



Situation awareness issues during outdoor activity

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In complex and dangerous environments such as extraterrestrial terrain, performance and risks issues are often driven by insufficient situation awareness and poor representation sharing.

For a better understanding of situation awareness issues and in order to adapt tools and interfaces and to propose appropriate training procedures, tests on analogue terrains are of primary importance. Numerous experiments have already been conducted in the field. Examples:

- Several experiments have been carried out by CREW 185 at Mars Desert Research Station at the end of December 2017. The objective was to study spatial shared representations and communication strategies between a crew member staying at the base and an astronaut in EVA. The protocol of the experiment was split in two steps. Day one, a crew member “Capcom” goes in the field and builds a small cairn in a specific location known only to him. He also pays attention to the different environmental cues that may help finding the path to the cairn. Day two, another crew member “Astronaut” goes in the field. He communicates with Capcom using simple walkie-talkies. He starts a few hundred meters from the cairn and Capcom tries to explain how to find it. There is no map, no GPS and no compass. The experiment has been carried out 8 times with different combinations of 2 persons among a group of 4. As expected, the degraded situation awareness made the task difficult to complete. Sometimes, the cairn was never found or it was found after a long time. Several failure reasons have been identified: Small differences in what has been memorized by Capcom and the reality of the terrain, inappropriate instructions interpretation, wrong representation of the path or communication losses. In order to reduce errors, it is recommended to train astronauts to appropriate behavioral skills and to carry out tests in similar conditions.

- In a different context, unpressurized ATV (All Terrain Vehicles) have been tested in the field [1]. It was reported several important difficulties and some advices have been made to increase situation awareness. First, there was an incredible difference in performance between an ATV expert and a beginner. While the expert was able to go fast and at very low risk in many places (rocky terrain, high slope, etc.), beginners were going slowly and were not able to go in similar places without risks. A specific high level ATV driving skill must therefore be defined. Second, provided that winches are available, it was found that a large part of the zone was accessible to unpressurized rovers while it was certainly out of reach from heavy pressurized ones. As the exploratory performance could be strongly impacted by the type of vehicle sent to the surface of the planet, it is recommended to test the vehicles in different analogue terrains.

[1] J.-M. Salotti, C. Laithier, B. Machut, A. Marie, A. Bruneau, G. Grömer, B. H. Foing, Small rover exploration capabilities, *Advances in Space Research*, vol. 55, pp. 2484-2491, 2015.