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
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
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

Voice Pitch [Hz]

- 130
- 120
- 110
- 100
- 90

3 Min Start Phase

Flight Phase

3 Min Docking Phase

Normal State

Sleep Deprivation

3 Min Start Phase

Flight Phase

3 Min Docking Phase
240 days Isolation
Continuous voice pitch monitoring of in-out oral communication

Subjects

214
213

Voice Pitch [Hz]

Phone-F0m
Test-upper F0m
Test-lower F0m
Decrease of variability in subjective responses

240 d

Subjective feeling during phoning [Scores]

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“
The autonomic nervous system reacts as a system. One has to monitor the effects of an autonomic reaction on (possibly) all effector organs.

- EOG
- EKG / BP
- Resp
- EGG
- EEG, EP
- Pupillometry
- EKG / BP
- Temp.
- EMG
- SCL

The equations can be represented as:

\[ f_{ij} = \beta + \text{cs}i\text{p}j + e \]
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)
„6df“ – Diagnostics / Monitoring during coaching and training for individuals and dyades
Применение двух различных тренажеров и сравнительный анализ формирования навыков ручного управления объектом с 6-ю степенями свободы.

Сальницкий В., Дудукин А., Артюхова А., Йоханнес Б.
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
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 development
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 development

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!