Envisioning the Future Role of an Exploration Clinical Decision Support System

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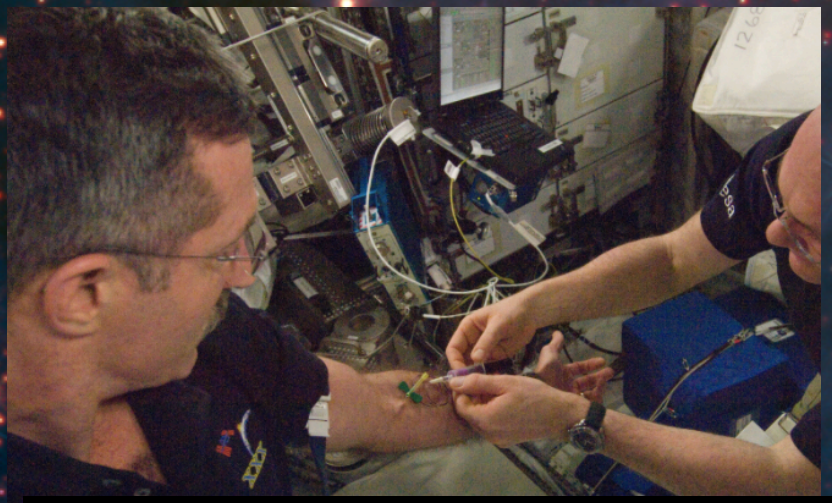
Virtual Room AHFE 7

Spaceflight Stressors

- Microgravity
- Elevated CO_2
- Chronic Stress
- Head Injury
- Atmospheric Toxins
- Isolation
- Confinement
- Decompression
- High Workload
- Radiation

Risks

- Fluid Shifts
- Cognitive
- Sleep Loss
- Circadian Disruption
- Vision Changes
- Fatigue
- Muscle Atrophy
- etc.



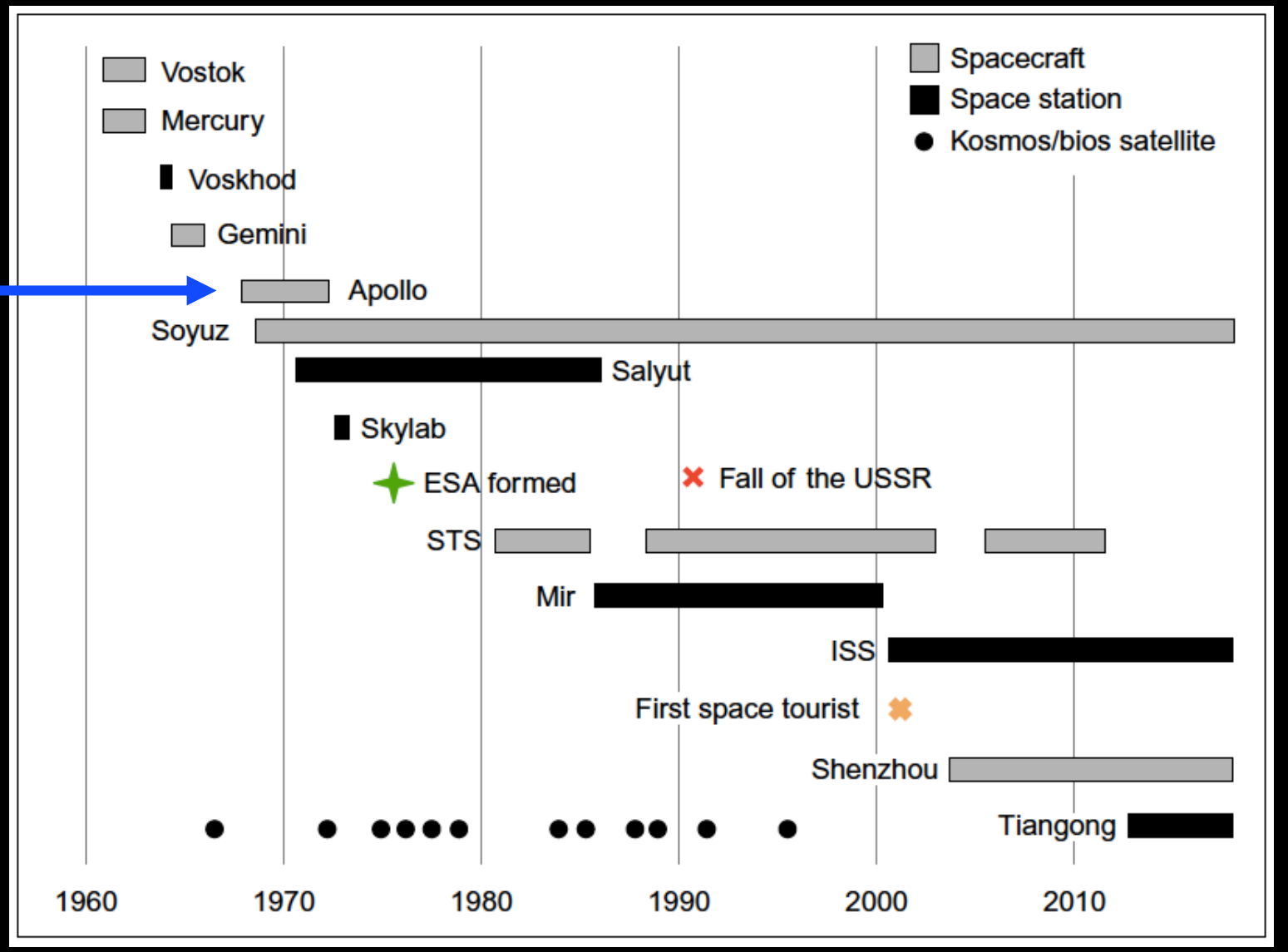
Integrated Immune Blood Sample Draw

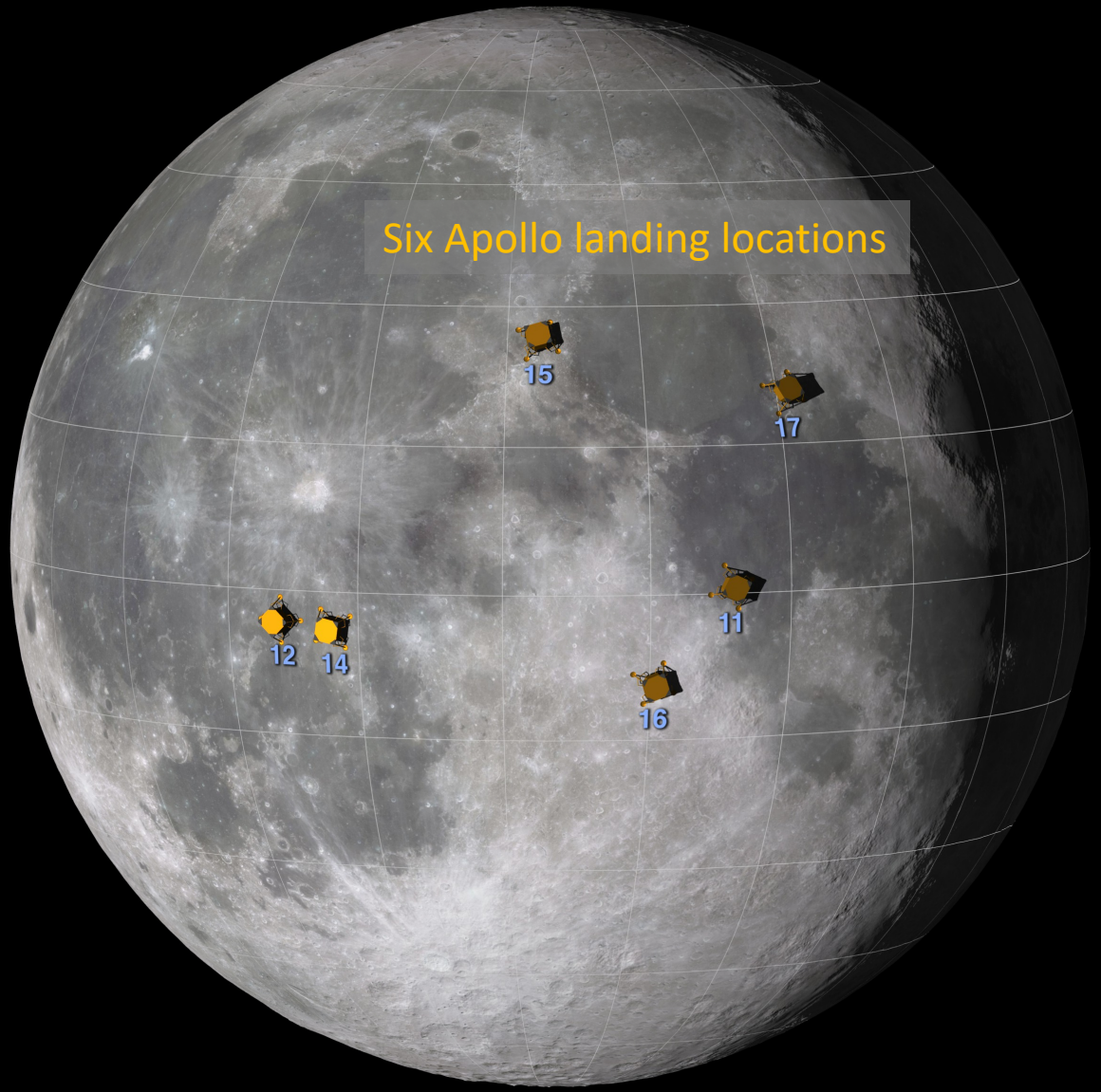
Cognitive Testing

Spaceflight associated Neuro-Ocular Syndrome (SANS)

Manned Spaceflight Missions

Outside of Low Earth Orbit





12 men have walked on the Moon

Depth Cue - Shape from Shading


International Space Station
250 miles from Earth
Go here to find out when the station is over your home
spotthestation.nasa.gov

Current modes of crew decision support (examples)

- Routine, recurrent and just-in-time training
- Procedures/checklists
- Schedules
- Manuals

Current measures taken (examples)

- ✓ Performance Measures (e.g., cognitive testing)
- ✓ Questionnaires
- ✓ Sensors (e.g., activity measures, local CO2 monitoring)
- ✓ Computer-controlled events
- ✓ Electroencephalography (EEG)

ActiWatch

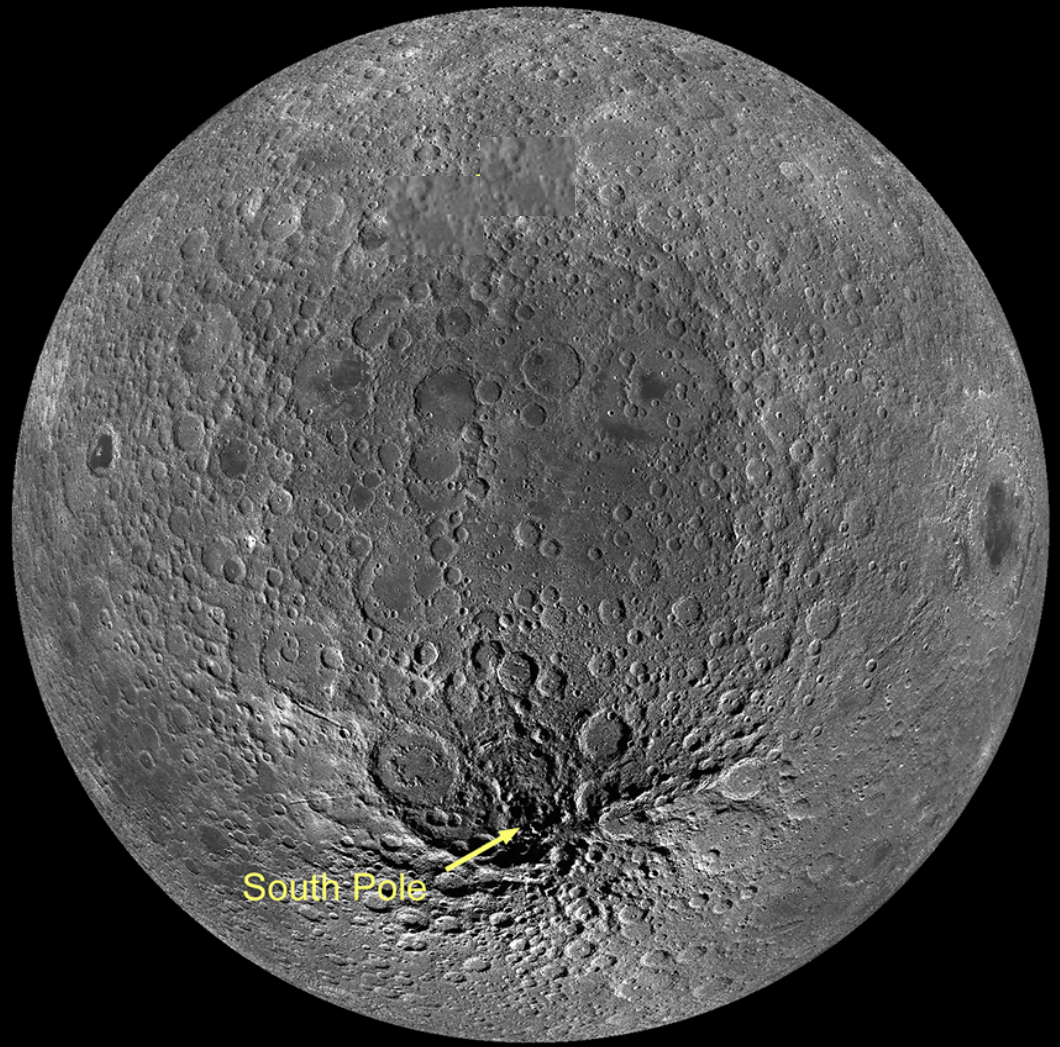
CO2 Monitor

EEG

EEG

ISS Mission Control Solves Critical Problems for the Crew

Send astronauts to the Moon's Lunar South Pole
240,000 miles from Earth



Space Motion Sickness

Back Pain

Headache (CO_2, SAS, other)

Toothache

Bone Fracture

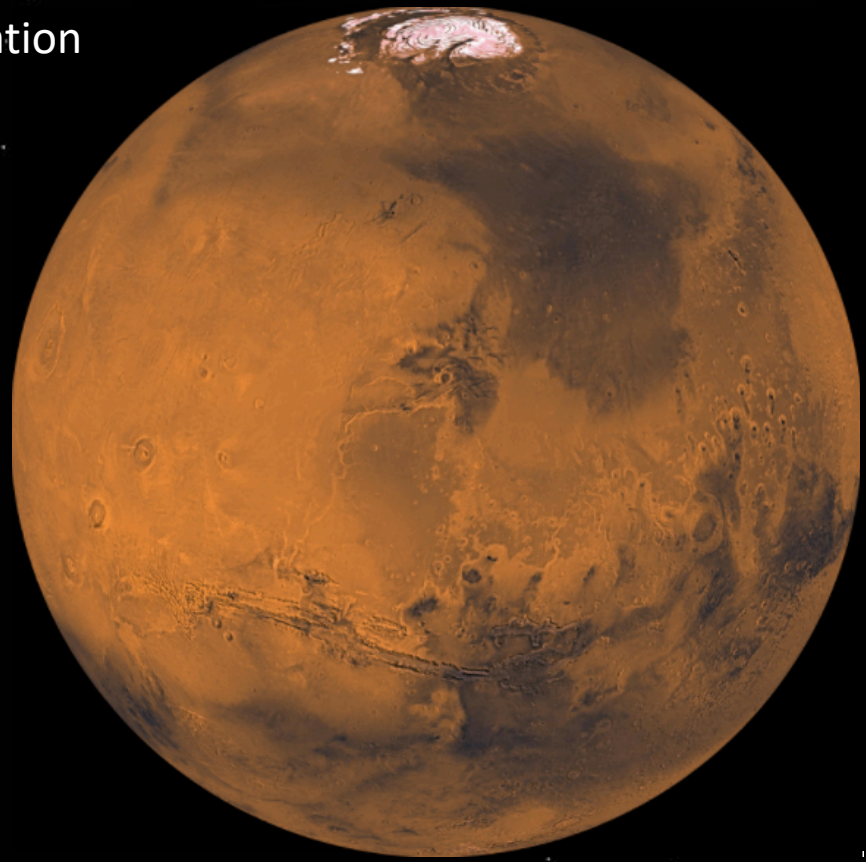
Smoke Inhalation

Shoulder Dislocation

Burns

Toxic Exposure

Mars
88,000,000 miles from Earth



- Neuroimaging
  - Electromagnetic – (EEG, ERP, MEG)
  - Hemodynamic – cerebral blood flow (DTI, TCDS, fNIRS)
- Non-invasive procedures
  - tDCS, TMS

Build and test on the Moon
Operate on Mars

Neuroscience

Neural bases of perceptual, cognitive and motor functions:

- **Seeing**
- **Hearing**
- **Attending**
- **Remembering**
- **Deciding**
- **Planning**
- **Grasping**
- **Moving**
- **Lifting**

in relation to technologies in the workplace

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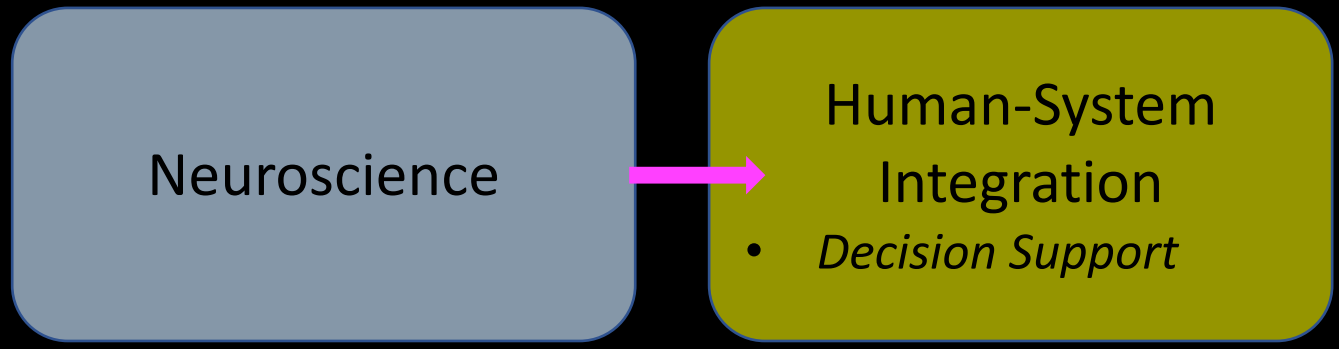
Operate on Mars



Clinical Decision Support Systems (CDSS)

Current modes of terrestrial medical decision support (examples)

- Alerts of critical values,
- Reminders of overdue preventive health tasks,
- Guided clinical workflows,
- Advice for drug prescribing,
- Critiques of existing health care orders, and
- Suggestions for various active care issues.

What aspects of existing CDSS can be leveraged to assist crew during exploration class missions?

How can these be tailored to exploration crew needs?

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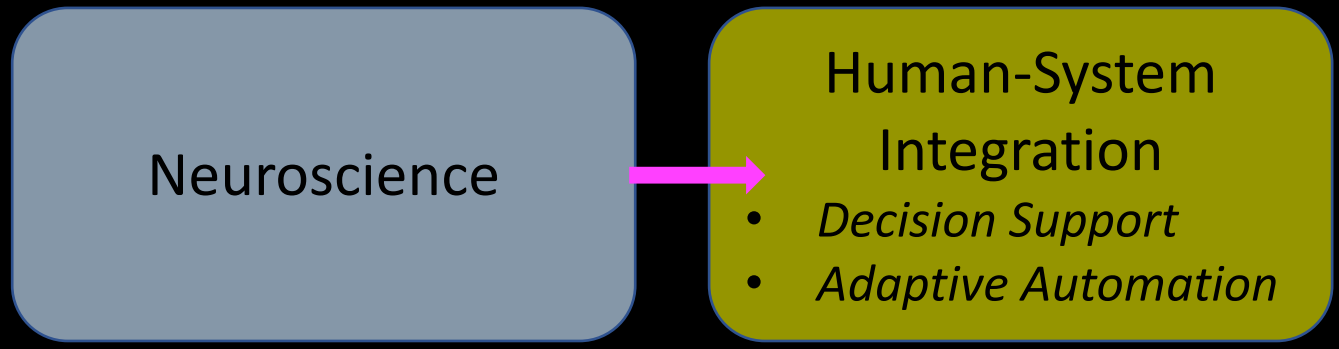

Artificial Intelligence
Computer Science

Neuroscience

Human-System
Integration

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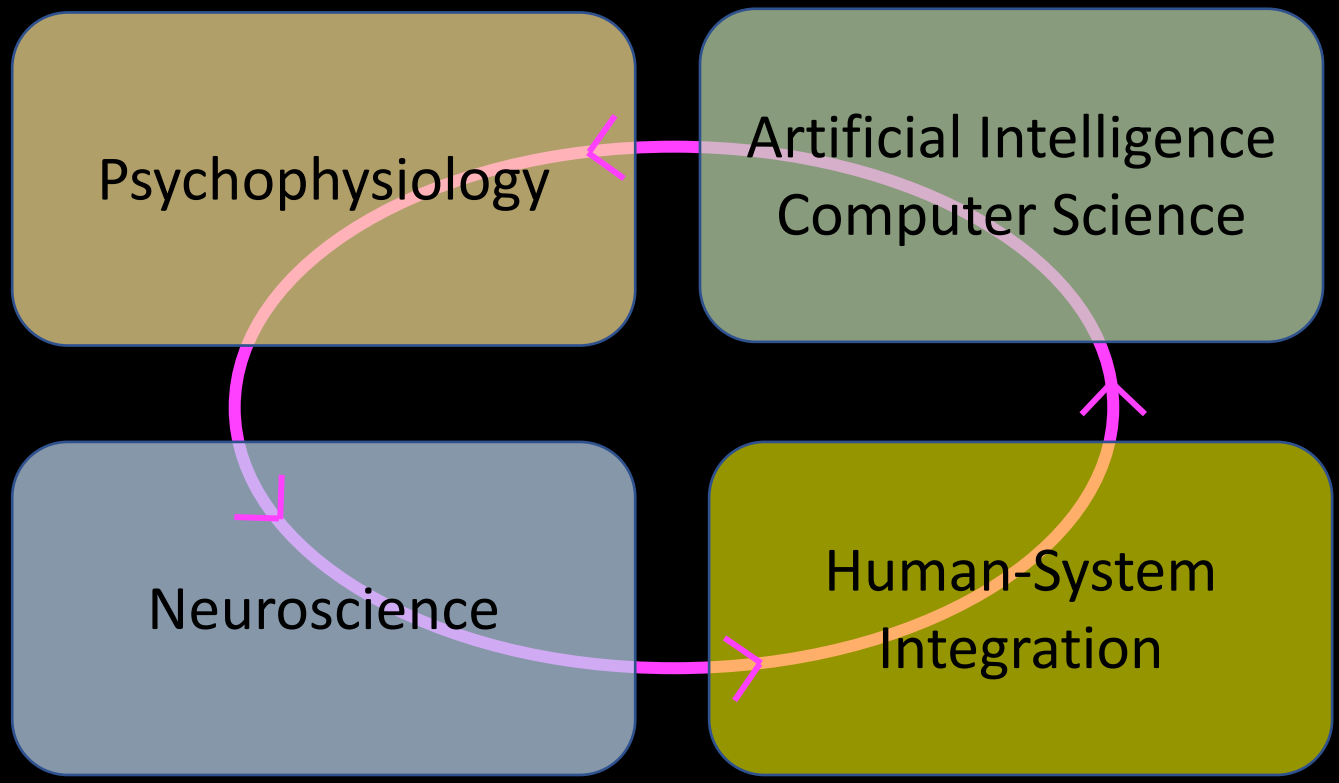

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