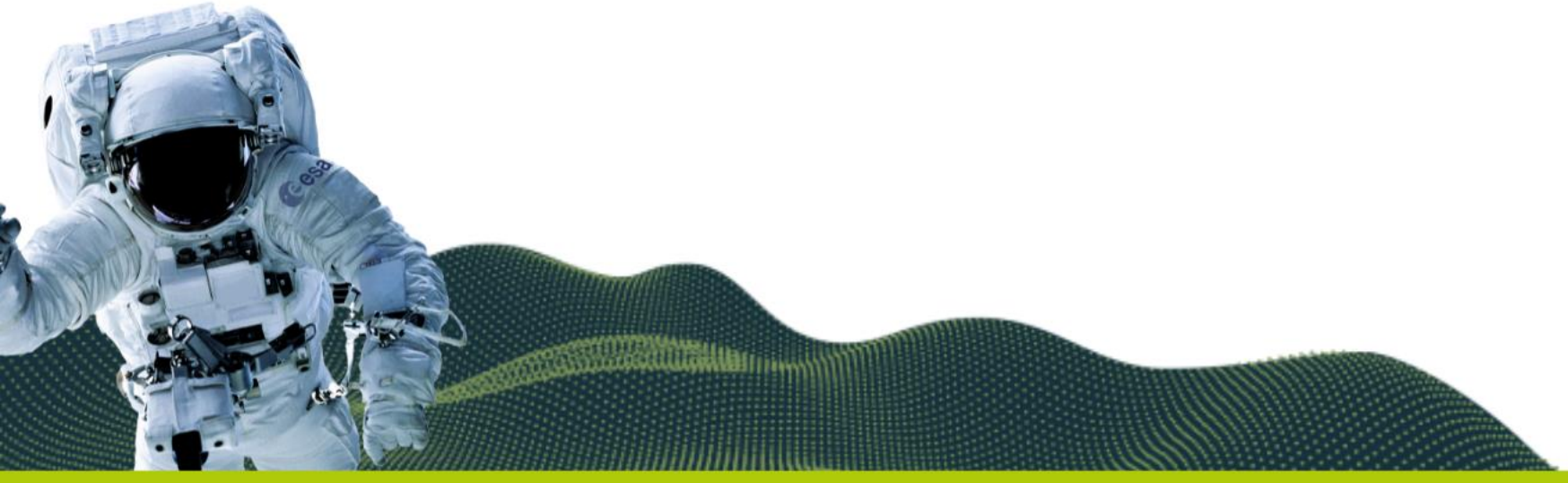
MELISSA
MICRO-ECOLOGICAL LIFE SUPPORT SYSTEM ALTERNATIVE

2022 MELISSA CONFERENCE
8-9-10 NOVEMBER 2022

CREATING A CIRCULAR FUTURE

Analog astronaut habitats and space simulation systems

Kato Claeys



INTRODUCTION

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MOON HABITATION DESIGNS

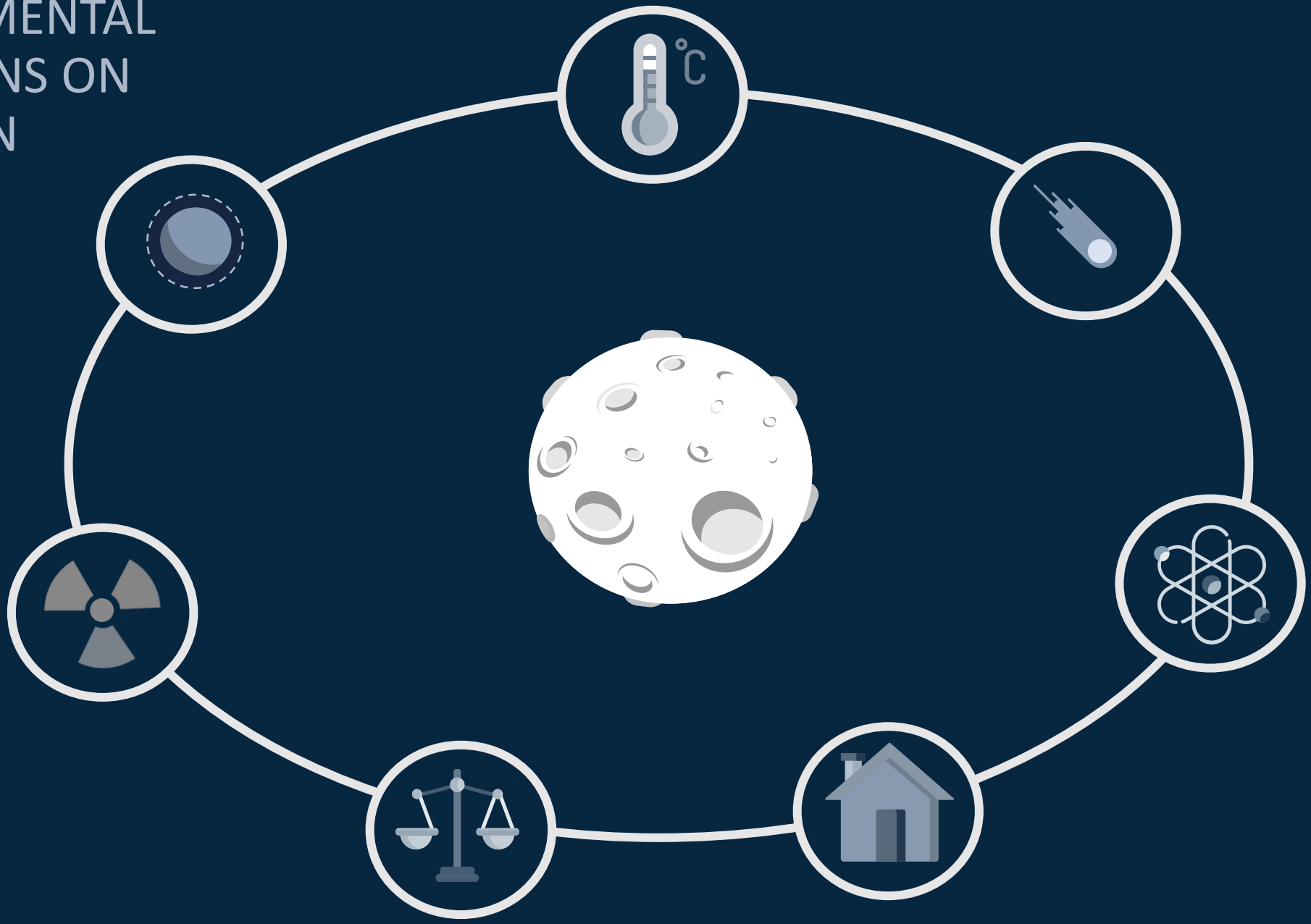
SPACE ANALOGUE MISSIONS

EMMPOL 10

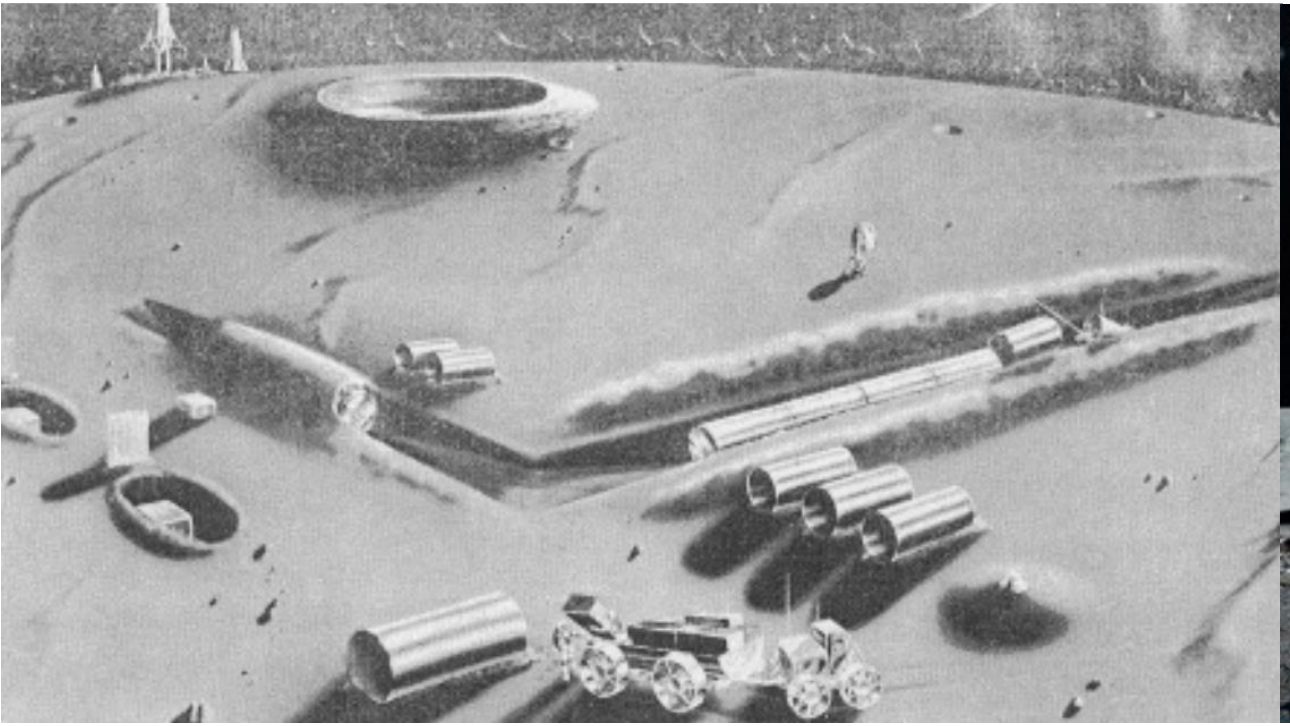
PROXIMITY EXPERIMENT

CONCLUSION

ENVIRONMENTAL CONDITIONS ON THE MOON



RIGID



- Designer: Wernher Von Braun
- Year: 1959
- Crew size: 12
- Dimensions per module:
  - Length: 6m
  - Diameter: 3m

INFLATABLE

- Designer: Fosters + Partners
- Year: 2012
- Crew size: 4
- Dimensions:
  - Length: 10m
  - Width: 5m
  - Height: 5m

RIGID STRUCTURES

Name	*Proj. Horizon*	*ELS*	*LESA*	*Galaktika*	*LSB*	*Zvezda*
Designer	Wernher Von Braun	Garrett AiResearch	NASA	Vladimir Barmin	University of Houston	Valentin Glushko
Year	1959	1966	1966	1969	1972	1974
Duration	Extended period	30 days	6 months	1 year	Extended period	Extended period
Crew size	12	2	6	4-12	12-180	6
Dimen-sions	Per module: Length: 6m Diameter: 3m	Length: 4.9m Diameter: 2.5m	Height: +/- 8m Diameter: +/-5	Length: 8.5m Width: 3.5m Height: 3.5m	Per module: Length: 10m Diameter: 5m	Length: 8.6m Diameter: 3.3m

INFLATABLE STRUCTURES

Name	*STEM*	*Tuft Pillow*	*InFlex*	*MoonCapital*	*Lunar Outpost Design*	*One Moon*
Designer	Goodyear et al.	Vanderbilt et al.	ILC Dover	Andreas Vogler	Fosters + Partners	SOM
Year	1965	1988	2006	2010	2012	2019
Duration	8 to 30 days	Extended period	(not known)	Extended period	(not known)	300 days
Crew size	2	(not known)	2	60	4	4
Dimensions	Length: 5.3m Diameter: 2.1m	Length: 6.1m Width: 6.1m Height: 3.0m	Diameter main module: 3.6m	Diameter: 135m Height: 45m	Length: 10m Width: 5m Height: 5m	390m^3

SIMULATION OF SPACE CONDITIONS

SIMULATION OF SPACE CONDITIONS

EMMPOL MISSIONS

- Poland
- AATC and EMM
- Mostly students
- Crews up to 6
- 7 days

EMMPOL 10 CREW

William Dobney – Commander & Communication Officer
Loughborough University, United Kingdom

Daily briefing and debriefing, Set tasks for the crew, Keep moral up

Kato Claeys – Vice-Commander
KU Leuven, Belgium

Assisting the commander, Keeping track of the schedule

Flavia Palma – Medical Officer
University of Padua, Italy

Daily medical checks, Monitoring of physical, metabolic and visuospatial capacity, Monitoring of cardiovascular Parameters

Saikumar Mutte– Space Engineer
KU Leuven, Belgium

Technical support for all crew members, Monitoring the habitat sensors

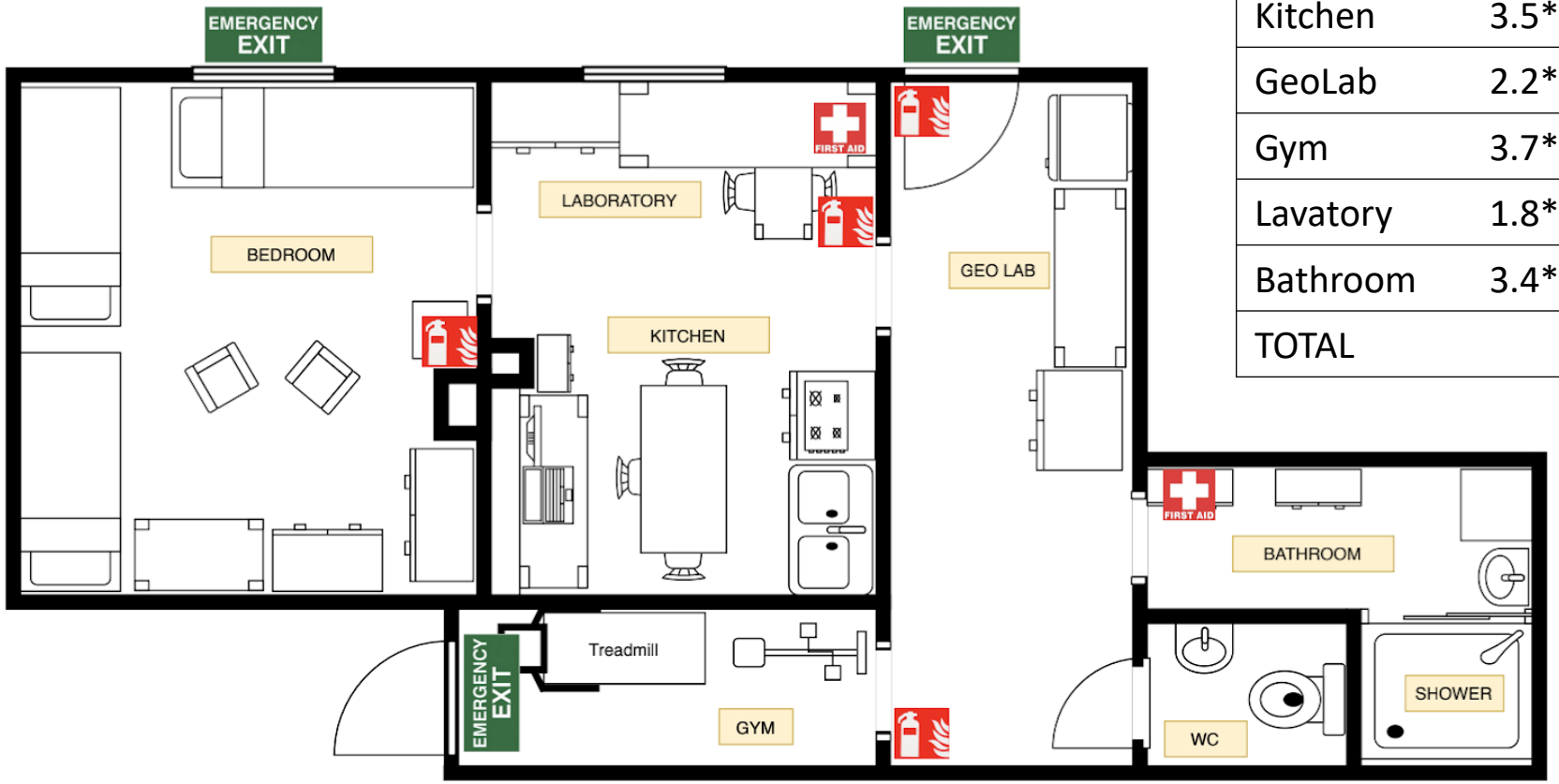
Liliana Balotti – Public Outreach Officer
University of Bologna, Italy

Setting up live events, Promoting our content on social media

PRE-MISSION TRAINING

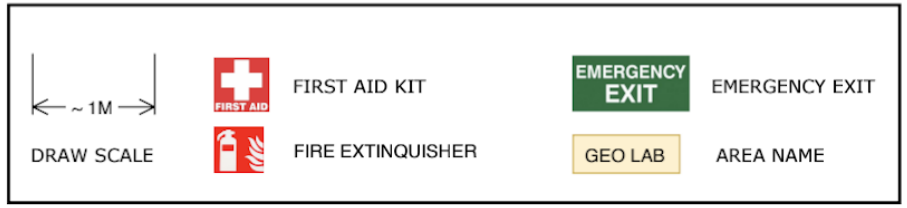
- Survival training
- Cryotherapy
- Cold water immersion
- Diving

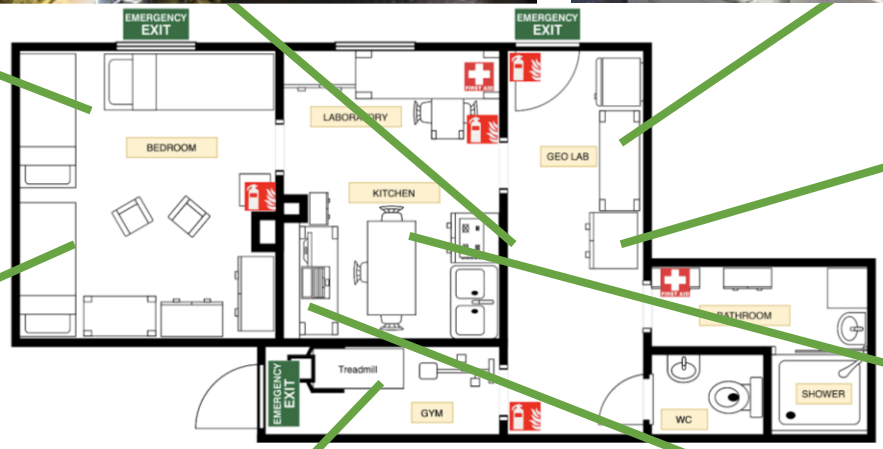
THE EMMPOL HABITAT

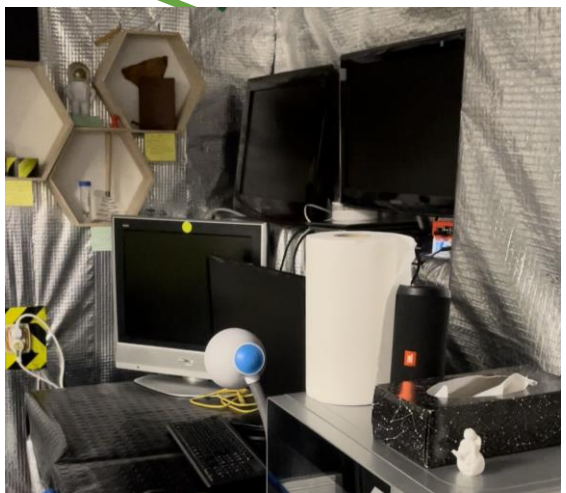


Room	Dimensions (m)	Area (m^2)
Bedroom	4*4.5	18
Kitchen	3.5*4.5	15.8
GeoLab	2.2*6	13.2
Gym	3.7*1.4	5.2
Lavatory	1.8*1.2	2.2
Bathroom	3.4*2.6 (L-shape)	6.3
TOTAL		60,7

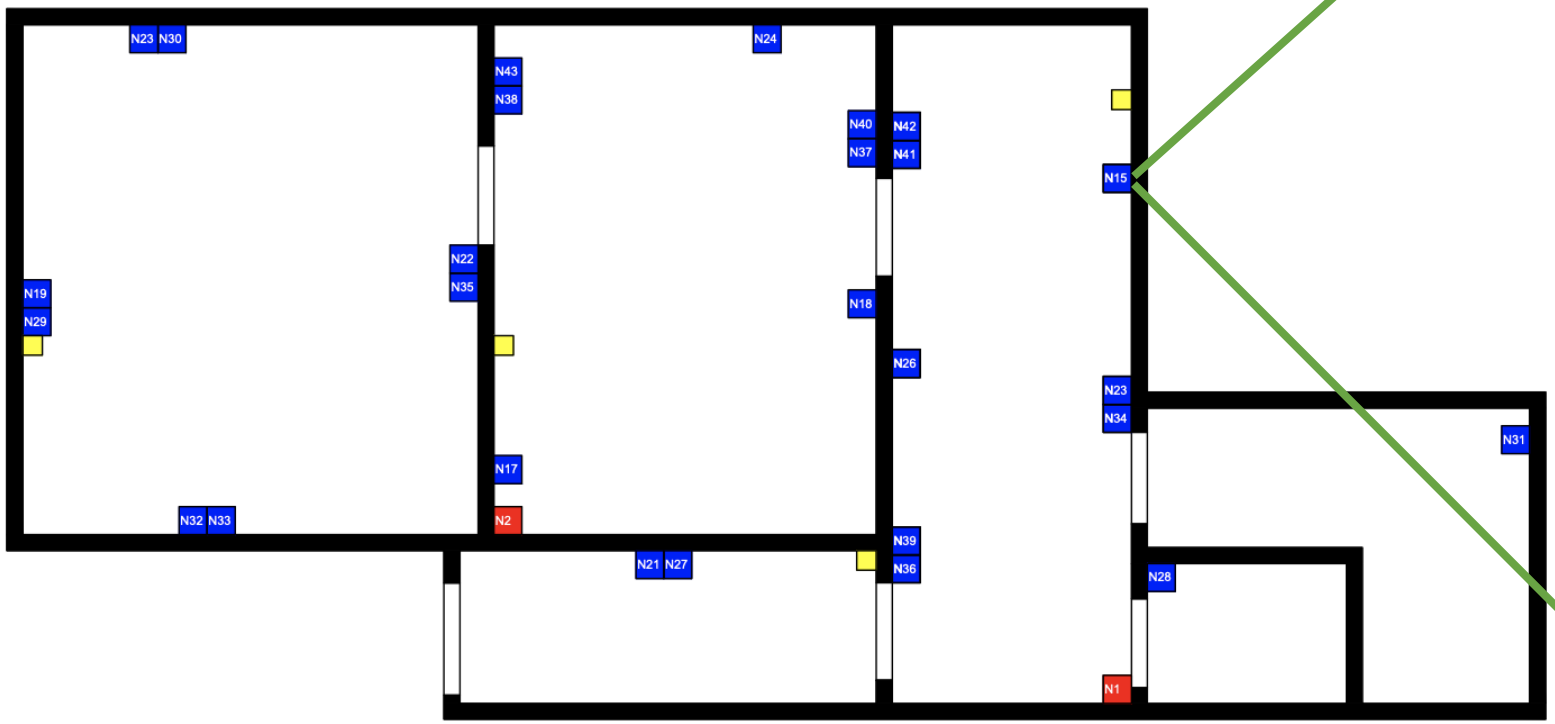
LEGEND




EMERGENCY EXIT
EMERGENCY EXIT
BEDROOM
LABORATORY
KITCHEN
GEO LAB
BATHROOM
Treadmill
EMERGENCY EXIT
GYM
WC
SHOWER



ENVIRONMENTAL CONTROL SYSTEMS



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PHYSIOLOGICAL MONITORING

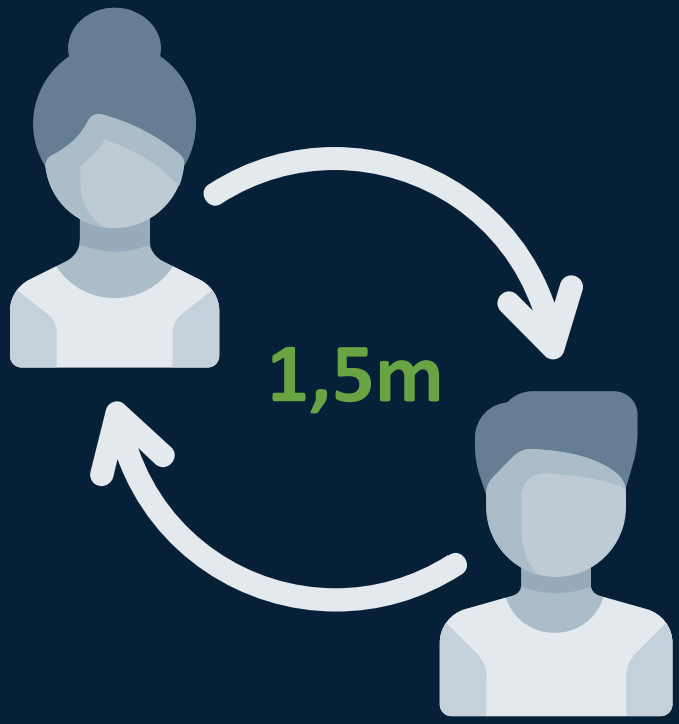
- Sleep pattern
- Water consumption & urine production
- Circadian rhythm
- Sports

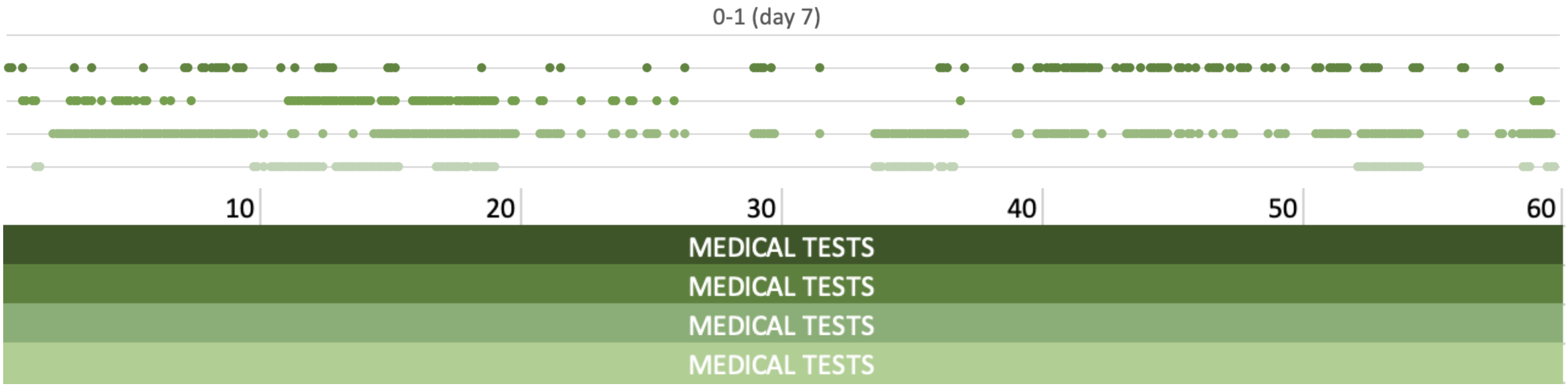
OTHER EXPERIMENTS

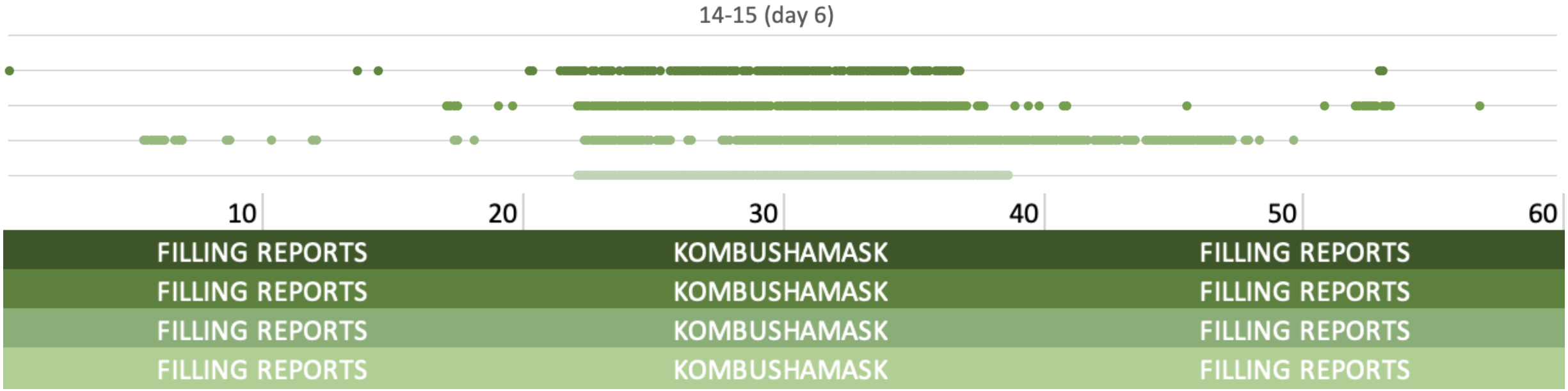
- Psychological experiments
- Vinci nap
- Kombucha mask & tea
- Subjective time perception
- Virtual Reality induced stress and social dynamics in an isolated Moon/Mars Environment
- Self-healing hydrogels and bacterial growth
- Friction testing REMMI rover on lunar regolith simulant

PROXIMITY EXPERIMENT

- Inspired by covid-19 pandemic
- Hypothetical experiment
- Social distance assistant
- 3 hours a day
- Questionnaires
- Audio analysis → Graphs
- Limitations
  - Limited data
  - Background noise
  - Analysing method




0-1 (day 7)
10
20
30
40
50
60
MEDICAL TESTS
MEDICAL TESTS
MEDICAL TESTS
MEDICAL TESTS


14-15 (day 6)
10
20
30
40
50
60
FILLING REPORTS
KOMBUSHAMASK
FILLING REPORTS
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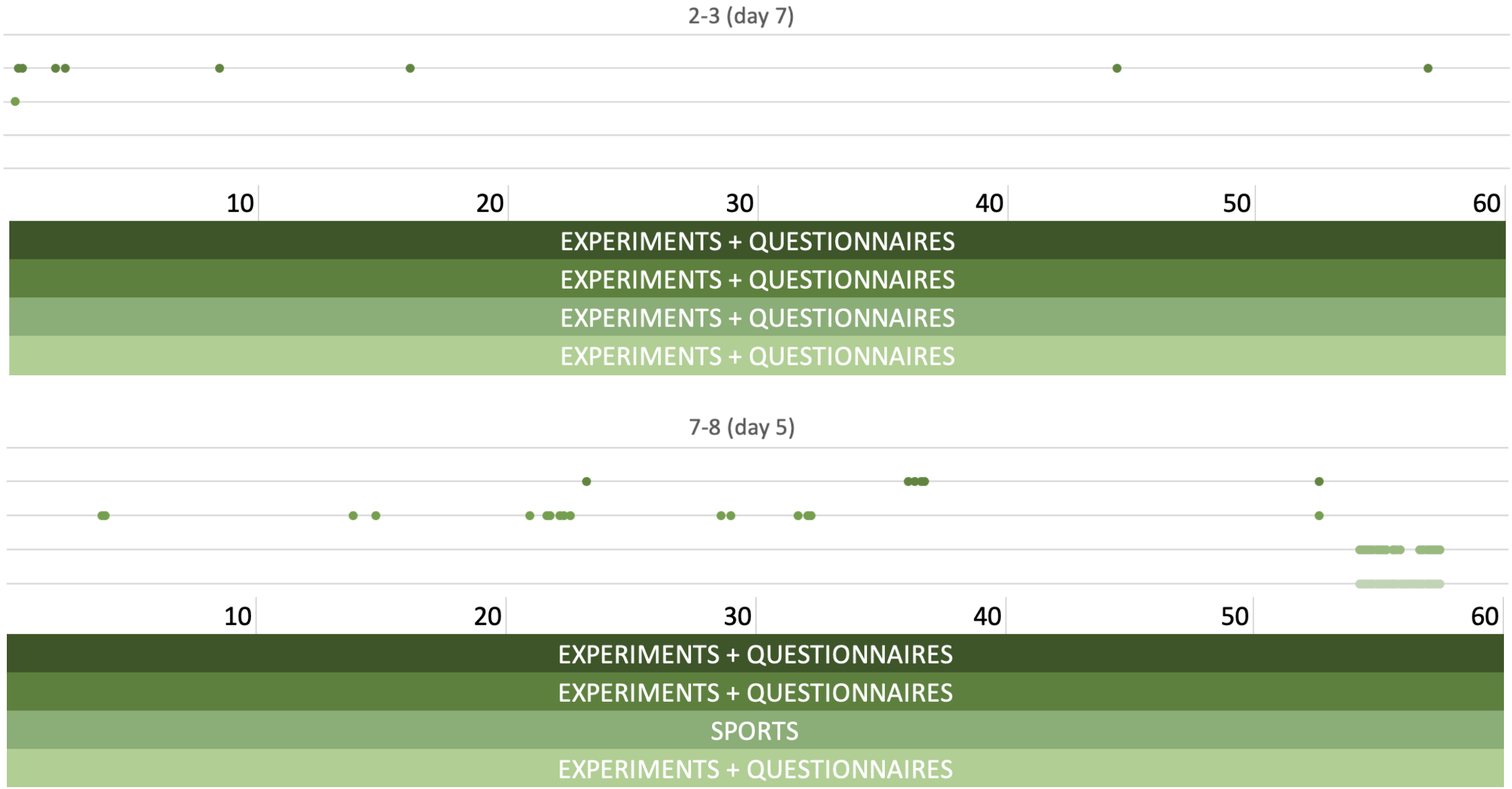
2-3 (day 7)
10
20
30
40
50
60
EXPERIMENTS + QUESTIONNAIRES
EXPERIMENTS + QUESTIONNAIRES
EXPERIMENTS + QUESTIONNAIRES
EXPERIMENTS + QUESTIONNAIRES
7-8 (day 5)
10
20
30
40
50
60
EXPERIMENTS + QUESTIONNAIRES
EXPERIMENTS + QUESTIONNAIRES
SPORTS
EXPERIMENTS + QUESTIONNAIRES

CONCLUSION

Most of the time it is possible to keep distance between crew members in the habitat

Two groups of distance infringements:

- Planned activities
  - Meals
  - Group activities
  - Mutual experiments

  → most of this can be adapted by the schedule
- Circulation issues

  → separated circulation system is necessary

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- Prof. Sofia Pavanello
- Agata Kołodziejczyk
- Matt Harasymczuk
- Prof. Bernard Foing

EMMPOL 10 crew

- Wiliam Dobney
- Flavia Palma
- Saikumar Mutte
- Liliana Balotti

EMMPOL 11 crew

- Philippe Frering
- Kiran Gautam
- Sarah Solbiati
- Luke Byrne
- Jack Renaghan
- Anet Vadakken Gigimon

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THANK YOU.

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Follow us

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