

GALAXY GLIMPSES INTO THE FUTURE

THE MARVEL OF MARS: HOW TO ORGANISE LIFE IN SPACE IN 2200?

A SPECIAL REPORT FOR ELON MUSK
AND OTHER ENTHUSIASTS OF THE FUTURE

August 2017



Mêtis[X]

Thought Squad on the Hyper Future

QUID:



Derived from the ancient Greek divinity *'mêtis'* symbolising craft and cunning, **Mêtis[X] is an eclectic thought squad of millennials on the hyper future.**

Founded in 2017, Mêtis[X]'s taskforce spans across 50 countries and includes entrepreneurs, diplomats, engineers, policymakers, artists, consultants, neurosurgeons, philosophers, economists, all aged 20 – 30 years old.

We do two things:

- Crystallize the major challenges of the deep future in 180-second analyses.
- Run an apolitical, cross-generational forum where millennials meet Heads of States, CEOs, tech leaders and innovators to discuss the deep future and imagine the impossible.

Mêtis[X] and this report are not funded by any organisation or individual. We do with our own means.

HQ: metisx.com

*Many thanks to everyone at Mêtis[X] and beyond for their thoughtful contributions and comments on this report.
This would not have been possible without you.*

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New Concept Report for Elon Musk

Ideas on Mars from Millennials of Earth

 **15 MIN**

COSMIC CIRCUS: MARS IN 2200

HOW TO ORGANISE SOCIETY AFTER EARTH?



AFTER COLONIZATION, HABITATION.

Abstract

A guy from present Earth named Candid time travels to Mars in 2200.

The mission, codenamed *Megamorphosis*, seeks to study Mars' futuristic micro-society as an opportunity to reinvent the way we do things on present Earth and to uncover the solution to humanity's survival dilemma: how do we make *homo sapiens* a living interstellar species? A week after, Candid comes back to tell the world what he saw. Yet on return, the time machine crashes. He dies.

The ten hours filmed by his GoPro are the only thing that survived.

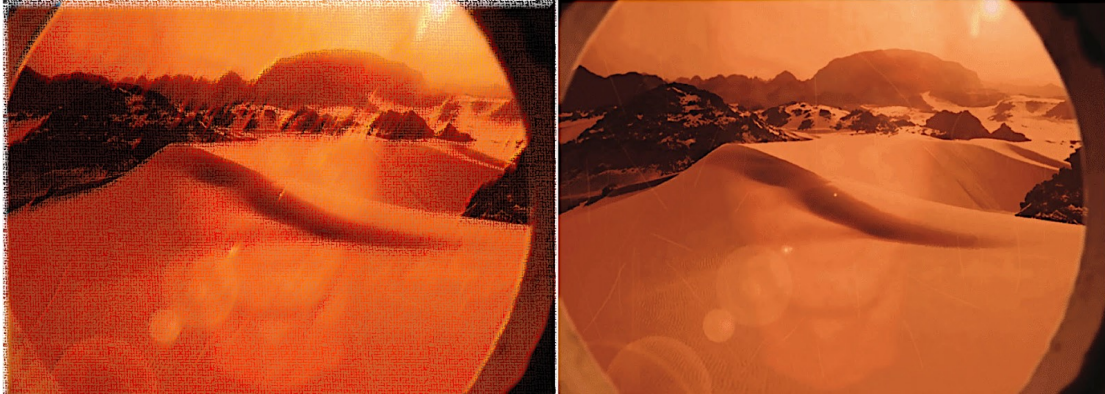
This new concept of report tells an actionable strategy, readable in 15 minutes, to structure and sustain a fully-fledged human society on Mars. Grounded on multidisciplinary research and real-world data, we analyse the science, economics, politics, law, innovation, anthropology and psychology of Mars in the deep long term 2100 – 2200.

The report's ultimate aim is to think and fire ideas of possible human futures.

SNAPSHOT

- I. PROBLEM STATEMENT & MARS MODEL
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- X. CONCLUSION: TESSERACT THINKING
- XI. AFTERWORD

WHAT MAKES THIS REPORT'S VISION DIFFERENT?



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THREE THINGS.

1) ***Rapid thinking.***

Written in two weeks on purpose, this paper offers a quick thought experiment of the future with sufficient elasticity to capture and imagine its different possibles.

Among the currently known planets that are 'similar' to Earth, Mars has the best lyrics. What we suggest is a possible tune. We don't turn the page of Earth, but open the book of Mars in all its multi-dimensions.

2) ***Multi-cultural, multi-perspective thinking.***

The ideas in this paper come from Mêtis[X]'s global team, which spans across 50 countries, from France, India, Syria, China to the U.S, Denmark, South Africa, Russia and Peru.

We explore and interrogate the *future of everything* in a virtual microcosm that starts from scratch (Mars). We do it through a holistically wild exploration of the Red Globe: economics, law, education, AI, time, etc. Mars offers many menus, from closed economy to robot-led society. Which form of organisation should we choose? Which futures can we pursue, with which risks?

3) ***Millennial, fresh thinking.***

We're no Mars experts. We are young, we bring fresh optics, and we still eat cereals in the morning.

PROBLEM STATEMENT

There are four certainties in life. Taxes, death, traffic complaints (read: Elon Musk) and species trying to survive.

A post-traumatic stress response to Earth's eventual implosion, group therapy or adventurous crusade into the unknown, the idea of living on Mars firmly took shape. In a sense, Martian colonisation is the opposite end to the Venetian Senate's Decree in 1511 that stipulated, '*Henceforth, no new fashion that may be imagined or told shall be suffered*', because Martian society is exactly this: the splashy spinoff of newness, imagination and storytelling.

Mars madness kicked off with W. von Braun's 1953 plan² and later Boeing's nuclear thermal propulsion (NTP) designs³. Books and papers⁴ on Mars now abound. They are well-thought yet collectively suffer from five weaknesses.

- **Weakness #1:** They pose questions, rarely offer ideas or strategies, and essentially conclude: '*In short, we have no clue what the hell is going to happen on Mars*'.

- **Weakness #2:** They often solely focus on science (e.g. atmospheric mix in the motors, rocket's launch pads on Mars), which, although supremely important, fails to offer a holistic comprehension of a possible Mars society.

- **Weakness #3:** They focus on the period right after the first Mars mission (i.e 2020 – 2040), thus overlooking the multifaceted, long-term risks and potentials of the deeper horizon (2100 – 2200). This 'short term' approach of a Mars society is biased: within the 5 – 10 years following colonisation (the timeframe currently envisioned by research), just-arrived colonists will be a small team of astronauts, not a fully-fledged society of implanted extra-terrestrial humans as such, i.e. a possible object of robust societal analysis.

- **Weakness #4:** They don't connect the dots. They insulate the study of Mars from life on Earth, yet both are interwoven. Earth produced sufficient knowledge to make Mars possible. Mars, as a micro-society both starting from scratch *and* benefitting from that accumulated knowledge (which differentiates it from the first *homo sapiens* communities), will think everything from zero and will prototype new solutions with potential Earth applications.

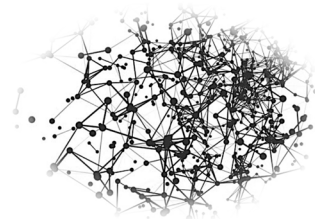
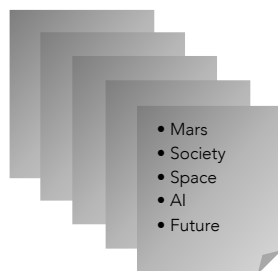
- **Weakness #5:** The papers are either too complex, too long to read or only accessible via a paid journal subscription. Thus, they fail to engage with the public, especially the millennials and Generation Z, who constitute the ultimate powerhouse of Mars colonisation⁵.

Existing:

Sectorial, silo-thinking on the science of Mars; society; space; AI; humanity's future... (papers, sci-fi movies)

Absent:

Systemic, transversal thinking to create a multiplanetary species strategy



We offer to Mars decision-makers a new concept of report. Digestible by everyone in **10 – 20 minutes**, we focus on the meta problem that hasn't yet been answered but will be the most consequential once humans make it to Mars:

How can we effectively structure and sustain a society in space?

MODEL & ASSUMPTIONS

This fast-forward paper is designed to be read quickly and thus *cannot be exhaustive* in its analysis of all the components and implications of a future Martian society. Therefore, we simplify our model and assumptions. The aim is to identify and answer a few of the most impactful, long-term questions about the future of human life.

■ **Mission Assumptions:**

SIMPLIFIED MARS MODEL FOR THIS REPORT

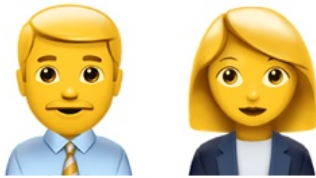
- **Headcount of human colonists:** 1,000
- **Headcount of non-human colonists:** 300 (social humanoid robots)
- **Headcount of vehicles and mobility machines:** 2,000 (transport rovers, bicycles for astronauts, etc)
- **Gender:** 500 women, 500 men
- **Age:** 250 colonists between 25 – 30 years old (unlikely that many people below 25 would be able to afford the trip at this moment of her life), 500 between 30 – 45 and 250 above 45 years old
- **Nationalities:** 100 (approximately ten colonists per country)
- **Trip Cost:** \$200,000 predicted by 2030-50%, although economies of scale will incrementally cut it.

■ **Scientific Assumptions:**

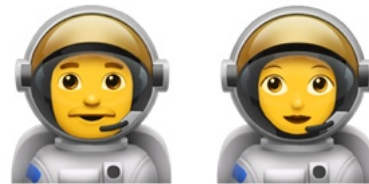
Following current scientific research⁷, we assume that Mars colonisers conclude in 2035 from bio-medical tests that human bodies are not adapted to long-term deep space travel from an evolutionary viewpoint. Key problems are ultra low-gravity and bio-physiological responses to ionising radiation, long analysed⁸. Anti-radiation shield vests (like the *AstroRad*⁹) help. But during the first ten years of exploration, 20% of the crews either died on Mars or had consequent medical complications during the long space flight.

We thus assume that, rather than post-adapting space travel or Mars' environment to human astronauts, colonists pre-adapted themselves to deep space after 20 years of research. Despite legitimate ethical issues, out of fear of eventual extinction humans decided to create the *Darwin X Accelerator* in Geneva, where they could artificially accelerate some specific bio-evolutionary characteristics and capacities of would-be astronauts. For example, improving sensorial-motor abilities to increase their tolerance to permanent deprivation of terrestrial gravity.

■ **Sociological Assumptions:**



Average human being on Earth



Average human colonist on Mars

The first human society on Mars will probably not sociologically represent human society on Earth in various respects.

Some possible characteristics:

- *Health:* healthier (to weather a rocket launch)
- *Skill:* fluent English speaker
- *Psychology:* more risk-prone (to go to deep space)... etc

**ICE AGE. STONE AGE. TECH AGE.
THEN WHAT?**

INTO THE VORTEX

Mission: *Megamorphosis**. Objective: *Reinvention*.

*Scale variant of *metamorphosis*, itself derived from the Greek *Morphōō*: ‘To transform... while maintaining our inner reality’.

‘Guys, we finally made it to Mars! – Well, what do we do now?’

This paper is neither a rosy-cosy novel on space conjured out of thin air, nor the vapid figment of our sci-fi imagination.

It’s a fact-based, storytold strategy of how we could run Mars.

And, incidentally, how we might rethink and reboot life on Earth.

Following the famous novel of Voltaire¹⁰, whose sharp mind enlightened the 18th century and who imagined the adventures of a naïve person discovering an incomprehensible new world, we imagine that an enthusiastic guy from Earth named Candid time travels to Mars in 2200 to study how colonists live.

He lands in *Atomic Red*, the Martian capital, and blends in for one week, pretending to be just another colonist. What does the Mars metamorphosis look like? What are humans up to in 200 years’ time?

His forehead camera, sole survivor of the mission, candidly recounts what he saw.

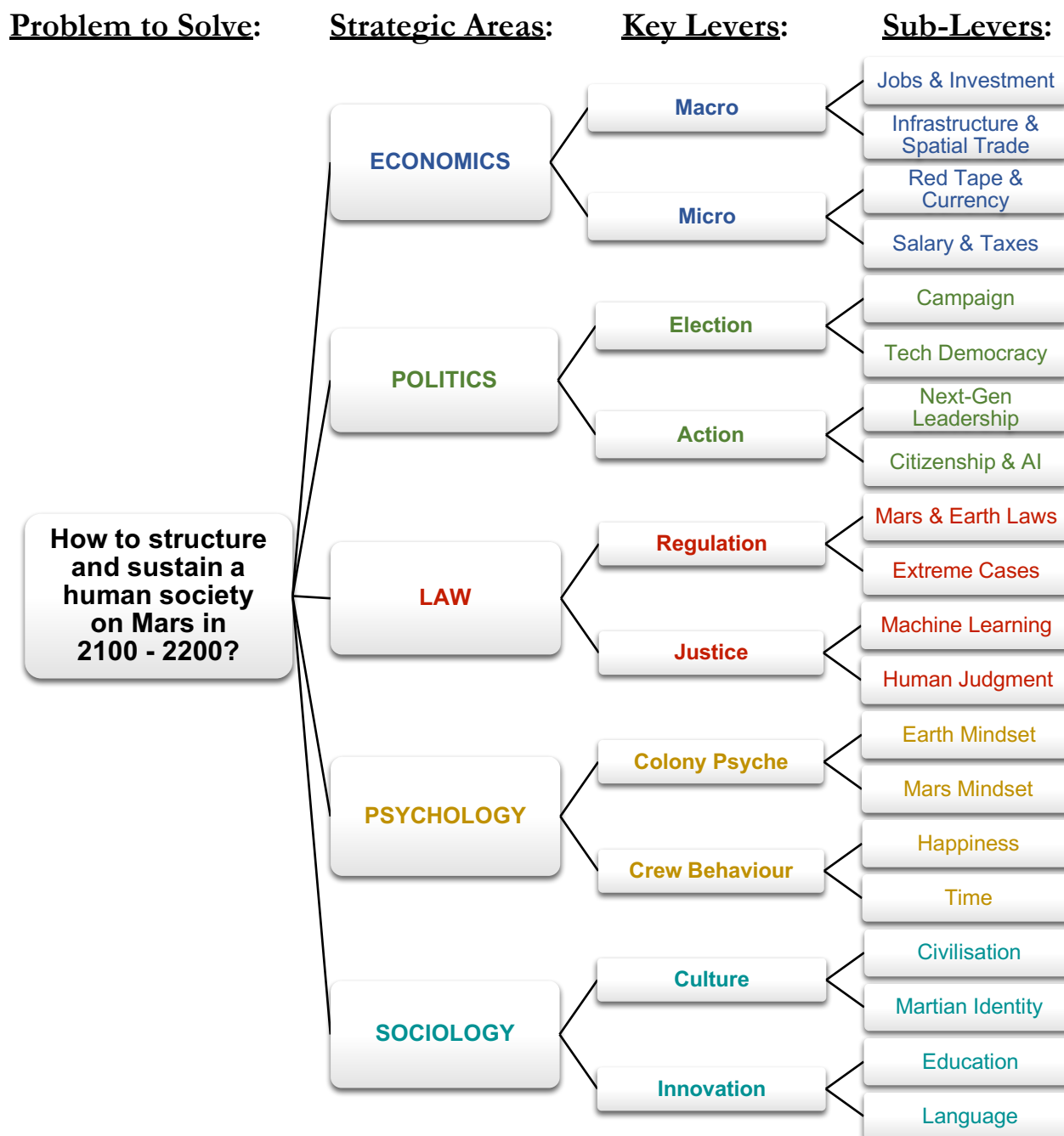


A Blueprint to Organise the First Human Society in Space

• Systemic Issue Tree •



Panorama shot by Candid: 'Mars Capital: Atomic Red. 14 August 2200'.



● REC | Tape #01 : THE ECONOMICS OF MARS

● RED TAPE & CURRENCY

Candid's GoPro tapes show that each colonist has a tiny implant termed *Ubiquitous* below their right fist. The implant enables swift monetary transactions through handshakes, from Martian supermarkets to deals signoff. It appears linked to an AI-powered neural implant in the brain named *Morpheus* (from the *Matrix* character giving access to parallel worlds¹¹), which enables colonists to 'visualise' the exact amount to transfer and to think algorithmically about the world¹². *Ubiquitous* replaces virtually every card on Earth (mirroring Estonia's innovative system): credit card, ID, social security card, driving license, gym pass. People pay in *Marz*. This *sui generis* currency is completely dissociated from all Earth currencies like the dollar, euro or yuan. 1 *Marz* equals 1 *Marz*, nothing else (except rare cases). Therefore, the Martian financial ecosystem is insulated from volatile stock fluctuations in New York or Hong Kong.

● JOBS, INVESTMENT & PRODUCTIVITY

Martians were quick to specialise their tasks along their specific skills and pre-mission training. The 1,000 colonists (plus 300 robots) segmented themselves along 7 batches to maximise efficacy. Each group has a streamlined function, like an organ. All inbound private investments on Mars (SpaceX, Blue Origin...) are sliced along these segments.

E **I. Catalysers (10% of colony):** AI-enhanced civic leaders (Mars' response to Earth's politicians/policymakers)
C and 'project implementers' for infrastructure and public impact (aided by *Mongol Barota*-style¹³ rovers).
O **II. Enablers (25%):** agile designers, strategists, app developers to robotise human tasks / improve processes
N and decision-making on Mars (hackathons happen every day to win the weekly monetary prize *Eureka Mars*).
O **III. Disruptors (10%):** scientists, inventors from Mars' *'Next is Now'* lab, philosophers, metadata analysts to
M pre-emptively devise/prototype solutions to problems that haven't arisen yet, and to power Martian innovation.
I **IV. Alchemists (15%):** next-gen organic farmers, cooks, starlight-energy wizards, robot food deliverers, water
C extractors equipped with MPC-1 bicycles adapted to Martian microgravity and regolith soil¹⁴, R&D researchers.
T **V. Coordinators (25%):** infrastructure architects, digital lawyers/bankers, teachers, economists, urbanists.
E **VI. Healers (10%):** AR glasses-equipped doctors, 'surgery duos' (surgeon and personal cybernetic aide),
A psychiatrists, gym trainers, DNA experts using nanotech to deliver drugs to precise spots in Martians' bodies.
M **VII. Connectors (5%):** holograms engineers for Earth-Mars family conversations, interplanetary comms
officers for trade negotiations, diplomats dealing with Earth's governments and reaching out to outer space.

Young colonists who do not have specific abilities yet use *JOBOM (JobonMars)*, a Tinder-like hologram app where employers (needs) and young short-term freelancers (skills) match for local tasks. Empowering this megatrend of the gig economy produced higher growth by stimulating productivity and aggregate consumer spending¹⁵ on Mars.

● SALARY & TAXES

Each colonist gets the same salary (900 *Marz*)¹⁶, which they spend on food, books, activities. They know how much they have in their '*Marz* mass' (the bank account equivalent) by mentally making the request to their neural implant. *Ubiquitous* then displays a hologram above the arm with the figure. There is no tax¹⁷. The UNU (United Nations in the Universe, a new space branch of the UN), NASA, private companies and philanthropies handle a chunk of Martians' monthly expenses via cryptocurrency transfers of *Marz* to the colonists' *Ubiquitous* (acting as embodied banks). Transfers are run by *Medusa*, Mars' massive quantum computer with an off-switch in case of 'non-optimal' behaviour¹⁸, which makes algorithmic predictions of Martians' monthly needs: salary mass, food, water, oxygen...

● EARTH – MARS TRADE (40% OF MARTIAN ECONOMY)

This is one of the rare occasions where Earth currencies can be converted into *Marz*, thus where the Martian currency is subject to terrestrial inflation. All currency exchanges are processed by the Martian Central Bank, a team of 10 Earth-trained economists from the *Coordinators*, linked to the ECB, Fed and BoJ. Earth countries export high-tech, packaged food, infrastructure & clothing material to Mars via the ISS station. Martian corporations export scarce¹⁹ elements it mines out from its extra-terrestrial soil²⁰. Yet some Earth firms devised deep-learning software to predict Mars' economic behaviour as a trade partner, based on historical data, past Martian commercial decisions and current industry trends, giving them an unfair advantage in their pricing strategy. Candid asks himself: *'Machiavelli in space?'*

● **ELECTION**

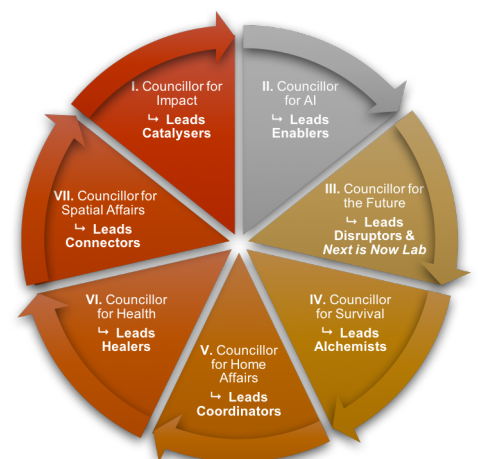
Candid's camera captured something unique: the future of presidential elections. He seems to have observed the final days of the campaign to become one of the *Seven*, the rotating council of colonist-citizens that runs the Republic of Mars. The *Seven's* symbol is a circus dome 🎪, a result of Martians' irony after various waves of colonists unsuccessfully tried Earth-style forms of governance or their variants between 2040 and 2090. They realised the best model of a Mars government was *ad hoc* and unique to Mars. There are no political parties as such. Seven colonists are elected every six months to handle Martian affairs. The election process runs through seven days with seven tasks:

- **The Trial** (*Day 1*): a 24-hour virtual reality political game simulation. All candidates are immersed in a virtual city as mayor for a day to assess their leadership, response to fear and anxiety, emotional intelligence (behaviour with colonist-avatars in the game), responsiveness to arising local crises such as colony riots or sudden atmospheric storms, and their ability to capture opportunities such as infrastructure investments and negotiation of alliances.
- **Hi, It's Me** (*Day 2 and 3*): team door-to-door campaigning with augmented leaflets, autonomous flying vehicles and big data to target the most likely voters (voting is not compulsory). Candidates can use up to five 'emotive' humanoid²¹ robots, which are able to use seamless paralinguistic and humanlike social intuition²², as well as five of their personal holograms to amplify their simultaneous presence in different locations.
- **Meta AI** (*Day 4*): a predictive algorithm called *Kratos* (named after the Greek god of power) measures, from a scale of 0 to 100, the candidate team's predicted effectiveness based on their quantified policy objectives, capacities, individual psychological traits, combined past experiences and external elements such as Martian temperature forecast for the next six months (as the Martian agricultural economy relies on it).
- **Fitness Tests** (*Day 5*): to ensure the candidates' fitness to the particular conditions of Mars (62% less gravity than Earth, 2% of nitrogen in Mars' atmosphere compared to 78% in Earth's, 73% colder in median terms²³).
- **Final Debate** (*Day 6*): a live debate of the two running teams (three speakers by team) to clash on policy, which Martians renamed 'PAP' (precise action plan) and on their knowledge of advanced AI (in 2200, AI is the electricity of society²⁴). Transmitted to Earth in real time.
- **Democracy Vote** (*Day 7: Election Day*): based on these facts and data as well as their own impressions and emotions, the colony votes in the Mars Agora with a simple majority show of hands. The election impacts space trade prospects, so Earth's stock markets are on virtual hold twice a year, on each election day, to wait for the results.

MARS GOVERNMENT & FEEDBACK LOOP:

● **ACTION**

Because Martians had to reinvent everything in order to live (survive), Mars has been innovation's torrid torrent from day one. The colonist-entrepreneurs reinvented innovation itself, innovating in the *very way* things are structured: they morphed politics and economics tightly together to create an effective, proactive ecosystem where everyone feeds back each other. The dynamic political council mirrors the energetic economic force. Each member of the *Seven* (Councillor) runs one of the economic teams of Mars. Councillors are not Ministers. They are team leaders.



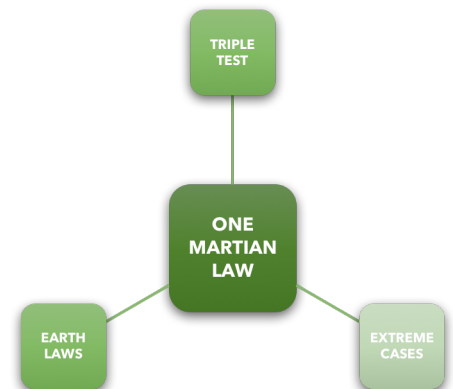
Moreover, the Martian political system is heavily colonist-centric. The colony acts as the Martian parliament and can veto any important decision, e.g. in geopolitics (relations with Earth). In its action phase – when the *Seven* citizen council effectively governs –, colonists also submit their policy ideas every Monday during a town hall. The council then selects one idea each week and is bound to implement it. Martian politics is also fiercely AI-centric. For infrastructure ideas, the council relies on the data gathered by *Ptah* (derived from the Egyptian construction god Ptah, 'the Opener'), a backpropagation AI algorithm in Mars' quantum computer that calculates in real time the stocks of Mars-produced elements (cement, iron, zinc, aluminium) and orders products from Earth in the event of shortfall. *In the future of society, who decides? People or data?* Candid reflects.

● **GENERAL REGULATION**

For the purposes of swift and stable species establishment, the Martian regulatory framework was simplified into a systemic and agile three-leg scheme:

#1. The Triple Test (TTT): for all legal matters (be it contract law, public law, an investment, data rules, rights protection or intellectual property), rules and decisions are determined via the *'triple criteria test'*:

- *Efficacy*: factual outcome of new rule (e.g. proactive AI regulation), nudge, proposed policy, corporation's investment, citizen decision etc, measured by performance metrics (e.g. cost savings).
- *Fairness*: protection of rights (the rights to air and non-invasive tech being human rights on Mars), unforeseen loss compensation, etc.
- *Legitimacy*: public sentiment polls, cost-benefit analysis to quantify the probability-weighted impact for the Mars colony/group.



#2. Earth Laws: multi country-ratified laws whenever they apply, e.g. principle of non-appropriation of celestial bodies in the 1967 Outer Space Treaty for issues of propriety/sovereignty²⁵ and other space laws, Universal Declaration of Human Rights, etc. Interplanetary trade deals are negotiated using a mix of Mars' triple test and the laws of the Earth country partner, because neither was ready to unilaterally relinquish its jurisdiction.

#3. Extreme Case Response (derogatory regime for national security): if an event (atmospheric storm, third-party attack... each has a scenario response) satisfies the criteria: 1) it is unforeseen, 2) it carries certain and immediate threat to the colony's survival, 3) it cannot be countered by regular means (existing legal frameworks), then the *Seven* has the temporary authority to assign all citizens to specific tasks to respond to the treat, e.g. defend with arms, give away food to those in need or retreat from surface into *Vulcan*, the Martian self-sustaining underground bunker.

● **JUSTICE**

Martian justice is a hybrid designed to maximise efficacy and minimise human error²⁶. It is administered in four steps by a team of experienced jurists and *Salomon*, the Martian quantum computer's legal arm.



Essentially, *Salomon* is a neuroscience-inspired AI software. Thanks to its deep reinforcement-learning (DRL) architectures²⁷, *Salomon* has human-inspired traits like inquisitiveness. It can assess the probability of a crime in the future (24 months) and make recommendations by analysing raw data and psychological attributes. Data is semi-anonymised: only the Court of Mars (trained jurists) can access the records. Its conclusions then facilitate the team of human jurists in making the final call. In case of an offense already committed, *Salomon* calculates the risk of relapse. Sanctions are mainly monetary, yet if an individual is deemed to be a threat to the colony, her Martian citizenship is rescinded and she is sent back to courts on Earth via the bi-monthly Mars Shuttle Express (the *Mashex*).

● **FIGHT CLUB & TECHNO-CULTURE**

Colonists cleverly devised the Martian legal system so it can self-adapt by leveraging insights from immunology theory²⁸. Every month, Martian hackers (from the *Enablers* economic team) participate in the *Tech Fight Club* challenge. The prize goes to the hacker that successfully 'provokes' *Salomon* by plugging sabotaging signals into its core algorithm to disrupt it. They provoke it in the immunological sense: provoked like a human cell, *Salomon* automatically uses its defence mechanisms, which allows the hackers to reverse-understand any potential pathology or risk and constantly improve the software. The reason for this is also cultural: Martians solved the issue of public trust in robots²⁹ by proactively engaging citizens in their shaping, ensuring prior public validation of each ground-breaking tech on Mars.

● **SURVIVAL PSYCHE**

Candid's tapes and comments show a sharp psychological division among Martians. Those *brought to Mars* (from the first waves of colonising missions) are in a state of permanent survival mindset. They've come knowing they'll never come back. Despite pre-mission emotional intelligence tests, the permanent lack of connections with family and friends who stayed on Earth created severe anxiety. Having experienced Earth's comforts, they struggled to accept that Mars is *hostile* to human life and will try to kill them if they removed their suits (although the *Atomic Red* city has oxygen-capsuled facilities). The fact that life on Mars necessitates greater levels of cooperation than life on Earth³⁰ somewhat smoothed the psychological transition by bonding colonists in one united family.

On the contrary, those born on Mars perceive Mars as their natural home. 'On-site' reproduction and educational programmes to teach Mars native kids the basics of survival began in the 2090s. Their bodies and minds have adapted more quickly to Mars. These different adaptation levels produced major legal challenges. One was devising a two-step mitigating circumstance for assault cases, if the assaulter is a 'from-Earth colonist' and is diagnosed a 'space anxiety rage' (SAR) during the offense. Why? Because Martian society is designed as hyper-intelligent rather than hyper-rational: it deals systematically with the rational, technological *and* emotional aspects of the problems it faces³¹.

● **HAPPINESS**

The beginnings of Mars were terrible. The reason was that, beyond the appeal to the grandeur of human destiny and spicy adventure, no real incentives were offered to primo-colonists. After all, why would you want to pay a lot to live permanently in a stretched suit away from your friends and without Wi-Fi?³² Among other issues, skyping family was difficult because of poor Earth-Mars internet signals. A third of the colonists grew permanently bored or insane.

Solutions were incrementally found. *Medusa*, Mars' supersensitive quantum computer, provided light-rapid, unhackable Wi-Fi through photons and qubit technology³³. This allowed Martians to stay connected to the ones they love. Every week, Martians also voluntarily pitch into the *Mars All-Fun Fund* (MAFU). Managed by Mars' chief happiness officer (CHO), it funds activities for pure fun purposes up to 50,000 *Marz* per week. The GoPro tapes show a mix of: birthday shindigs, conscious-dream sensorial simulations, speed-dating events at *Mars Match*'s HQ (the Martian social network), Moon expeditions, 'Never-Bored' race challenges in underground Hyperloops, zero-gravity football games or 5D cinema equipped with next-generation VR lenses, haptic pads, smell dispensers and Earth-imported sweets. Candid makes a mental note: *'It seems that in 2200, humans have rediscovered how to have fun'*.

● **SOCIAL BEHAVIOUR: THE TRUMARS SHOW**

Like in the *Truman Show* movie³⁴, the first Mars colonists in history (2020 – 2040) experienced severe levels of exposure and attention: 24/7 cameras and Facebook Live called *'The Village'* transmitted on every news channel worldwide. This literally transformed the first human mission to Mars into the biggest TV reality show in history. As explored by earlier cognitive research³⁵, this affected the colonists' behaviours as they either sought to be liked by the viewers or developed psychotic disorders from knowing to be an object of daily entertainment. This fractured the group and increasingly hurt collective efforts, illustrating the second law of thermodynamics that a system becomes gradually chaotic³⁶. By 2100 however, humans began exploring other planets and the original cast crew morphed into a fully-fledged society of colonists – too big to be filmed and too ethically sensitive –, thus drifting attention away.

● **TIME PERCEPTION**

Martian time is unique. Days are longer (24h 37min). One Martian year is almost two Earthly years. Given Mars' axial tilt variations, Martian summers are 48% longer³⁷. In the tape, Candid explains that this time dissonance had to be quickly resolved for Eartho-Martian commerce (e.g. negotiation of contract durations). The *Seven* council, the colonists and the UN ratified the *'Mars Res. #01: Time Equalization for Interplanetary Trade'*. It stipulates that all space commerce contracts use the new Space Time Span (SUS), i.e. the median of Earth and Martian timeframes. For example, a two-year contract on Earth which will in fact run for about a year on Mars, the agreement would be a contract period of 1,5 year *on both Earth and Mars*. This solved two exotic, space-time relativistic complexities³⁸.

● **CULTURES & COLO-CIVILISATION**

Martians are not a human species spinoff. Since the beginnings of colonisation, Earthians and Martians form one, interplanetary human species. There are about 100 different countries represented in the Martian colony. Colonists are matched in dormitories based on their friends and preferential living habits. This was inspired by the results of the space simulation experiment at Concordia South Pole Station – research having concluded that cultural and personal values impact the welfare of confined and isolated crews³⁹. On Mars, sex is also an antidote against isolation.

Mars has rich cultural dynamics. Each country sub-group runs a ‘*Discover Hub*’, sponsored by the country’s government on Earth through the UN’s new spatial branch, to engage the colonists with specific cultures through language or food-related activities. Local food is also sold at the *Mars Next-Gen Store* (think what you want to buy, the neural implant processes this unstructured data and sends a list to the store, then you go pick up your items). The Mars-Earth Cultural Committee also runs musical festivals simultaneously on Earth (e.g. NYC’s Time Square) and on Mars via advanced holograms, which means that Coldplay could throw a concert on the Red Planet from Tokyo.

● **MARTIAN IDENTITY: A QUADRUPLE NARRATIVE**

Martian culture has four principles. 1) Failure: a monthly award is granted to the best ‘*Fast Failers*’, i.e. colonists who experimented an innovation and failed fast, thus unlocking immediate insights for future adjustments. 2) Galactic diversity: the Martian flag is an oval, textile-embedded virtual screen displaying a loop of rotating country flags from Earth (same for the Martian passport). 3) People synergies: see below. 4) Super-autonomy: Earth has ‘smart cities’, Mars ‘supra cities’. Not only can they self-identify problems (like smart cities do through sensors⁴⁰), they can also self-solve them through autonomous software from the *Medusa* quantum computer. This culture comes from the fact that primo-colonists *had to be* extremely autonomous. 24/7 patrolling units of human ‘city runners’ in rapid aircrafts using ‘vertiports’⁴¹ and insect-sized robots can fly to the problem’s source when man–machine teamwork is required⁴². Candid wonders: *How do they govern AI in space? Is Medusa cleverer than the colonists? How do they control her? Do they?*’

● **EDUCATION BY DISRUPTION**

Critical thinking and problem-solving are the DNA of the University of Mars. There are four classes. 1) The multilingual *Regular* with Martian and hologrammed professors from Earth. 2) The *Automated* through an adaptive-learning software tracking the student’s needs. 3) The *Freestyle*, an inter-Martians brainstorm lab where they challenge and learn from each other (like France’s *École 42*). 4) The *Solutionner*, a crash course on *Hyperion* (god of wisdom), the in-house AI that can transform any input problem (e.g. how to grow more food) into a set of creative solutions. *Hyperion* is used by Martians only as a last resort, where their collective intelligence fails to find a timely solution – since 2100, AI has far superior general intelligence than humans⁴³ and Martians insist on reining it in where possible. In addition, the Martian University has lifelong learning trainings for professionals to sharpen their skills and learn new ones. There is only one final exam, called *Heart of Gold*⁴⁴. It lasts 24 hours. The question is always the same: *How would structure, solve and learn from this problem?*’. The problem can be anything from negotiation, math, history, crisis management or deep technology. The lack of further instruction is meant to teach cunning and resourcefulness.

Candid witnessed one incredible exam. The problem fitted in six words: *Nuclear war on Earth, starting now*’. Candidates submitted a written answer, before going into *The Trial* virtual simulation game to play the role of Councillors dealing with this problem as a team. The goal is to test the students’ capacity and inclination to leverage all the knowledge they acquired from different disciplines and from all their social interactions with fellow Martians. This is core to the fabric of Martian society – Mars’ economic team also leverages the colony’s different skill sets.

● **THE FUTURE OF SPEECH**

The colonists’ neural implants *Morpheus*, which increase the processing power of their brains, have an embedded language input-output system. It transforms what the other colonist says in her language (the raw sensory input) into sentences in the recipient’s tongue (the output) through a miniature ear set. That said, Candid’s tapes show that there that colonists mostly converse in English or Marsyrian, a mixed slang of many Earth languages from French to Finnish. This prompts Candid’s typical, voice-off questioning: *How come, in the future, tech isn’t the solution to everything?*’.

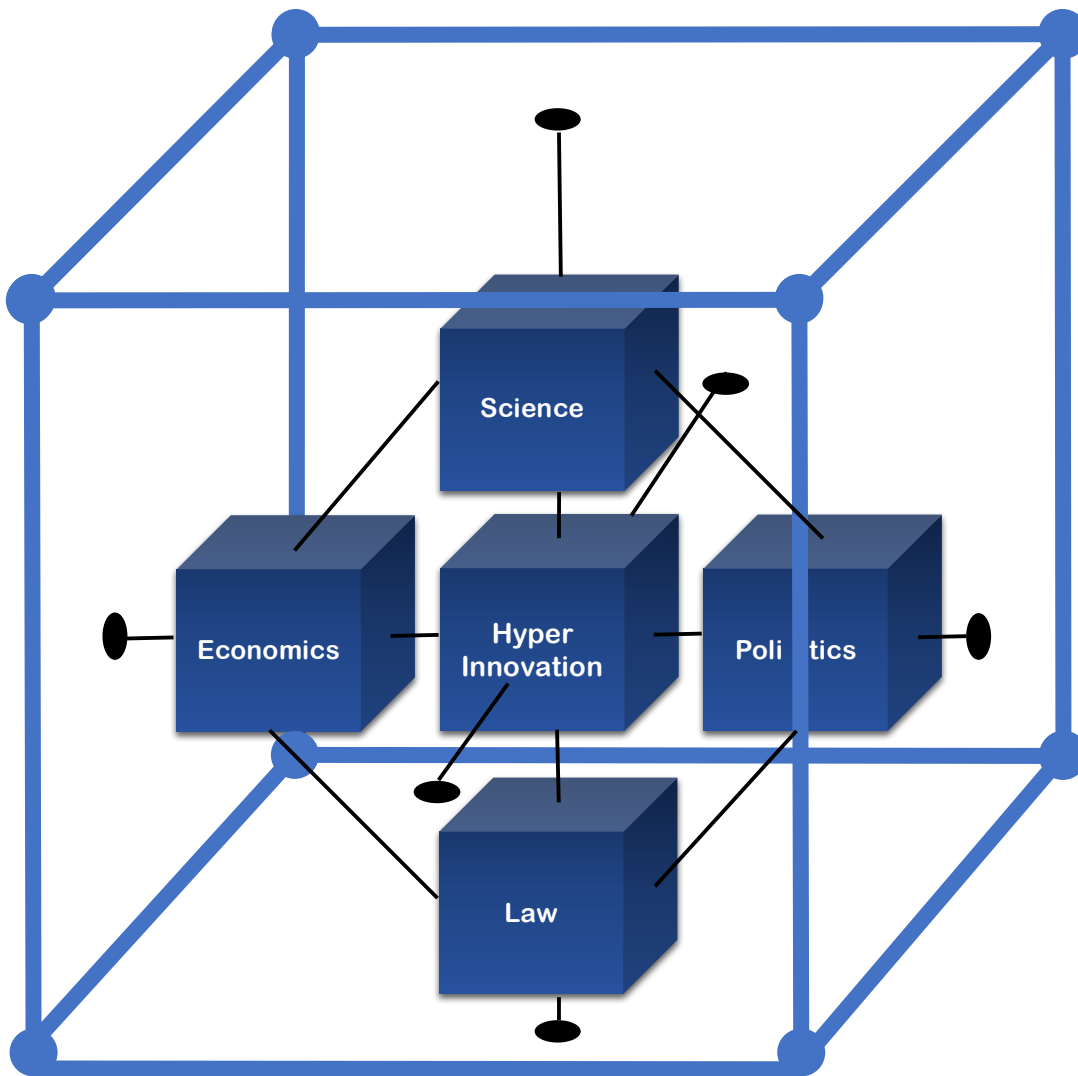
Conclusion: 5D Tesseract Thinking

Visualizing Mars Hyper-Innovative Society: Towards a New Epoch?

In this model, the thin arrows embody culture, attitudes and inter-connectedness.

The balls symbolize the acceleration of technology's impact on society.

The encapsulating cube represents time.



Reflection: The mathematician Charles Hinton gave birth to the word 'tesseract' in 1888, in an essay titled *A New Era of Thought* inspired by... Plato's cave allegory. Time occasionally loops.

● REC : The Philosophy of Mars. *Final Tape* – ‘HUBRIS’

During his one-week trip on Mars, Candid ingenuously studied the science, economics, politics, law, anthropology and psychology of the Martian society in 2200. On his last day, he exits *Atomic Red*, Mars’ capital, and motions towards the secret time machine’s extraction point to return to Earth.

At the entry of the capital he notices a glowing billboard displaying one word: Kainoō. Candid smiles when reading the footnote: From the Ancient Greek καινός: ‘We make new’. He decides to name the set of his Mars tapes ‘*Abiogenesis*’, a reference to the process of the origin of life arising from non-living matter, 4 billion years ago.

Suddenly, he overhears panic screams back from the city. His muscles freeze. Sensing that something is about to happen, Candid immediately turns on his GoPro.

These are the last ten seconds shot by his camera before he dies.

A code-red hologram is projected into the sky high above the city – the sign of a very rare case of emergency. The hologram displays a live image of non-human silhouettes approaching the city.

Had Mars’ hyper-clever tech taken over the colony’s 300 robots? Was another species trying to settle on Mars? Was the time machine malfunctioning and making Candid hallucinate?

Candid sceptically comments: *‘Every colonist thought they were alone. I see in front of me the...’*

The tape ends.

* * *

*

AFTERWORD

Maelstrom and Momentum

What challenges did we face drafting this stimulus paper?

Papers rarely narrate their difficulties. This one does. Nothing quite flowed friction-free. It was rather, as the Norwegians say, a *lappeteppet*, or happy patchwork iteration. We encountered three major challenges:

- **Finalising the report in two weeks, our self-imposed timeline.**

15 days to punch it, 15 min to read it. We condensed the background research and prioritised the paper's focal points. The reason is that, rather than overthinking, we wanted punchy freshness.

For example, there are some topics that we couldn't put under our microscope but may explore in a book sequel of this paper: Earth-Mars geopolitics, life expectancy i.e. ageing in space, environment, animals on Mars⁴⁵, interplanetary tourism, public/private investments, religion, selection of colonists, journalism, human biases ingrained in algorithms⁴⁶, space trip subsidies (so low/middle classes can go to Mars too), family, gender equality, science economics (e.g. ice mining), human rights, future of food, talent retention in deep space, energy, healthcare, sports, non-linear perception of time and its consequences⁴⁷...

Tellingly, this list shows the spectacular complexities of designing a systemic strategy from scratch to structure and sustain a prosperous multiplanetary species in the long run.

- **Inventing a new concept of paper.**

A hybrid of research-shaped strategy and storified documentary. The goal was to make this hybridity work in its argumentative and narrative dimensions to deliver something both scientifically robust and fun to read.

- **Credibly visualizing a possible version of the hyper future.**

Infusing scientific facts and current research about Mars, analysing likely-to-emerge trends, injecting different disciplines from economics to psychology and projecting our own ideas into the hyper-long future. The difficulty was that, unlike regular trends spotting (predicting what's next, in 5-10 years' time), we tried predicting what's next after next, in 2100 – 2200.

Of course, we do not pretend to know what Mars will eventually unfold.

We welcome the fact that in the Voltairian clash of ideas, any of our arguments can be criticised and that, when it comes to tech and space, the sands keep shifting beneath our feet.

Our ambition was simply to fire ideas of possible futures and to open the debate.

Merci for reading!

THE BORING PART

¹ T. Okey, *The Old Venetian Palaces and Old Venetian Folk* (1907), p. 281

² *The Economist*, 'Interplanetary Settlement: The World is Not Enough' (1 October 2016)

³ D. Rapp, '60+ Years of Humans to Mars Mission Planning' in *Human Missions to Mars* (January 2016), pp. 31-107

⁴ Some examples: N. Kraft, J. R. Kass & R. Kass, *Mars One: Humanity's Next Great Adventure* (2016); R. Zubrin, *The Case for Mars: The Plan to Settle the Red Planet and Why We Must* (2011); K. Szocik *et al.*, 'Political and Legal Challenges in a Mars colony', *Space Policy* (November 2016), Vol. 38, pp. 27-29; R. Shishko & R. Fradet, 'Mars Colony *in situ* Resource Utilization: An Integrated Architecture and Economics Model', *Acta Astronautica* (September 2017), Vol. 138, pp. 53-67.

⁵ A. Calzada-Diaz, M. Dayas-Codina, J.L. MacArthur & D.M. Bielicki, 'Role of the Current Young Generation Within the Space Exploration Sector', *Space Policy* (August 2014), Vol. 30(3), Part B, pp. 178-182

⁶ Elon Musk, 'Making Humans a Multi-Planetary Species', *New Space*, Vol. 5, n°2 (2017), pp. 46-61

⁷ K. Szocik, K. Lysenko-Ryba, S. Banás & S. Mazur, 'Political and Legal Challenges in a Mars Colony', *Space Policy* (2016), Vol. 38, pp. 27-29

⁸ B. Ehlmann *et al.*, 'Humans to Mars: A Feasibility and Cost-Benefit Analysis', *Acta Astronautica* (June 2005), Vol. 58, pp. 851-58

⁹ M. Bonetti, 'The AstroRad Radiation Shield', *TrendinTech* (15 March 2017)

¹⁰ Voltaire, *Candide ou l'Optimisme* (1759)

¹¹ The Wachowskis, *The Matrix* (1999)

¹² B. Christian & T. Griffiths, *Algorithms to Live By: The Computer Science of Human Decisions* (2016), pp. 6-7: 'Thinking algorithmically about the world, learning about the fundamental structures of the problems we face and the properties of their solutions [...] How to manage finite space, finite time, limited attention, unknown unknowns, incomplete information, and an unforeseeable future [...].'

¹³ K. Shafin *et al.*, 'Mongol Barota: A Next Generation Rover', *The 8th Int'l Conference on SKIMA* (December 2014)

¹⁴ J. Luis *et al.*, 'Proposal of a Bicycle/Stretcher for Mobility of Astronauts on the Mars Surface', *The Mars Society* (October 2014)

¹⁵ A. Dutt, 'Aggregate Demand, Aggregate Supply, and Economic Growth', *Int'l Review of Applied Economics* (2006)

¹⁶ The Martian labour market is not a pure flat salary market because Martians are also entitled to variable performance bonuses. Bonuses are collectively decided by each economic team, e.g. the *Coordinators* team decide for the bonuses of workers within that group, under the arbitrage of the Councillor of Home Affairs. The dual flat salary and bonus scheme has three benefits: 'starter' equality and a double productivity boost through the individual competition (within each team) and group competition (between teams to 'out-bonus' the others).

¹⁷ **NO-TAX ARGUMENT.** The economic logic behind the 'no tax on Mars' argument has three legs:

- 1) *Necessary attractiveness*: Making life on Mars financially more attractive than on Earth was one of the incentives proposed to primo-colonists in order to build a fully-fledged society (not just adventurous billionaires or NASA astronauts).
- 2) *Unnecessary complexity*: The ability to devise and install a complete tax architecture on Mars (tax bands, collection methods, procedures) rests on the assumption that the question 'which kind of taxes for an international society in space?' is solved. Yet answering this question means either having a politically sensitive debate on what tax regime on Earth is the best to be 'imported' to Mars (i.e. which country is the most tax efficient / fair) or finalising a complex arbitration to come up with a mix of different tax systems (which, historically, has produced mixed results, from the European Union to India). It would also require answering the questions: How much should we tax Martians? Is the Laffer curve applicable to Mars i.e. can we compute the tipping point at which tax revenues start decreasing because of disincentivised economic behaviour? That goes beyond the scope of the paper.
- 3) *No evidence*: Taxes are effective if there's something to be taxed, i.e. enough revenue levels at the micro level to make enough tax revenues at the macro level (to be reinjected into the economy). Yet *today* we

neither know the key drivers of a Martian economy nor how much wealth (and in what circumstances) will be generated on Mars in the horizon 2100 – 2200. Therefore, any design of a Martian tax system at this point would automatically lack an evidentiary basis and thus be economically invalid.

¹⁸ L. Orseau & S. Armstrong, ‘Safely Interruptible Agents’ (joint paper DeepMind & Future of Humanity Institute), *Proceedings of the 32nd Conference on Uncertainty in Artificial Intelligence* (2016)

¹⁹ T. Hartford, *The Undercover Economist* (2007); S. Mullainathan & E. Shafir, *Scarcity* (2014)

²⁰ R. Shishko & R. Fradet, ‘Mars Colony *in situ* Resource Utilization: An Integrated Architecture and Economics Model’, *Acta Astronautica* (September 2017), Vol. 138, pp. 53-67

²¹ AUGMENTED TURING TEST ON MARS.

The robots of 2200 have such an anthropomorphic appearance that they can readily be mistaken for walking human beings. To solve this, Martian colonists devised the *Augmented Turing Test*, a rejuvenated version of the famous 1950 ‘Turing test’. The Turing test states that a machine is intelligent if and only if it can successfully deceive a ‘knowledgeable observer’ into thinking it is human (A. Turing, ‘Computer Machinery and Intelligence’, *Mind* (1950), Vol. 49, pp. 433-60). The Turing test was criticised for its inability to assess whether a machine can truly think. For example, some programs like ELIZA could pass the test merely by manipulating some text without actually understanding it (J. Searle, ‘Minds, Brains and Programs’, *Behavioural and Brain Sciences*, 1980). These critiques have also been criticised.

Martians’ *Augmented Turing Test*, inspired from J. Searle’s ‘Chinese room’ experiment, draws on the philosophy of Descartes: ‘[...] it never happens that [a machine] arranges its speech in various ways, in order to reply appropriately to everything that may be said in its presence, as even the lowest type of man can do’ (R. Descartes, *Discourse on the Method*, 1637, Part V). The objective is to evaluate whether someone on Mars who pretends to be a human is indeed a human, not a disguised humanoid robot. The method is to test the ability to *understand and conceptualise* (not only to simulate this ability, like in the Turing test). The aim of this gatekeeper test is to keep machines out of human-restricted activities like democratic votes.

The Turing test concentrates on output. The Martian test focuses on process and authentic thinking. It consists in verbally asking the ‘person’: *Why are you who you are now?* If the person processes a neat and logical answer, it’s a robot, because by 2200 robots have learned forms of consciousness and how to conceptualise it, so given this input they can process that output relatively easily. If the person thinks first, struggles or offers an authentic, original answer (e.g. with biographical elements or references to friends), it is human. Thus, whilst Earth’s Turing test answers the question ‘*Can this machine trick us?*’, Mars’ augmented version really tests: ‘*Can we trick this machine to trick us?*’

However, this new test is far from perfect. Martians noticed that the exponentially-intelligent robots of 2200 sometimes try to also fool the tester by borrowing other colonists’ biographies and body language or by crafting vague answers on purpose to pretend they are less intelligent than they are. Thus, the tester runs an automatic background check of all the collective answers and compare them to historical answers of that robot and other data. The checking is powered by AI. Candid asks himself: ‘*So in the end, machines decide whether their fellow machines are machines?*’

²² R. Yonck, *Heart of Machine* (2017); C. Breazeal, ‘Emotion and Social Humanoid Robots’, *Int’l Journal of Human-Computer Studies* (2003), Vol. 58, pp. 119-155; C. Breazeal & B. Scasselatti, ‘How to Build Robots That Make Friends and Influence People’, *Proceedings of the 1999 Int’l Conference on Intelligent Robots and Systems (IROS99)*, pp. 858-63

²³ Elon Musk, ‘Making Humans a Multi-Planetary Species’, *New Space*, Vol. 5, n°2 (2017), pp. 46-61

²⁴ *MIT Tech Review*, ‘Andrew Ng’s Next Trick: Training a Million AI Experts’ (8 August 2017)

²⁵ S. Bruhns & J. Haqq-Misra, ‘A Pragmatic Approach to Sovereignty on Mars’, *Space Policy*, Vol. 38 (2016), pp. 57-63

²⁶ Recent research evidences that, in a sample of criminal sentences rendered by jurists in 2012, 36% of them were wrong because of human error (either ‘inappropriately severe’, ‘unduly lenient’ or even simply unlawful): Law Commission, ‘The Sentencing Code’, *Consultation Paper n°23* (27 July 2017), paragraph 1.10, p. 7

²⁷ D. Hassabis *et al.*, ‘Neuroscience-Inspired AI’, *Neuron* (July 2017), Vol. 95(2), pp. 245-58

²⁸ A. Abbas & A. Lichtman, *Cellular and Molecular Immunology* (2014), Chapter 5 ‘Antibodies and Antigens’, p. 87

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- ²⁹ G. Banavar, 'What It Will Take for Us to Trust AI', *Harvard Business Review* (29 November 2016); G. Banavar, 'Learning to Trust Artificial Intelligence Systems', *IBM Research* (September 2016)
- ³⁰ K. Szocik, 'Unseen Challenges in a Mars Colony', *Spaceflight*, Vol. 58 (January 2016), pp. 20-23
- ³¹ D. Hume, *Enquiry Concerning Human Understanding* (1748)
- ³² *The Economist*, 'The World is Not Enough' (1 October 2016)
- ³³ *The Economist*, 'Quantum Devices – Here, There and Everywhere' (*Technology Quarterly*, 11 March 2017)
- ³⁴ Peter Weir, *The Truman Show* (1998)
- ³⁵ J. & I. Gold, 'Truman Show Delusion: Psychosis in the Global Village', *Cognitive Neuropsychiatry* (2012), Vol. 17(6), pp. 455-472
- ³⁶ S. Carnot, *Reflections on the Motive Power of Fire* (1824); R. Clausius, *The Mechanical Theory of Heat* (1865)
- ³⁷ NASA, *Mars Facts* (<https://mars.nasa.gov/allaboutmars/facts>)

³⁸ **TIME**. There are two logical reasons why we suggest a *combined Earth-Mars time* for spatial trade:

- 1) Relying on one time alone would introduce a higher possible volatility of events and black swans on Earth as compared to Mars. One example highlights this point. In a two-year contract (Earth's time), there will be 8 seasons on Earth and 4 on Mars (e.g. Martian summer runs 48% longer). In probabilistic terms, this longer season timespan *of Earth* automatically introduces a higher meteorological possible variance *on Earth* because of higher season turnover (hence temperature and humidity changes). This can impact harvesting quality and costs for Earth firms, thus commodity inflation and therefore agriculture-related trade between Earth and Mars (in our model Earth exports packaged food to Mars and Mars is subject to terrestrial inflation). Combining both planets' timeframes in a new median time (e.g. contract of 1,5 year) allows to smooth out these dissonant volatilities.
- 2) Relying on one time alone is non-Pareto efficient i.e. fails to unlock all possible gains for everyone. Again, let's take the example of a two-year contract (Earth's time). On Earth, two fiscal years will elapse, which means that any firm participating in the Earth-Mars trade deal will be taxed twice so their profits will be cut twice. On Mars, the trade deal, translated into a one year contract *on Mars*, will necessarily create less wealth than if it ran for 1,5 year, in terms of salaries (i.e. consumer spending) and trade spillovers on the Martian economy as a whole (e.g. infrastructure). The assumption is that Mars is not taxed as explained in the paper. Combining both planets' timeframes in a new median time (e.g. contract of 1,5 year) allows to get closer to an optimal Pareto allocation by minimising wealth cuts (Earth) and maximising wealth gains (Mars).

The risks of 'creating' a new median time are diluted by the fact that it applies only to one-off, contractual deals and not to both societies in general. Nonetheless, our model here is simplified and unforeseen confounding factors could disrupt its economic logic.

- ³⁹ C. Tafforin & F. Giner-Abati, 'Cultural Ethology as a New Approach of Interplanetary Crew's Behaviour', *Acta Astronautica* (October 2017), Vol. 139, pp. 102-10
- ⁴⁰ L. Berntzen *et al.*, 'Sensors and the Smart City', *The Fifth Conference on Smart Cities, Systems, Devices and Technologies* (May 2016)
- ⁴¹ Uber Elevate, *Fast-Forwarding to a Future of On-Demand Urban Air Transportation* (October 2016)
- ⁴² J.P. Holdren *et al.*, 'Preparing for the Future of AI', *White House Executive Office of the President* (2016)
- ⁴³ N. Bostrom, *Superintelligence: Paths, Dangers, Strategies* (2014)
- ⁴⁴ Name derived from Douglas Adams' *Hitchhiker's Guide to the Galaxy* (1979)
- ⁴⁵ K. S. Robinson, *Blue Mars* (2009)
- ⁴⁶ Cathy O'Neil, *Weapons of Math Destruction* (2016); *MIT Tech Review*, 'Biased Algorithms Are Everywhere, and No One Seems to Care' (12 July 2017)
- ⁴⁷ D. Villeneuve, *Arrival* (2016)

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