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Experiment Design Document

Repairing robotic surgery: 2D barcode alphanumeric vs XR/VR Instructions

Question (uncertainty)

Is Concept 2* better than the reference idea* from the perspective of assisting astronauts to repair robotic surgery equipment?

Author

Masoud Rastgou, UEF

Method

I will review my courses related to XR/VR technology and their properties and also search on the internet about the possible conditions in the process of repairing equipment.

Prediction

Concept 2 will be less effective as the reference for assisting astronauts to repair robotic surgery equipment. Because, XR/VR will not be beneficial to the astronauts.

Model/Rationale

I believe that Concept 2 is less effective than the reference in assisting the astronauts to repair robotic surgery equipment because XR/VR gadgets need to be connected to the other sources which will restrict the vicinity of operations. Also, VR gadgets are not sufficient to be used in the process of repairing equipment.

***Concept 2:** Video+Simulation for same situation+2d barcode alphanumeric+Xr/Vr instructions+Mars Environment

***Reference Idea:** Symbology and Satellites+Simulation for same situations+2D barcode Alphanumeric+Robot Crane+Chemicals,germicides

Illustration w. Keywords

youtube.com/watch?v=axBE09xhH1E (picture)
edition.cnn.com/2017/12/13/health/virtual-reality-vr-dangers-safety/index.html

Experiment Results and Insights

Repairing robotic surgery: 2D barcode alphanumeric vs XR/VR Instructions

Question (uncertainty)

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Author

Masoud Rastgou, UEF

Results

- Comparison between Concept 2 and the reference idea showed that VR gadgets include some restrictions in the process of assisting astronauts.
- The experiment illustrated that Concept 2 can have less functionality compared to the reference idea.

Insights

VR gadgets can be developed to help astronauts to visualize the process and all the instructions but in the process, XR gadgets would be used to combined virtual reality and real environment. In the future, they can be developed in a way to be used even with fewer restrictions such as connection problems and functionality.

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Experiment Design Document

Working with experts on Earth: Video/Phonecall vs. Simulations on earth

Question (uncertainty)

Does working together via phonecall make it easier to find a solution than simulating an issue on earth without constant connection?

Author

Simon Plank, Karelia UAS

Method

1. I will try to let my roommates figure out solutions to different problems alone and with a connection with delay from a few seconds to a few minutes to each other.
2. One part of the experiment is to describe 20 exercises one after another to one of them, he then has to describe a part of the exercise for his partner in written form, who is in another room. This person then gets the message to solve the part of the exercise and send the solution back to the first one to help him finish the exercise.
3. The second part of the experiment is to connect them together via a delayed phone call (can be done with an app for rooted Android phones) and let them solve another 20 similar exercises together.
4. Finally, the participants try to solve 20 exercises while being connected via a standard voice call via WhatsApp without delay.

The exercises are comparable/similar to each other. Mostly logical, mathematical and common knowledge exercises were used.

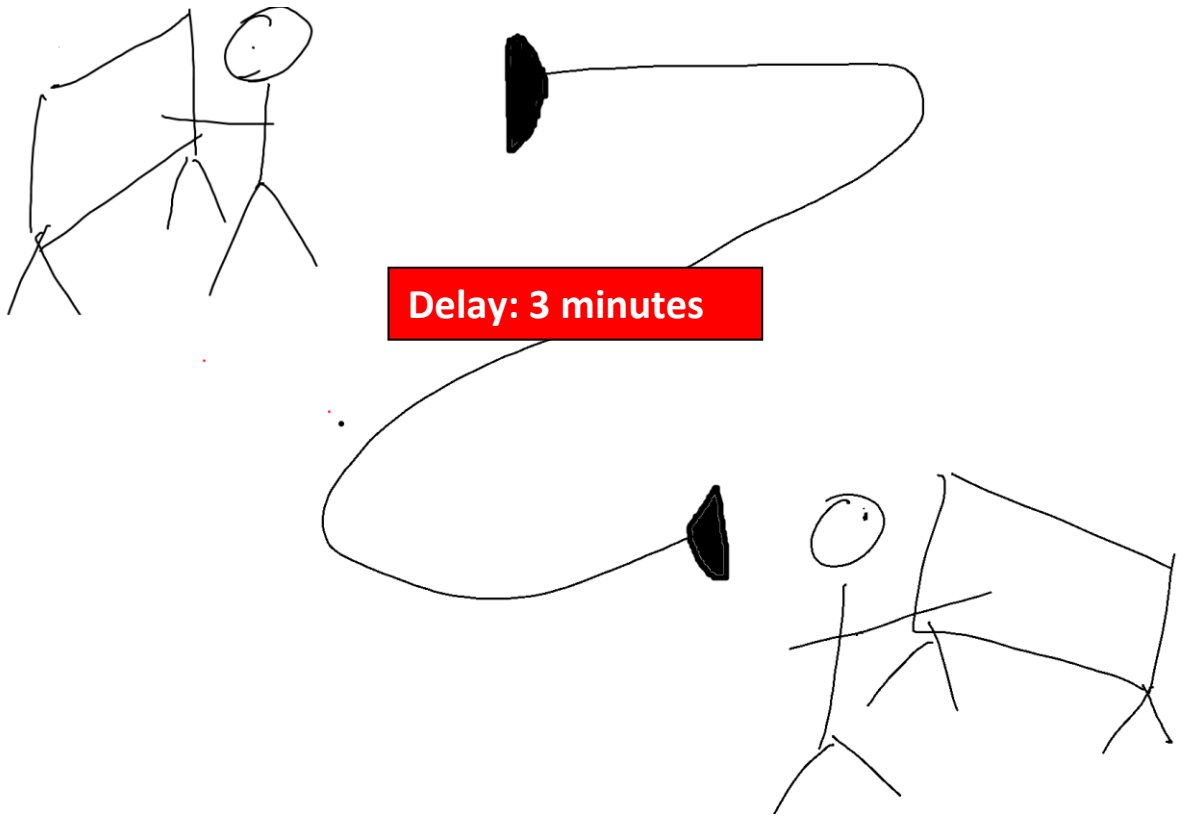
Prediction

I think, that finding solutions on earth alone is faster than working together on a (video)call

Model/Rationale

It is easier to let “one” expert or one side work alone on a problem (on a simulation or exact replica) than connecting two via a call that has a delay of about two minutes in both directions because they are constantly waiting for the a reply because without they cannot continue

Illustration w. Keywords



Experiment Results and Insights

Working with experts on Earth: Video/Phonecall vs. Simulations on earth

Question (uncertainty)

Does working together via phonecall make it easier to find a solution than simulating an issue on earth without constant connection?

Author

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Results

- The 20 exercises I let my roommates solve separately in their rooms could be solved in an average time of 4:33 minutes.
- The 20 exercises I let my roommates solve connected together with a delay could be solved in an average time of 9:01 minutes.
- The 20 exercises my roommates had to solve together while being connected normally could be solved in an average time of 2:52 minutes.

Insights

The results suggest that if it is not possible to work together on a call without delay the fastest, most efficient solution is to let one of the two separate teams work on a problem by themselves. Especially when only one of the sides has a specific knowledge about a certain field this makes the process of finding a solution easier.

High redundancy: Taking only robot crane tool vs 3d printing parts and tools

Question (uncertainty)

Is communication with the Huffman Coding algorithm as good as from being in the same simulation room at Mars for instruction solution developing?

Author

Halil Ibrahim Uluoglu, UEF

Method

Firstly, I will search which simulation environment has been using for space missions. Also, I will use a 3d model that I created for our concept idea. Then, I will create a Huffman Coding algorithm for messaging using Java programming language. I will output the result of the algorithm.

Prediction

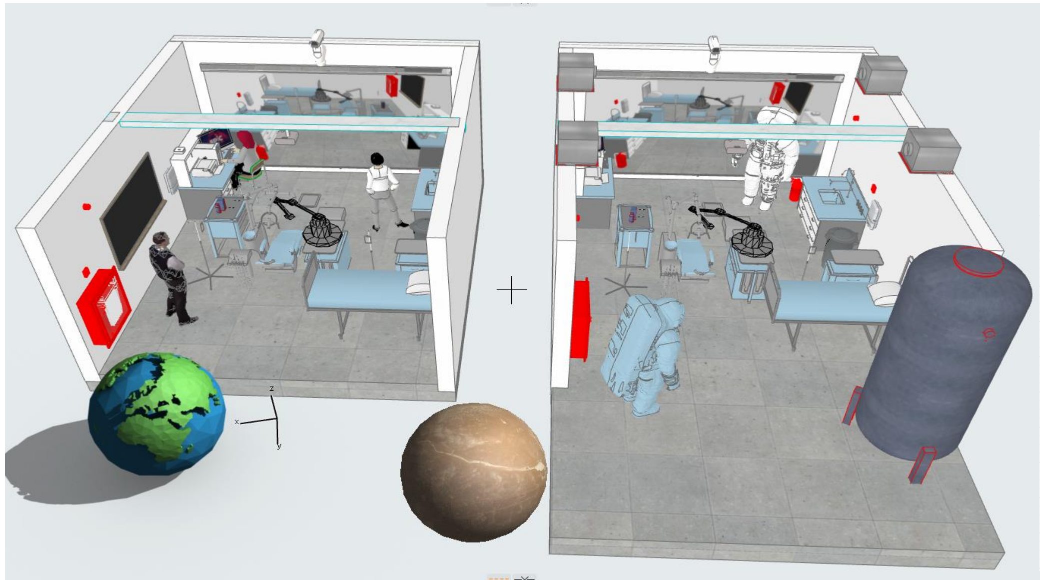
- Based on test data compression, using Huffman algorithm makes transmission as fast as with the reference idea.
- Simulation room can have multiple angles to see the problem and develop a solution for the problem.
- Huffman Coding can make quite fast communication for solution instruction developing.

Model/Rationale

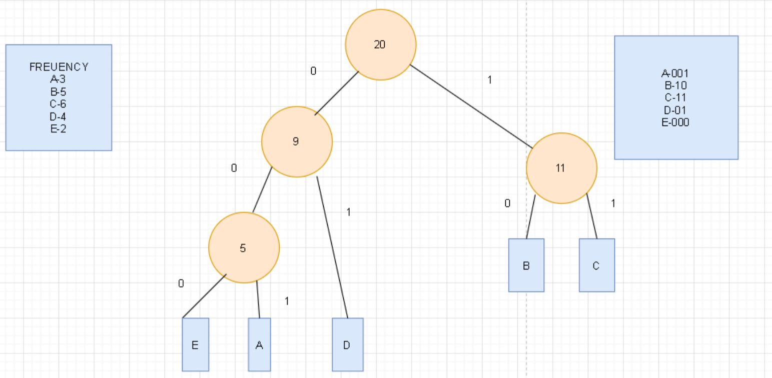
We believe that solution instruction developing is a very significant task for experts on Earth. Because It can be fatal every movement for astronauts on Mars. The experts must think every steps very cautiously. In this model, the simulation room needs to be created early from the Mars exploration. Also, experts need to learn basic computer program skills for the program with the algorithm in it.

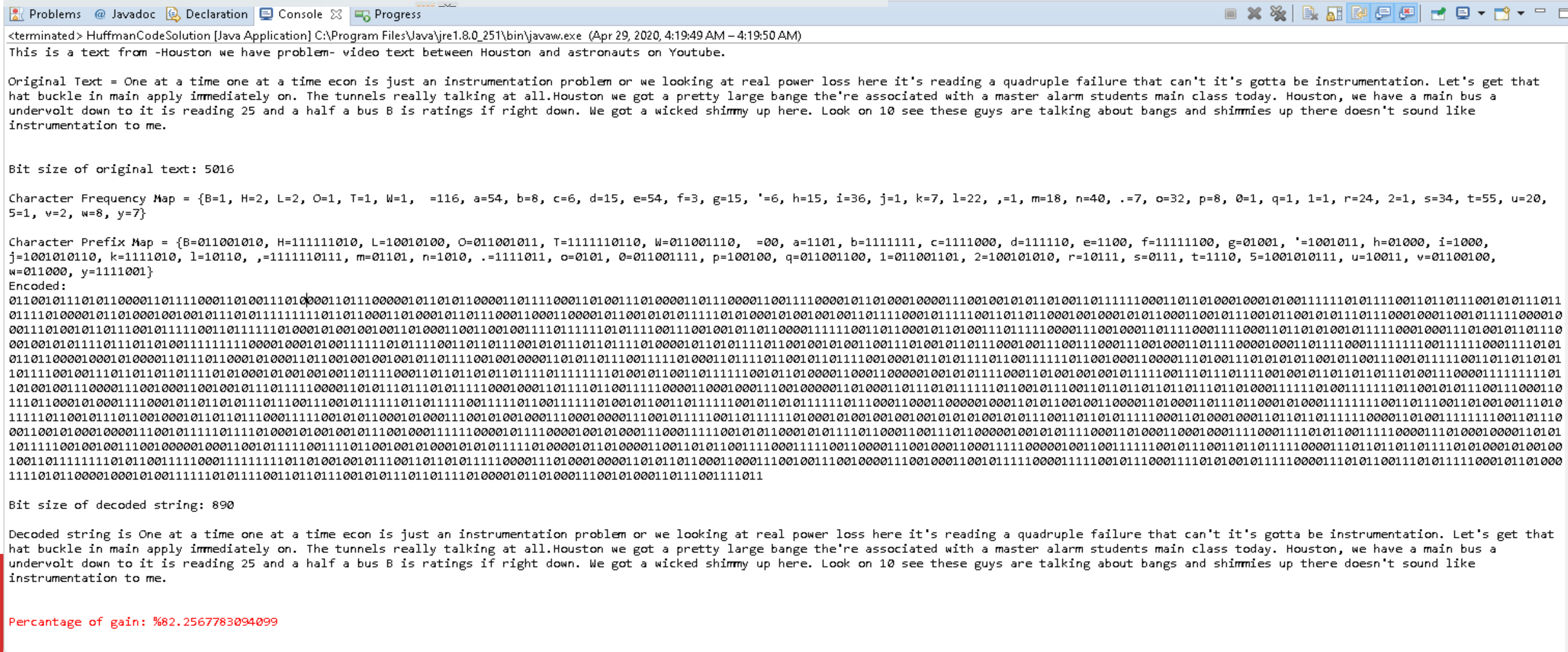
Experiment Design Document

Illustration w. Keywords



Huffman Tree





Experiment Results and Insights

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Author

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Results

- Huffman Coding algorithm succeeded to increase %82 percent of gain from a template text. (Bit size of original text: 5016 – Bit size of decoded string: 890 – Percentage of gain: %82). It can understand like this: The algorithm can present 100 letters text within 18 letters.
- Huffman Coding algorithm can able to make a very fast communication environment for solution developing the algorithm for experts that apart from each other.
- Simulation environment enables every angle that astronauts have. It allows to see every detail for instruction developing.
- The experts can access and test every element in the simulation room. Also, they can feel the same environment with astronauts, so it helps to understand the inside of the problem. It produces right on spot solutions.

Insights

The findings suggest that communication with Huffman Coding algorithm and being in the same simulation room for solution instruction developing are quite good two options. They produces fast and reliable outcome for developing solutions.

Experiment Design Document

Disinfecting the fixed medical equipment at the level required for surgeries:

Simulation on for same situation vs Using compression algorithms

Question (uncertainty)

Is Concept 2* better than the reference* from the perspective of disinfecting the fixed medical equipment at the level required for surgeries?

Author

Charles Rambo, UEF

Method

I will interview Dr. David Baker about the effectiveness and reasonability of using the Mars atmosphere as a disinfecting solution.

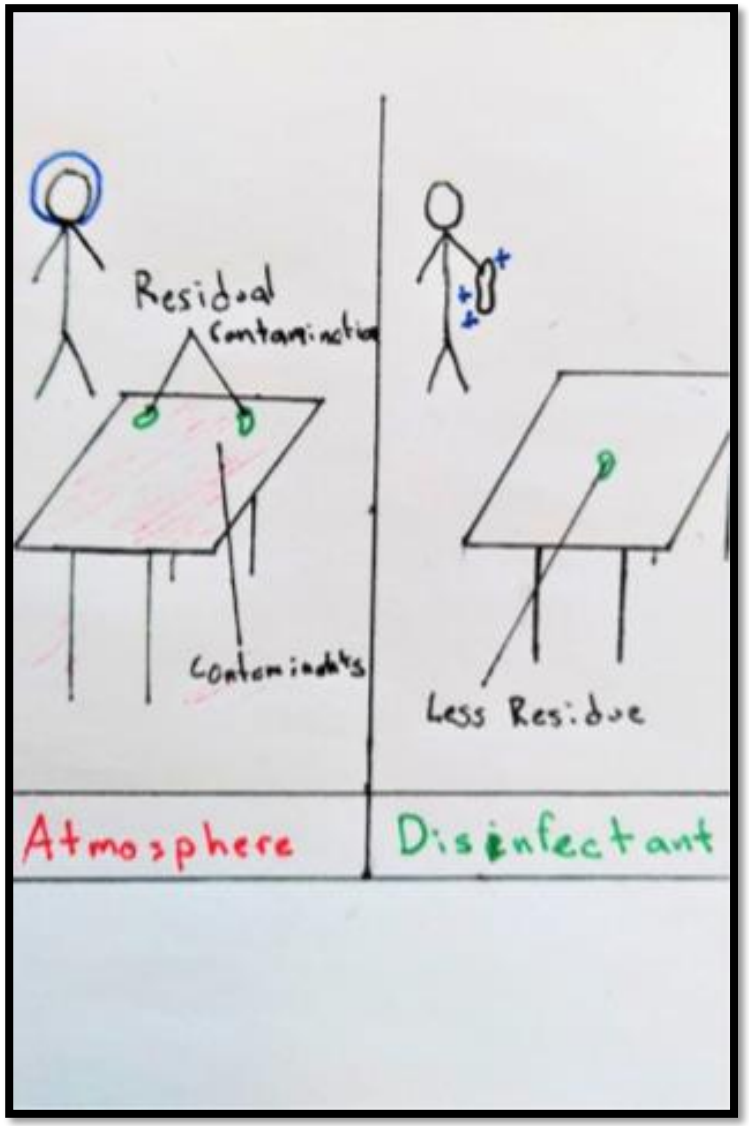
Prediction

The atmosphere will have disinfecting properties however we will learn that using the atmosphere cannot be relied on to disinfect to a surgical level.

Model/Rationale

I believe that using atmosphere for disinfection will generate other issues and importantly will be less effective at disinfecting the surgical robot than using the chemical disinfectants of the reference.

Illustration w. Keywords



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Experiment Design Document

Working on Mars: Reference concept vs Concept 2

Question (uncertainty)

Does concept 2* work better on Mars than the reference concept*?

Author

Lennart Jehle, 2000204

Method

I will search online for research that has been done on the environment of mars and will compare the findings with the solutions the two concepts offer

Prediction

The research will show that concept 2 is better than the reference idea because our team did research on this topic before we came up with our concept and we therefore expect it to performe better than the reference idea.

Model/Rationale

We believe that the data that is provided to us about mars is trustworthy because we cannot go there and check it ourselfes. Moreover we compare the outcome of the two concepts that is most likely and will not compare unlikely situations.
show quite close real results.

Illustration w. Keywords

Reference Concept:

Video
Phone call
Manual search
Video instructions
Boiling

Concept 2:

Video
Simulation for same situation
2d barcode alphanumeric
Xr/Vr instructions
Mars Environment

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Experiment Results and Insights

Working on Mars: Reference concept vs Concept 2

Question (uncertainty)

Does concept 2* work better on Mars than the reference concept*?

Author

Lennart Jehle, 2000204

Results

Concept 2 is superior to the reference concept in three main points:

- the 2d barcode system works more efficient and reliable than manual search
- the simulation is easier to understand than the phone call
- the Mars environment is superior to boiling when it comes to disinfection of the parts

Insights

Both concepts would work on Mars. Although as a conclusion you can say that concept 2 is better prepared to function well on Mars than the reference concept.

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Experiment Design Document

High robutsness: Robot Crane vs 3D printer

Question (uncertainty)
Can I be sure that the (spare) parts generated by the 3D-printer are robust enough if we use materials just from Mars?

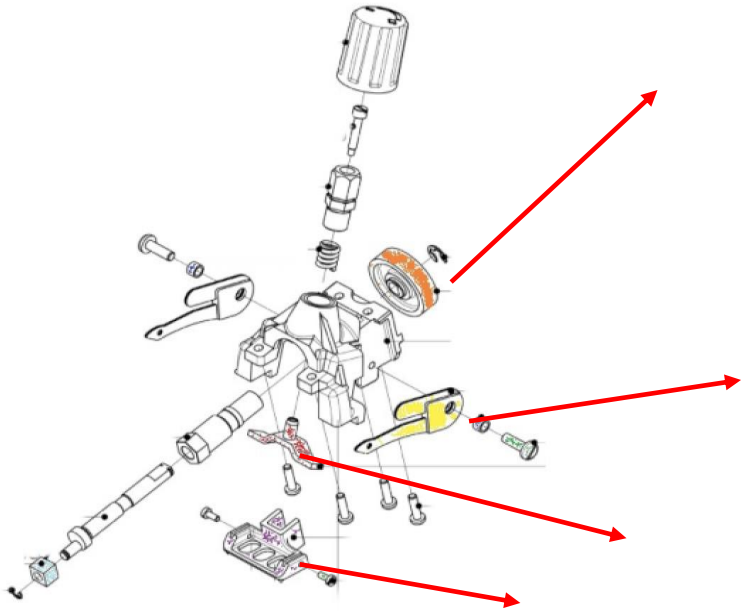
Author
Lukas Mitmasser, Karelia UAS

Method
I will research in which areas 3D printers are already used and what kind of material would be appropriate for a use on Mars.

Prediction
I believe that it will work with the right material from Earth or the extraction of suitable resources.

Model/Rationale
As NASA and partner companies are already trying to build habitats for astronauts to live on Mars, I think that they could also find material that´s usable for a precise thing like a robotic system.

Illustration w. Keywords



Will the 3D-printed (colored) parts be as robust as the initial parts of our robotic system?

Experiment Results and Insights

High robutsness: Robot Crane vs 3D printer

Question (uncertainty)

Can I be sure that the (spare) parts generated by the 3D-printer are as robust if we just use materials from Mars?

Author

Lukas Mitmasser, Karelia UAS

Results

According to scientists, the most abundant resources in the crust of Mars are silicon, oxygen, iron, magnesium as well as aluminum and calcium, which are already used for 3D-printing. So, we need an additional machine or technique to extract these resources from the crust and feed them to the 3D printer.

Insights

My results are in line with the prediction, but I gained knowledge in my research - especially about 3D-printing methods. As an example: I didn´t know that the technology with metal 3D-printer is quite far developed so that they can already produce complex parts by heats fine metal powder and then prepare it with a laser beam. Furthermore, I learned about materials in the Martian Crust and the plans for a living on the Mars.

Experiment Design Document

Solution Instruction Developing: Simulation on for same situation vs Using compression algorithms

Question (uncertainty)

Is taking raw material, printing 3d parts, and tools better than only taking necessary tools in Mars exploration considering redundancy perspective?

Author

Halil Ibrahim Uluoglu, UEF

Method

I will create a scenario and record a video from a video game simulation which is based on real physical rules and facts.

Prediction

- Based on expert estimation, It is important that to bring what you need considering about every pound is worth 10K$ even more for Mars. In this matter, It is to bring just raw material and convert to useful tools and parts. Also, It is good to recycle the tool and make another tool for its purpose. Therefore, 3D printing provides high level redundancy for Mars exploration.
- Taking raw materials more convenient than taking only some tools because you may able to convert raw materials to different tools.
- Therefore, we think printing tools will make good difference about time and cost.

Model/Rationale

We believe that if we want to understand and see the real results of the Mars atmosphere outcome and for this challenge, we need to arrange the same conditions as same as the real world. So, we use a video game simulation for this better and deeper understanding of this experiment. It based on facts and physical rules. Therefore, using this game for the experiment will help us to see millions of possible probability atmosphere and It will show quite close real results.

Illustration w. Keywords

If you can't play the video, please click here to go the video source.

Experiment Results and Insights

Solution Instruction Developing: Simulation on for same situation vs Using compression algorithms

Question (uncertainty)

Is taking raw material, printing 3d parts, and tools better than only taking necessary tools in Mars exploration considering redundancy perspective?

Author

Halil Ibrahim Uluoglu, UEF

Results

- Time and cost are one the main issues, so it is important to consider wisely. Therefore, taking only some tools increases redundancy because of reusability.
- Taking raw materials and printing parts and tools method is can create different tool options.

Insights

The findings suggest that some basic changeable possibilities are fixed for general purpose such as which material type. It is assumed that the materials suit printing tools and parts for this purpose. Also, including the life of a tool is important for redundancy. If a tool runs out of its time, converting that tool is a better option comparing from throw away.