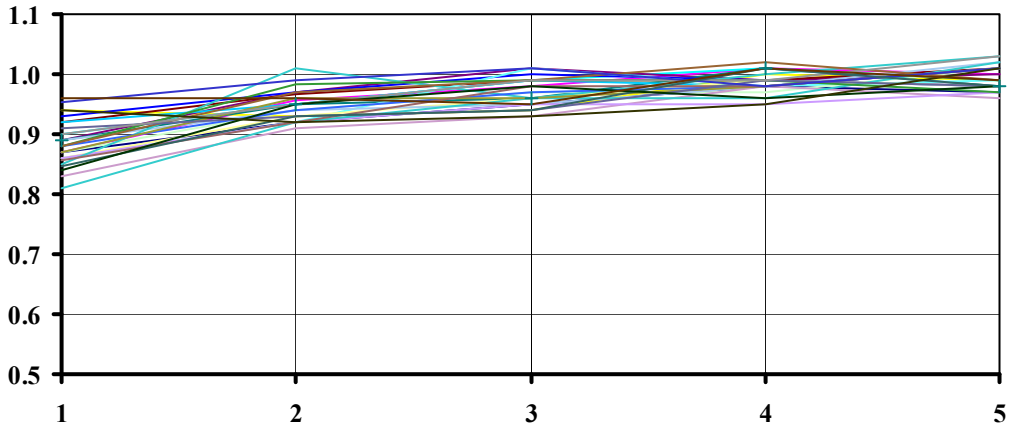
240 d

110 d

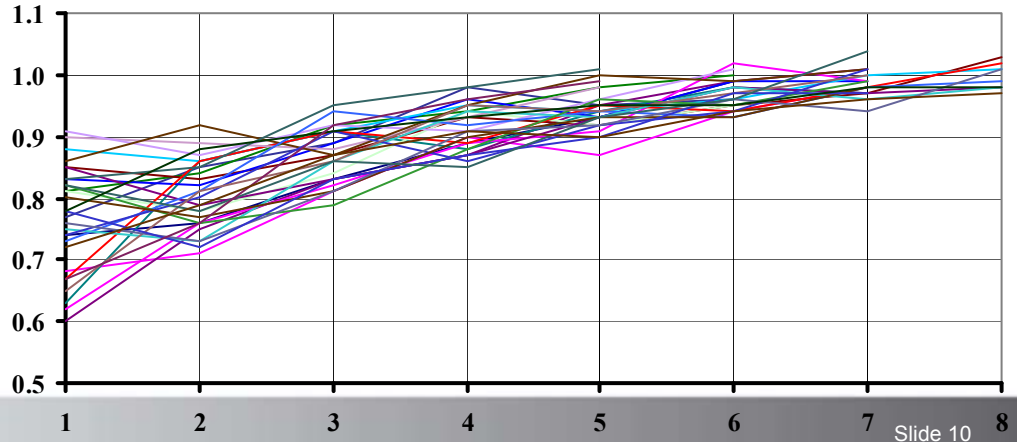


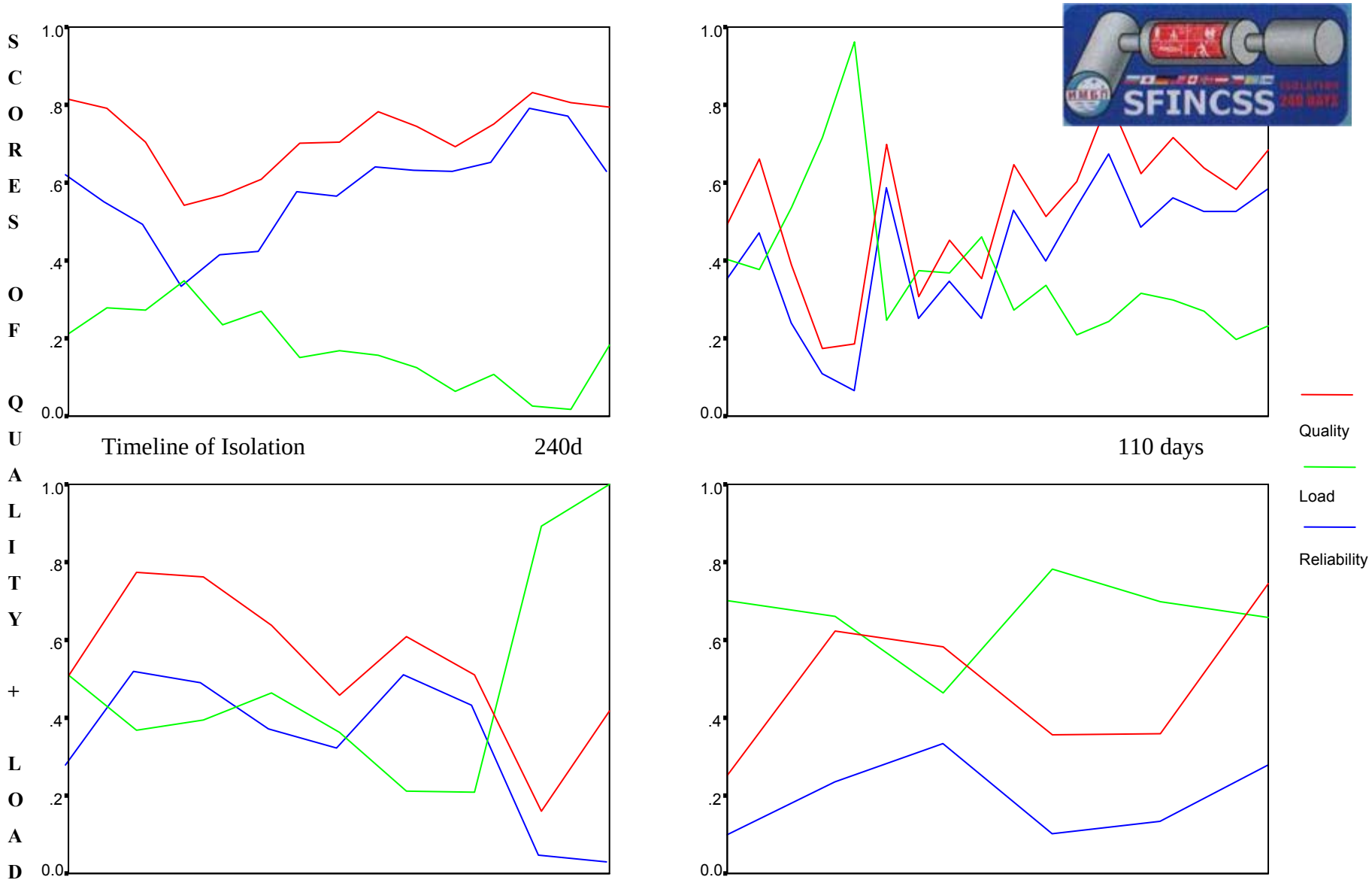
Dynamics of skill‘s re-establishment (Salnitski 2002) after 25-30 day break



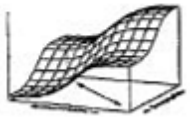


and after 75-90 day break





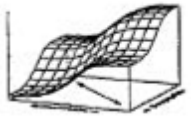
Individual long-term Changes in Performance and „Physiological Costs“



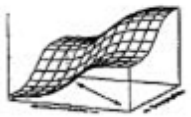
Voice

Pupillometry EOG

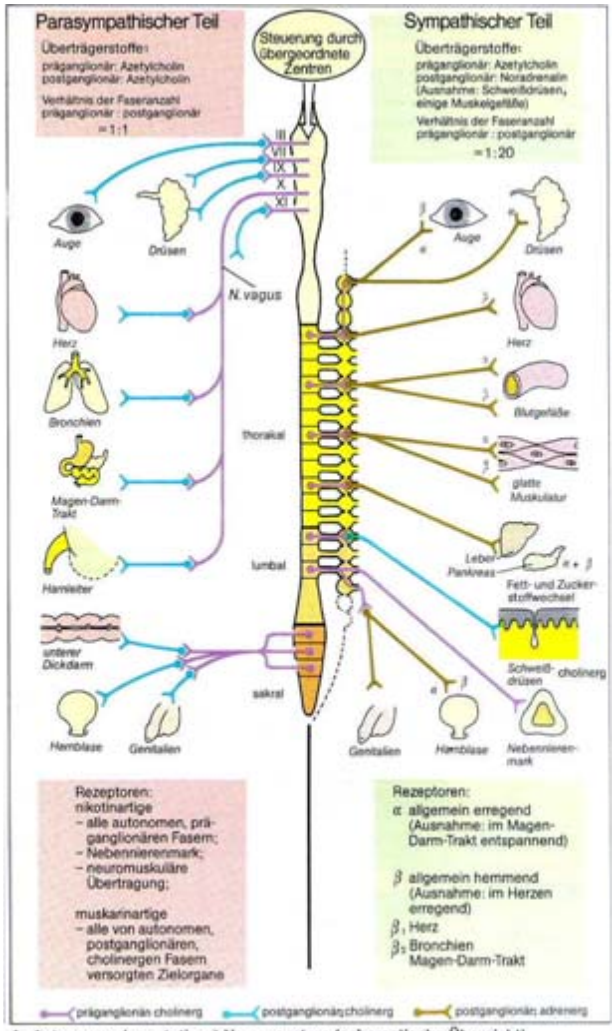
EKG / BP



Resp

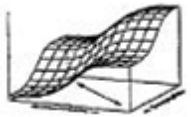


EGG

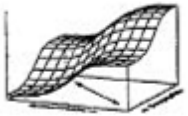


A. Autonomes (vegetatives) Nervensystem (schematische Übersicht)

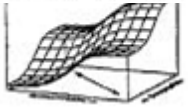
EEG, EP



Pupillometry

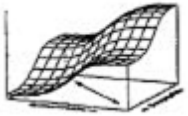


EKG / BP

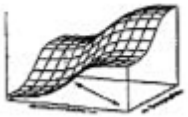


Temp.

EMG



SCL

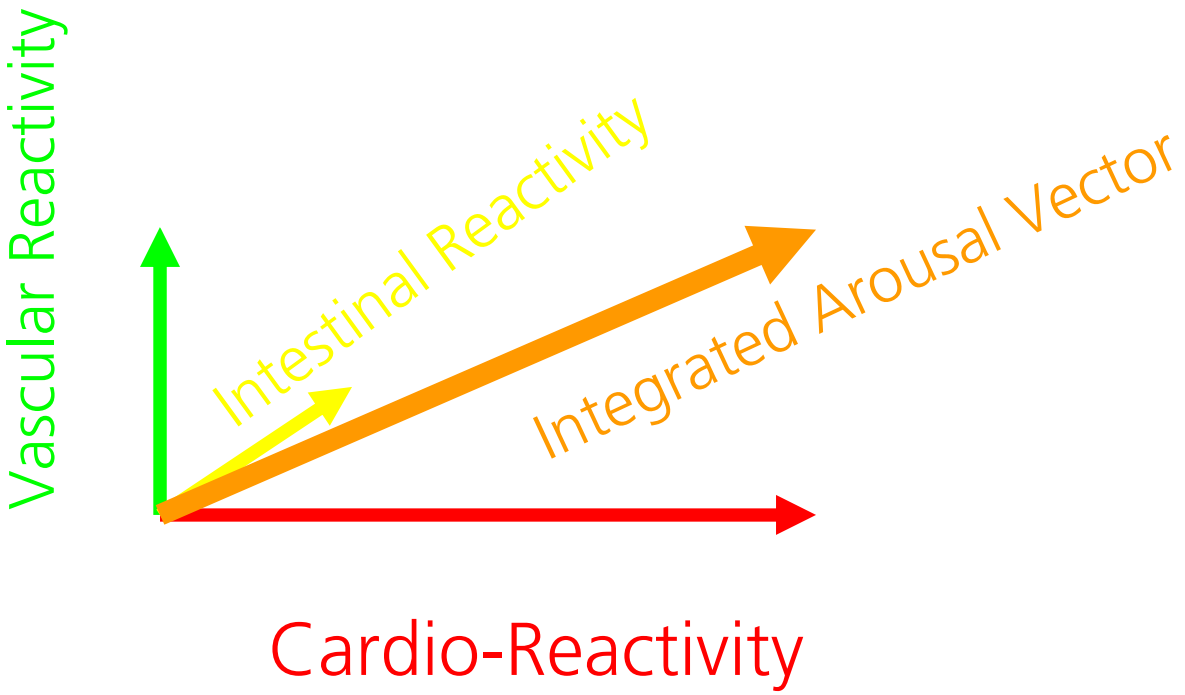


One has a monitor the effects of an autonomic reaction on (possibly) all effector organs

The Autonomic Nervous System reacts as a system

$$f_{ij} = p + c_{si} \cdot s_i + c_{qj} \cdot p_j + c_{sipj} \cdot s_i p_j + e$$

These are artificial, constructed data for illustration!



If one has three basic coordinates (orthogonal) of the „arousal space“

... one can for integration calculate the length of the vector sum (scalar): $PAV = \sqrt{CR^2 + VR^2 + IR^2}$

Performance Readiness Evaluation Tool (PRET)

Mars Exploration Simulator for Neurocognitive Assessment

Presented by Leena Tomi, Christian Lange, Mehdi Najjar

- Planetary exploration rover
- Remotely-controlled
  - Mars base
  - Sliding autonomy (teleops ↔ fully autonomous)

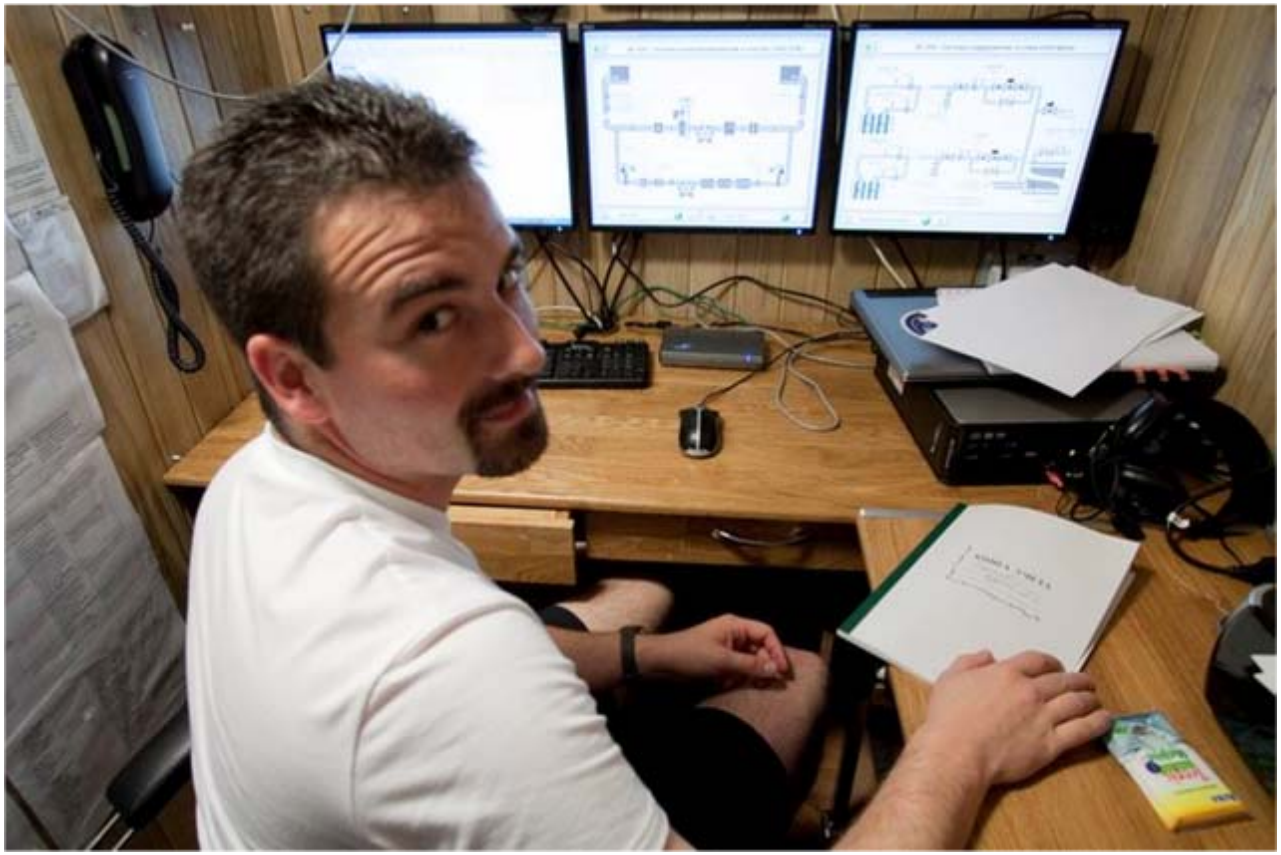
Astronauts, Life Science and Space Medicine

Space Exploration

Canadian Space Agency

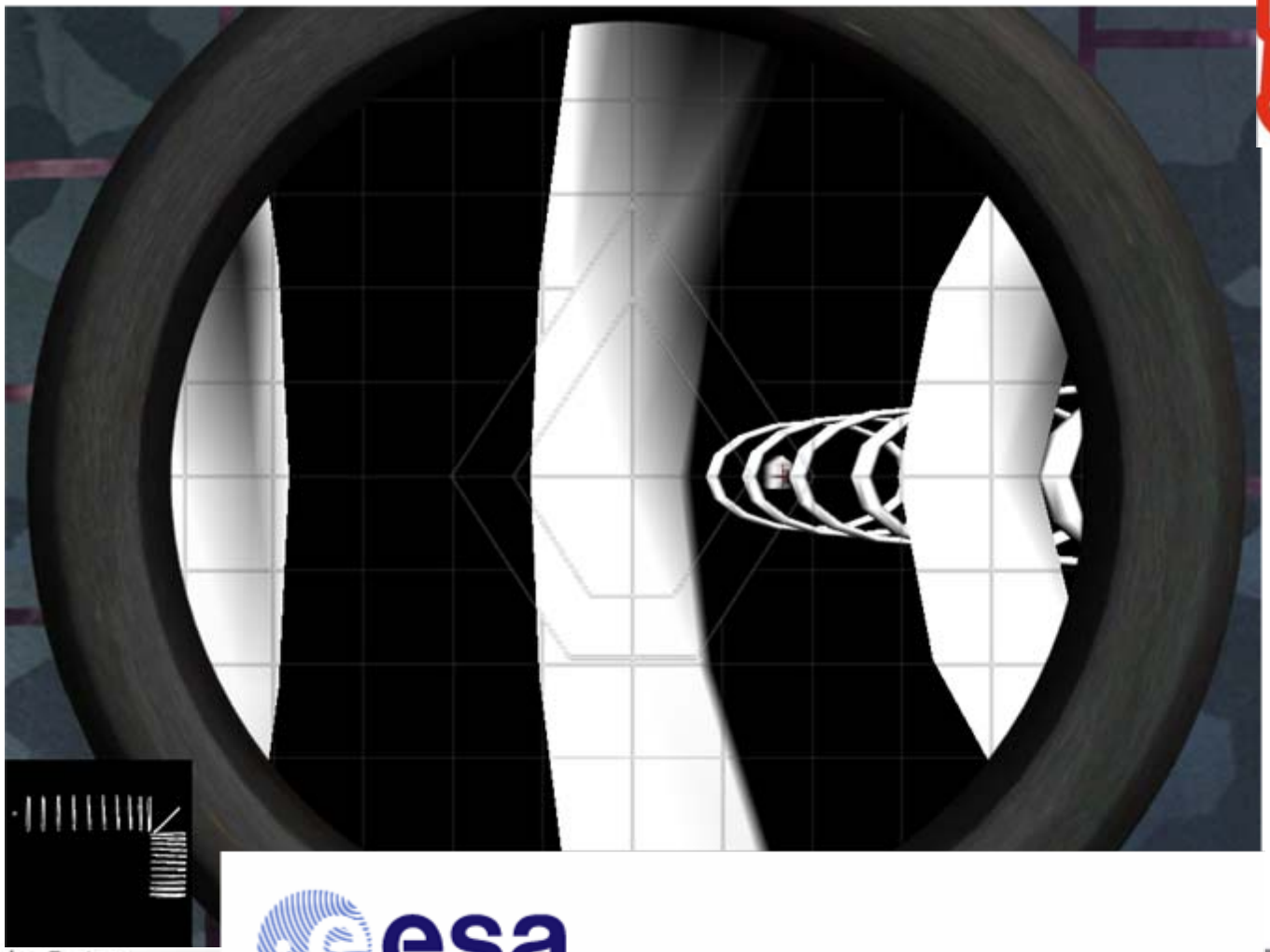
Embedded Testing and Neurocognitive Assessment

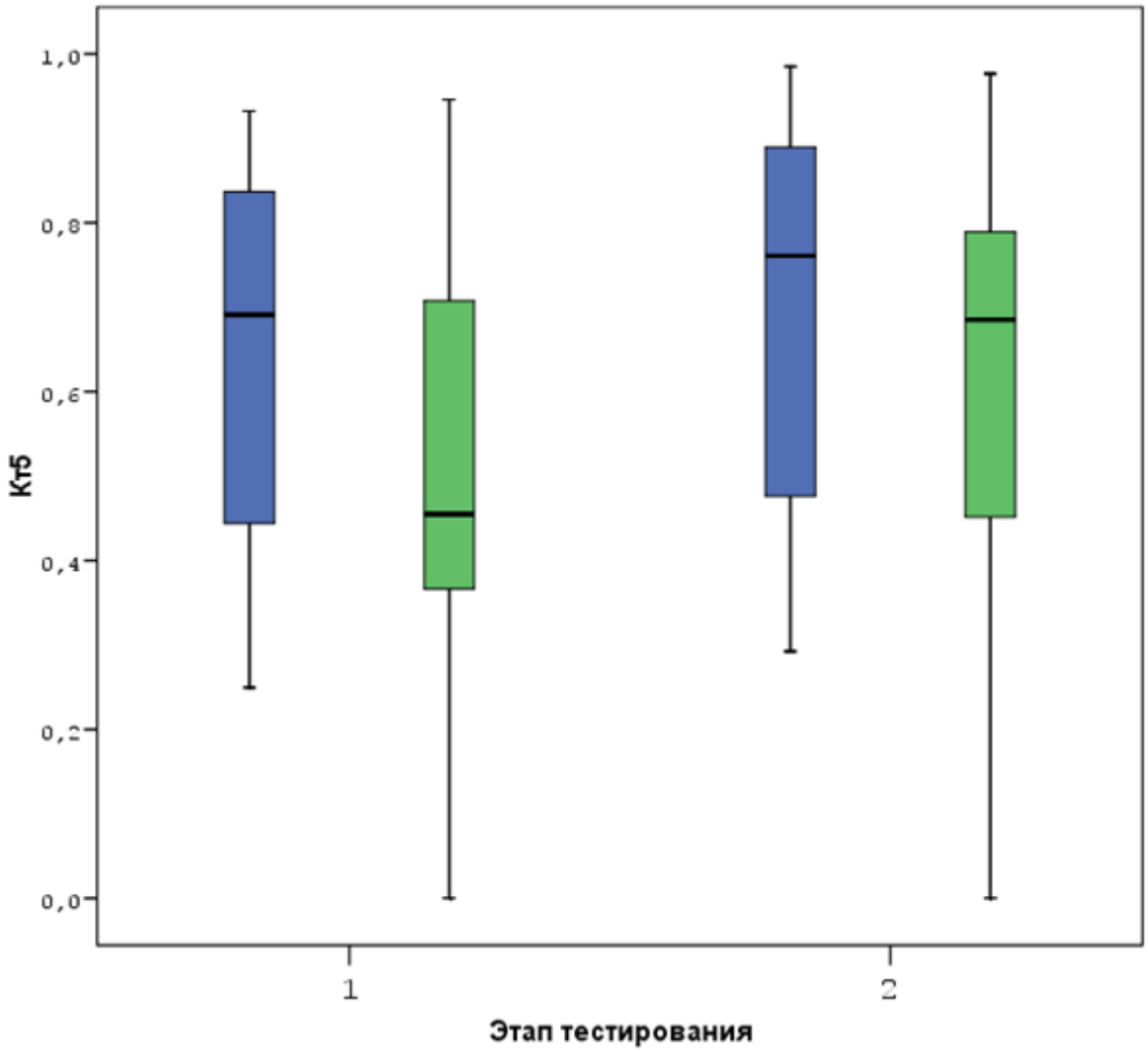
- Working memory
- Concentration
- Visual scanning & perception
- Divided attention
- Planning & decision making
- Situational awareness
- Sustained attention (fatigue)



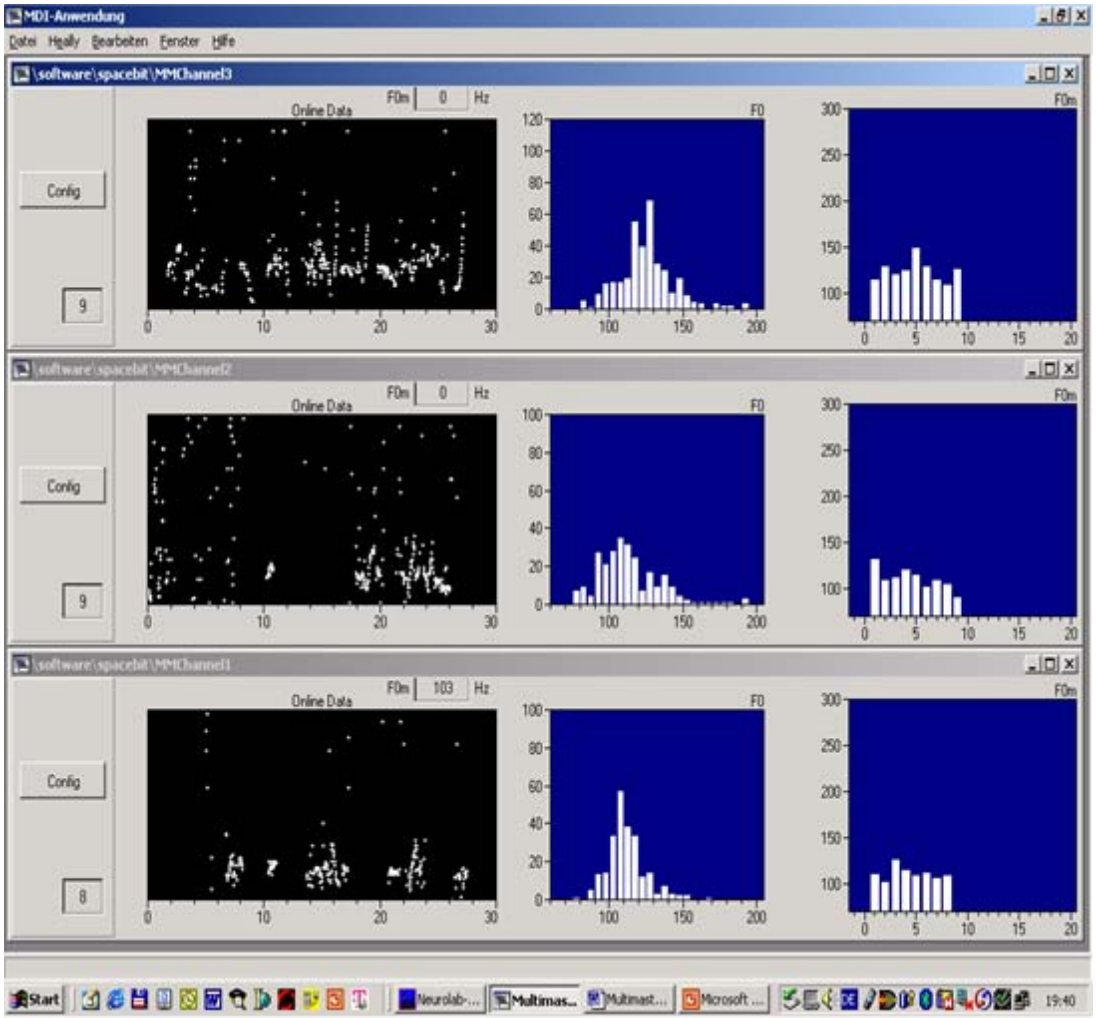
MARS 500

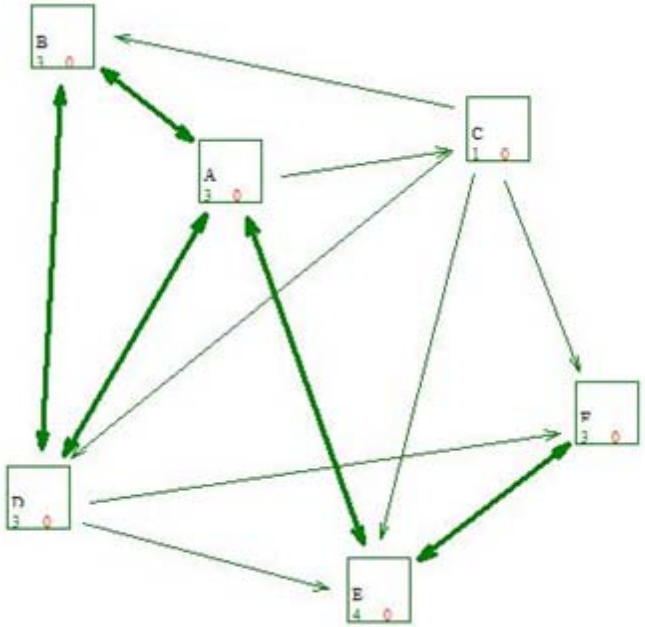
„6df“ – Diagnostics / Monitoring during coaching and training for individuals and dyades



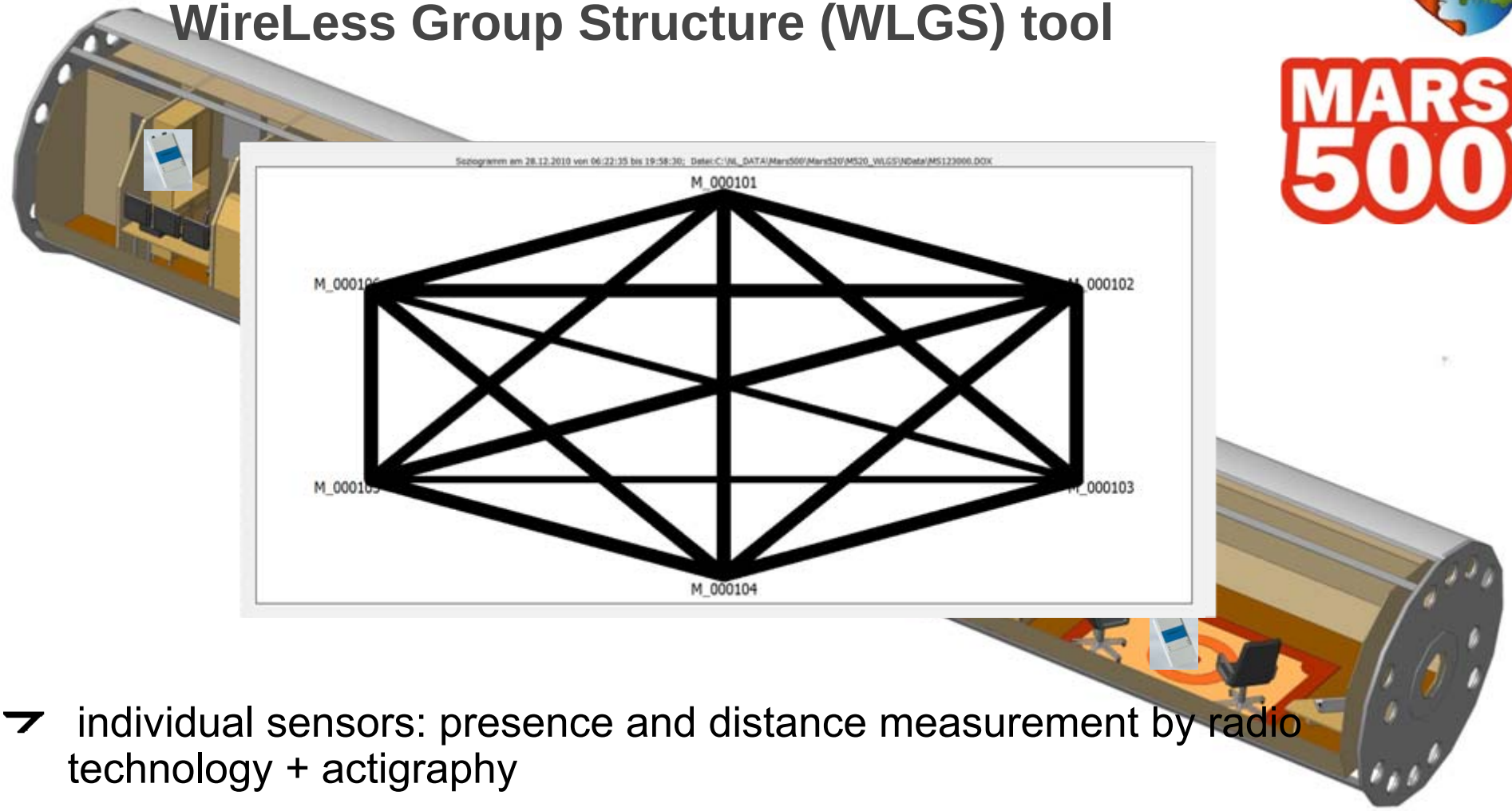

Группа испытуемых
"Пилот-1"
"Пилот-2" (6DF)
Ктб
1,0
0,8
0,6
0,4
0,2
0,0
1
2
Этап тестирования

Team cohesion analysis with voice cross correlation

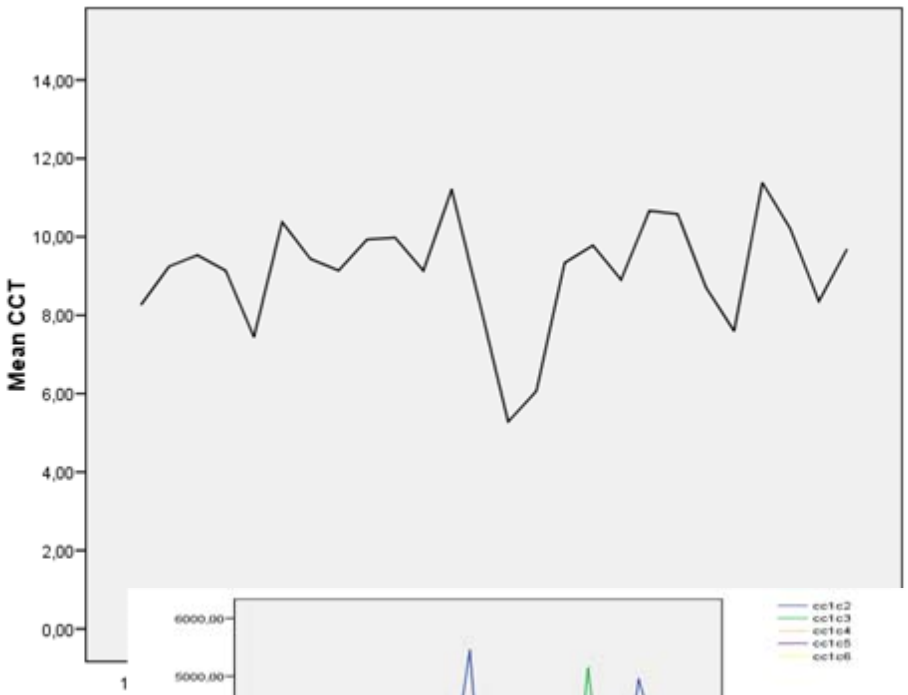


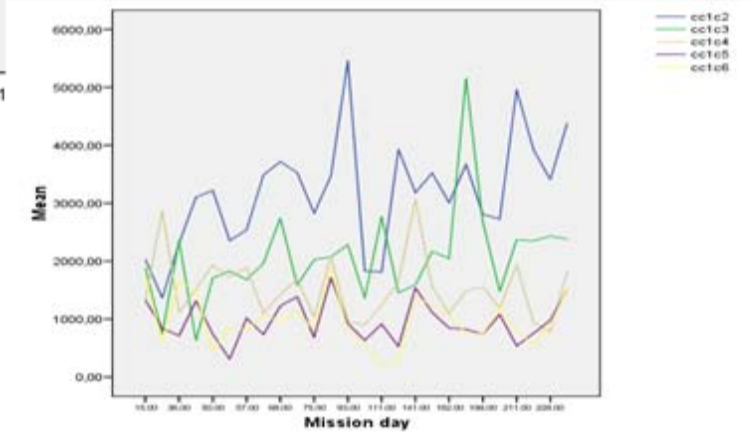


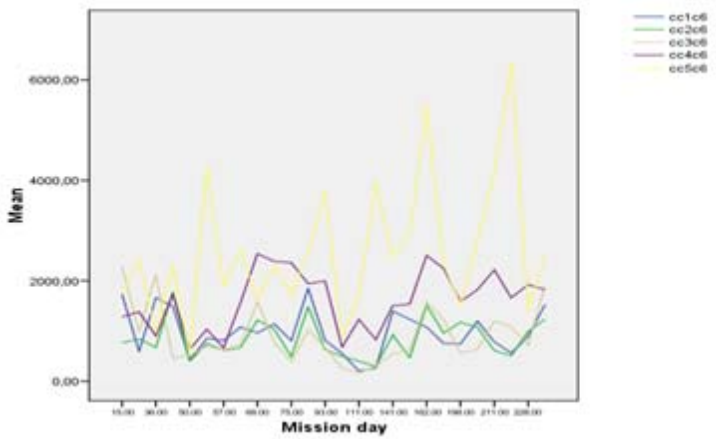
WireLess Group Structure (WLGS) tool



- individual sensors: presence and distance measurement by radio technology + actigraphy
- automated daily synchronization, data downloading and charging on a central docking station


Mean CCT
14,00
12,00
10,00
8,00
6,00
4,00
2,00
0,00


Mean
6000,00
5000,00
4000,00
3000,00
2000,00
1000,00
0,00
Mission day
cc1c2
cc1c3
cc1c4
cc1c5
cc1c6


Mean
6000,00
4000,00
2000,00
0,00
Mission day
cc1c6
cc2c6
cc3c6
cc4c6
cc5c6

„VIRTUAL SPACE STATION“
Harvard Medical School
James Carter et al., Boston, USA
DARTMOUTH MEDICAL SCHOOL
1797
NATIONAL SPACE BIOMEDICAL RESEARCH INSTITUTE
NSBRI
THE TROUPE
MODERN MEDIA DESIGN & PRODUCTION
MADE WITH macromedia®
This work was supported by the NSBRI through NASA NCC 9-58.

Long Duration Space Exploration Missions – Psychological Issues – kind of support

Main psychological “problems:

Danger for life as long-term intensifying factor

Isolation – no alternative social contacts -> lonely but not alone

Confinement, restricted resources and space, stimulus deprivation

Main psychological prevention support:

support social contacts, group developement

support environmental stimulation and change

Stimulus substitution and social contact in “Recreation Room”

Long Duration Space Habitats – Psychological Issues – Recreation Room

Virtual Cave chamber for different environmental simulations.

Active motion, cycling, jogging (swimming?) ball games,
in pairs, groups…
… never push them into isolation within isolation by providing the only chance for escapes individually .

Environmental stimulation: varying
temperature, humidity, wind, smells…

Main psychological prevention support:

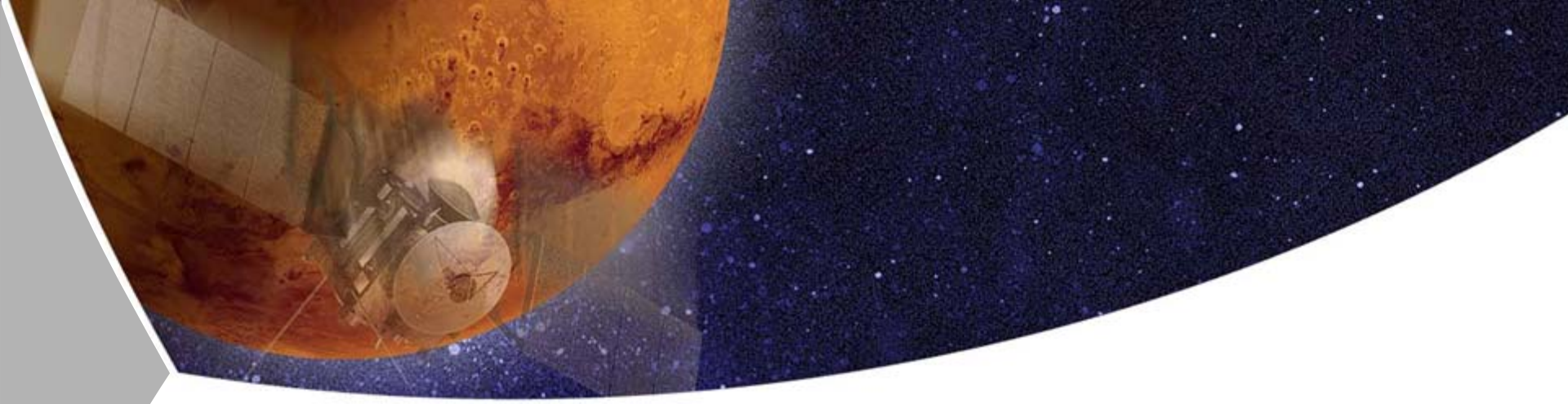
support social contacts, group developement

support environmental stimulation and changes

Stimulus substitution and social contacts in “Recreation Room”

Long Duration Space Habitats
– Psychological Issues – Recreation Room

Stimulus substitution and social contacts in “Recreation Room”



Thank You for Your attention!