

## Introduction



Figure 1: Virtual reality for spaceflight simulation training, (ADRIFT, Xbox One)

- NASA's 2016 evidence report on the risk of cognitive/behavioural conditions and psychiatric disorders (i.e., **mood disorders, neurasthenia, psychosomatic reactions, sleep, and cognitive functioning**) from prolonged space exploration
- VR provides promise in **psychiatric monitoring, exercise, continual and updated training, and sensory stimulation** to combat monotony and boredom.

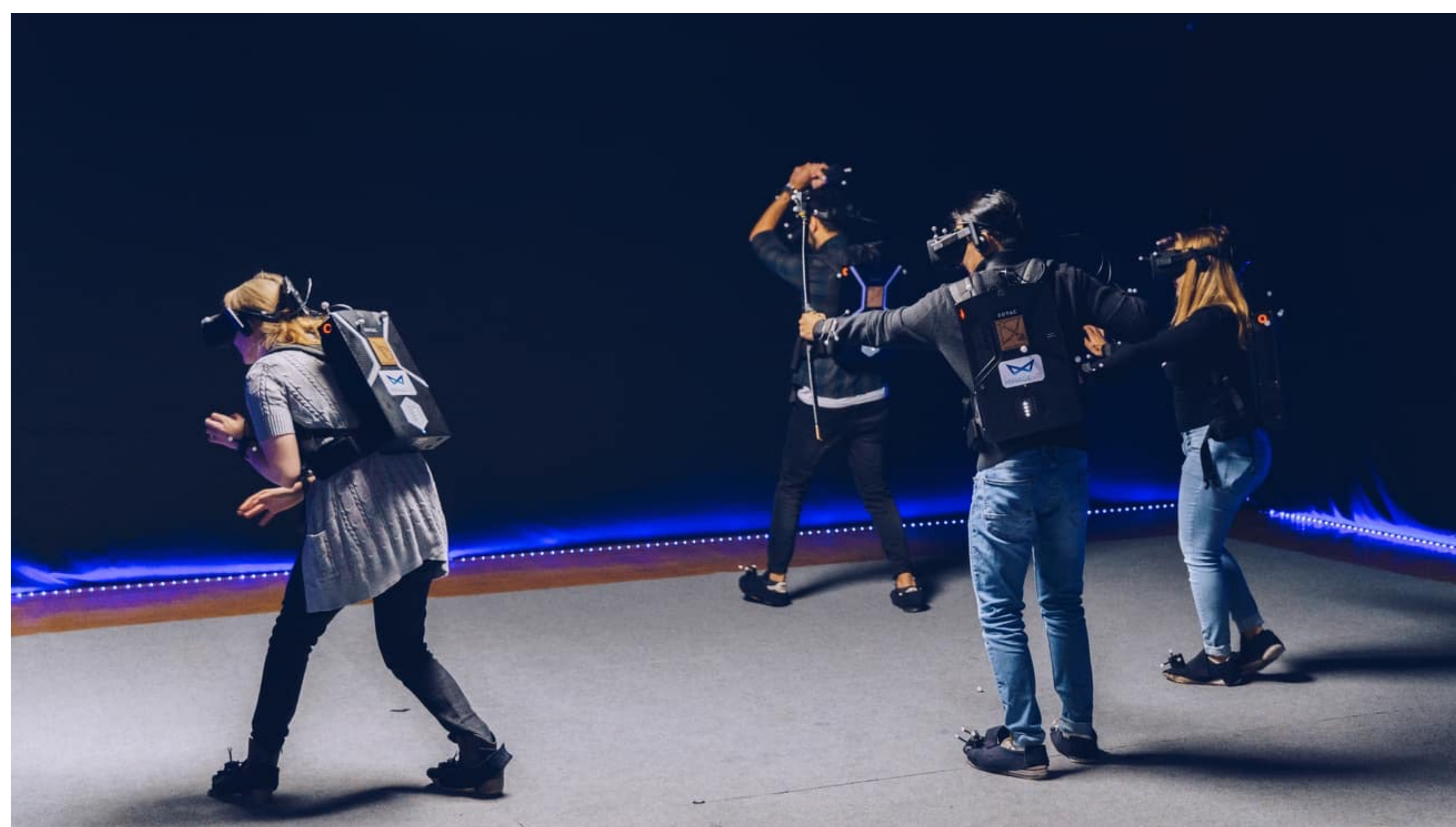


Figure 2: Virtual reality for team building, relieving stress, and boosting morale on prolonged missions (Mirage VR)

- VR can assist in **psychosocial adaptation** by supplying cooperative and leisurely activities for crews boosting **team morale and unity** while **relieving stress and tension** between members.

## Methods

- Study Design:** Narrative review of international/national agency recommendations and research following ENTREQ guidelines
- Databases:** PubMed/Medline, EMBASE, ADS
- Inclusion:** International/national space agency publications within last 10 years
- Exclusion:** Local guidelines/grey literature, not published in the last decade

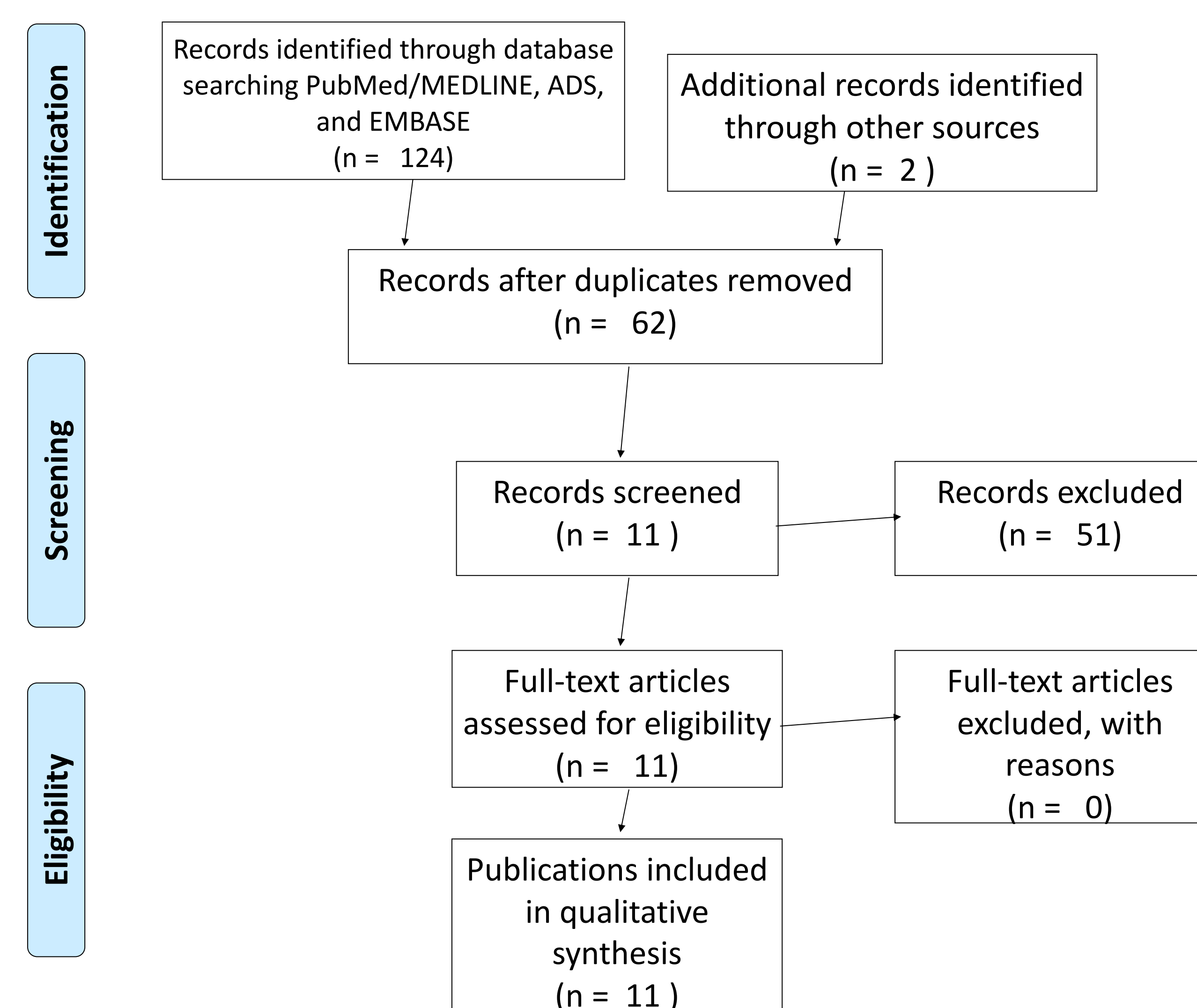


Figure 3: Flow diagram summarizing search strategy utilized for narrative synthesis following ENTREQ guidelines.

## Results

- Total: **11** included publications (majority NASA)
- “Sandbox” games**, i.e. open-world games in which players have creative control over environment suggested to improve **lack of space, autonomy, and privacy issues** experienced by astronauts **without overcrowding** shuttle spaces.
- The use of AI in VR Mars **exploration training** provides randomized scenarios to help astronauts **retain skills** over long-term missions and **preparedness** for emergency/improvised response.
- Eudaimonic well-being** (i.e. personal satisfaction, exclusive of hedonistic pleasure/pain avoidance) was more likely to be **autonomous**

## Results & Discussion

- Monotonous > compelling tasks = low eudaimonic well-being**
- Increased autonomy** for astronauts **negatively affect motivation and performance**
- Astronauts may also **desire increased independence** (e.g., shutting down communications with mission control)
- Reading novels, photographing Earth, or allowing astronauts autonomy (“breathing room”) only go so far, and **eudaimonic well-being may not sustain** through this arduous mental period

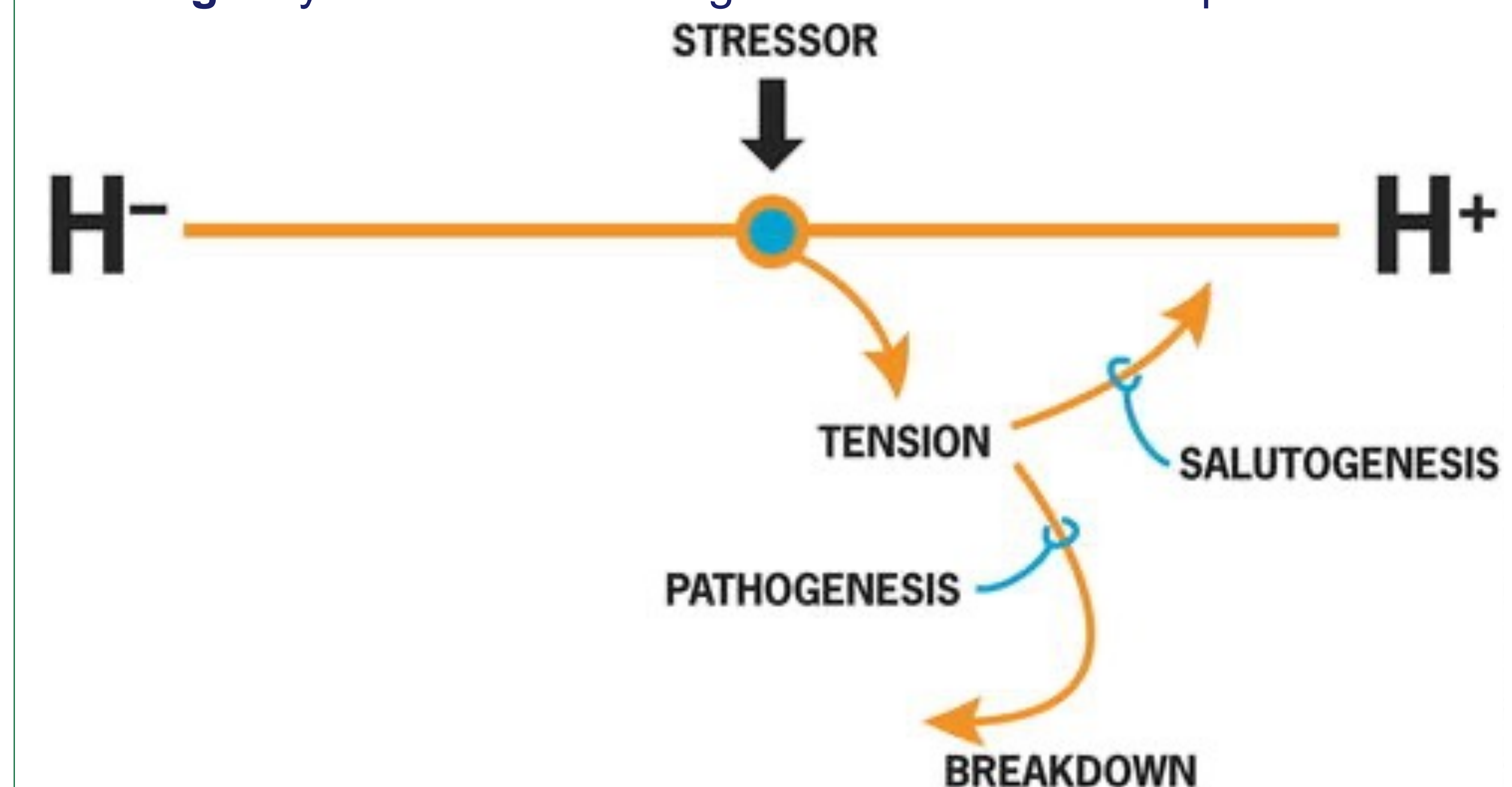


Figure 4: Simplified model of salutogenesis (long-term health response to tension largely predicted by eudaimonic well-being) and opposing pathogenesis leading to breakdown.

- Salutogenic experiences**, i.e. experiences that provide a sense of coherence and enduring positivity (e.g., photographing Earth) are **most meaningful activities** for astronauts, but not sustainable when the earth is out of view
- VR offers salutogenic experiences** “limited only by processing power and creativity”

## Conclusion

Virtual reality games hold **extensive promise** in addressing **challenges for psychosocial adaptation** faced by crew members on prolonged space missions, namely **enhancing eudaimonic well-being** and **promoting salutogenic experiences**.

## Acknowledgments