

Web design's effect on user attention and information retention: an eye tracking study

Ioan Croitor Catargiu,
Sebastian Fredriksson Karvelas,
Mario García Iribas,
Guillem Navarra &
Alexios Vasileiou

Overview

- Advertisements are everywhere
- How do they influence the reader while reading on a webpage?
- Consulting performances between two groups of subjects
- Seeking differences
- Results show that ads play a noticeable role in performances

Content

1. Introduction
2. Methodology
3. Results and Discussion
4. Conclusion

1. Introduction

Relation to cognitive psychology

Research-motivated questions

Hypothesis

Relation to Cognitive Psychology

○ Attention

- Highest level cognition determines where to focus
- Serial bottlenecks when focusing attention on more than one parallel processes at the same time
- Stimulus-driven vs goal-oriented factors when choosing on what to focus
- Shift of attention represented by corresponding eye-movement

○ Working memory

- Articulatory loop through which an 'inner voice' rehearses information
- Phonological loop which is the 'inner ear', that 'hears' the inner voice and then stores the information in a phonological form
- Ability to rehearse items from the short-term memory decays over a very short period of time

Research-motivated questions

Q1. To what extent do ads on a webpage distract a user who is reading an informative text on a page?

Q2. Does the distraction of ads on a webpage lower the users ability to retain the information they just read in the short term?



Hypothesis (I/II)

H1. Visual attention to the text will be greater when the text is presented without any distractions (ads) than when presented with distractions (ads)

H2. Visual attention to the text will be lesser when the text is presented with distractions (ads) than when presented without distraction (ads)



Hypothesis (II/II)

H3. The performance on the questionnaire will be higher when the text is presented without any distractions (ads) than when presented with distractions (ads)

H4. The performance on the questionnaire will be lower when the text is presented with distractions (ads) than when presented without any distractions (ads)



2. Methodology

Definitions of Variables

Procedure

Design

Definition of variables

Dependent variable

Ability to retain information in relation to level of attention/distraction.

Independent variables

Distraction on the webpage.

Control variables

Same text, physical environment, noise levels...



Procedure

- Pre-experiment
- Experiment
- Post-experiment



Design (I/III)

Mock terminal program for 'tracking facial expressions'



2. Methodology

Design (U/III)

Pioneering the Final Frontier: The Emergence of Space Factories

Published on May 10th, 2012 | By Maxime Vermeir



As humanity's curiosity extends beyond the confines of Earth's atmosphere, a fresh narrative is taking shape, one with the potential to redefine terrestrial industries. What tradition has often been dominated by the rigidity of historical industry profiles, behind the scenes the world is quietly paving the way for the emergence of extraterrestrial manufacturing. Both startups and established tech giants are now venturing into the uncharted terrain of off-Earth manufacturing, with a focus on the challenges posed by creating complex components, harvesting raw materials, and processing pharmaceuticals in the unforgiving environment of space. This intriguing quest, which also aims to the staff of space factories, is tightly interwoven with science fiction, and its implications are reaching those of us on Earth.

The advent of "off-planet manufacturing" lies in the exceptional conditions that space provides. Beyond Earth's gravitational pull, space offers an environment characterized by high temperatures and an almost perfect vacuum. These conditions present a unique set of advantages, presenting obstacles to what is, indeed, an ideal place for specific chemical processes which our world's facilities contribute to further terrestrial pollution. In the quest for answers from within the industry, we speak to Joshua Westman, the CEO of Space Forge, an on-space technology manufacturing based in Utah. The early stages of the mission: "Space is a much better place to do almost any industrial process. I live in an planet where we're weighed down by gravity, the trade winds, refrigeration, and the various things to help manufacture products on earth. And you go to space, you get these benefits for free."

One of the industries set for a transformation at cosmic proportions is pharmaceuticals. Companies like Merck have joined forces with the International Space Station (ISS) to explore the potential of cultivating proteins in the unique environment of zero gravity. The results have been nothing short of extraordinary. Astronauts conducting the experiments for Merck have observed that crystal growth in space for the production of the enzyme drug Eptacin leads to a remarkable difference from their Earth-based counterparts. They are not only smaller but also more uniform, making crystallization possibilities for the pharmaceutical sector. Meanwhile, researchers at Bristol Myers Squibb have embarked on a quest to harness off-planet resources to improve drug design, a pursuit that encompasses various therapeutic areas, including immunology, HIV, and oncological disease, and neuroscience. The potential to revolutionize the pharmaceutical landscape is undeniable.

While recognizing the immense potential of off-Earth manufacturing, how have actively engaged in collaborative efforts with commercial partners since 2011. This initiative is driven by the aspiration to cultivate a "low-earth orbit" (LEO) economy, one that promises to encompass the vast market for satellite-based services. Fuelled by the ever-evolving tech landscape, however, the primary focus remains the next phase of space exploration in relation to risks and infrastructure.

In a notable episode, SpaceX Space Exploration, a California-based startup, captured the world's attention by launching a capsule into Earth's orbit. This episode, intricately labeled "SpaceX Dragon," exemplifies the growth of the private sector in space exploration, a strong commitment to creating jobs. However, as the capsule prepared to return to Earth, it encountered an unexpected hurdle. TechCrunch reports that the Federal Aviation Administration (FAA) had to be called in to deal with the capsule's return to Earth. This episode highlights a potential shift towards greater private sector involvement in transportation and manufacturing. This lack of Space Forge, estimates a future where almost all manufacturing is done in space, creating a new era of space-based manufacturing. "Imagine there's one factory that does most of the work and research has historically been performed after it, there may be less of the first. That gives us opportunities to leverage research and development in a more integrated, and

In fact, a significant transition is set to unfold as the International Space Station (ISS) approaches the end of its operational life. Decommissioning the ISS means not only Earth's orbit will be cleared, but also the depletion of the Pacific Ocean. NASA's response to this situation is to utilize one of the agency plans to have space on commercial space vehicles, a move that is expected to take a substantial 15 billion in 2015 alone. This transition signifies a profound shift towards more private sector involvement in space exploration and manufacturing. This lack of Space Forge, estimates a future where almost all manufacturing is done in space, creating a new era of space-based manufacturing. "Imagine there's one factory that does most of the work and research has historically been performed after it, there may be less of the first. That gives us opportunities to leverage research and development in a more integrated, and



Pioneering the Final Frontier: The Emergence of Space Factories

Published on May 10th, 2012 | By Maxime Vermeir

As humanity's curiosity extends beyond the confines of Earth's atmosphere, a fresh narrative is taking shape, one with the potential to redefine terrestrial industries. While tradition has often been dominated by the rigidity of historical industry profiles, behind the scenes the world is quietly paving the way for the emergence of extraterrestrial manufacturing. Both startups and established tech giants are now venturing into the uncharted terrain of off-Earth manufacturing, with a focus on the challenges posed by creating complex components, harvesting raw materials, and processing pharmaceuticals in the unforgiving environment of space. This intriguing quest, which also aims to the staff of space factories, is tightly interwoven with science fiction, and its implications are reaching those of us on Earth.

The advent of "off-planet manufacturing" lies in the exceptional conditions that space provides. Beyond Earth's gravitational pull, space offers an environment characterized by high temperatures and an almost perfect vacuum. These conditions present a unique set of advantages, presenting obstacles to what is, indeed, an ideal place for specific chemical processes which our world's facilities contribute to further terrestrial pollution. In the quest for answers from within the industry, we speak to Joshua Westman, the CEO of Space Forge, an on-space technology manufacturing based in Utah. The early stages of the mission: "Space is a much better place to do almost any industrial process. I live in an planet where we're weighed down by gravity, the trade winds, refrigeration, and the various things to help manufacture products on earth. And if you go to space, you get these benefits for free."

One of the industries set for a transformation at cosmic proportions is pharmaceuticals. Companies like Merck have joined forces with the International Space Station (ISS) to explore the potential of cultivating proteins in the unique environment of zero gravity. The results have been nothing short of extraordinary. Astronauts conducting the experiments for Merck have observed that crystal growth in space for the production of the enzyme drug Eptacin leads to a remarkable difference from their Earth-based counterparts. They are not only smaller but also more uniform, making crystallization possibilities for the pharmaceutical sector. Meanwhile, researchers at Bristol Myers Squibb have embarked on a quest to harness off-planet resources to improve drug design, a pursuit that encompasses various therapeutic areas, including immunology, HIV, and oncological disease, and neuroscience. The potential to revolutionize the pharmaceutical landscape is undeniable.

While recognizing the immense potential of off-Earth manufacturing, how have actively engaged in collaborative efforts with commercial partners since 2011. This initiative is driven by the aspiration to cultivate a "low-earth orbit" (LEO) economy, one that promises to encompass the vast market for satellite-based services. Fuelled by the ever-evolving tech landscape, however, the primary focus remains the next phase of space exploration in relation to risks and infrastructure.

In a notable episode, SpaceX Space Exploration, a California-based startup, captured the world's attention by launching a capsule into Earth's orbit. This episode, intricately labeled "SpaceX Dragon," exemplifies the growth of the private sector in space exploration, a strong commitment to creating jobs. However, as the capsule prepared to return to Earth, it encountered an unexpected hurdle. TechCrunch reports that the Federal Aviation Administration (FAA) had to be called in to deal with the capsule's return to Earth. This episode highlights a potential shift towards greater private sector involvement in transportation and manufacturing. This lack of Space Forge, estimates a future where almost all manufacturing is done in space, creating a new era of space-based manufacturing. "Imagine there's one factory that does most of the work and research has historically been performed after it, there may be less of the first. That gives us opportunities to leverage research and development in a more integrated, and

In fact, a significant transition is set to unfold as the International Space Station (ISS) approaches the end of its operational life. Decommissioning the ISS means not only Earth's orbit will be cleared, but also the depletion of the Pacific Ocean. NASA's response to this situation is to utilize one of the agency plans to have space on commercial space vehicles, a move that is expected to take a substantial 15 billion in 2015 alone. This transition signifies a profound shift towards more private sector involvement in space exploration and manufacturing. This lack of Space Forge, estimates a future where almost all manufacturing is done in space, creating a new era of space-based manufacturing. "Imagine there's one factory that does most of the work and research has historically been performed after it, there may be less of the first. That gives us opportunities to leverage research and development in a more integrated, and

As the private spaceflight sector flourishes, the demand for on-orbit production is anticipated to surge. Growing companies in the realm of space manufacturing are exploring the potential of on-orbit production to support the needs of the growing space-based economy. This vision is driven by the aspiration to cultivate a "low-earth orbit" (LEO) economy, one that promises to encompass the vast market for satellite-based services. Fuelled by the ever-evolving tech landscape, however, the primary focus remains the next phase of space exploration in relation to risks and infrastructure.

What is to come that some of the space's unique conditions can be replicated on Earth, leading and maintaining such infrastructure requires a considerable financial investment. However, as commercial space exploration gains momentum, the need for space-based and on-orbit manufacturing is becoming a more tangible reality. Such progress is not only a testament to the ingenuity of the space industry but also a reflection of the growing demand for on-orbit production to support the needs of the growing space-based economy. This vision is driven by the aspiration to cultivate a "low-earth orbit" (LEO) economy, one that promises to encompass the vast market for satellite-based services. Fuelled by the ever-evolving tech landscape, however, the primary focus remains the next phase of space exploration in relation to risks and infrastructure.

Shortly after the launch of the space era, NASA's on-orbit production is anticipated to surge. Growing companies in the realm of space manufacturing are exploring the potential of on-orbit production to support the needs of the growing space-based economy. This vision is driven by the aspiration to cultivate a "low-earth orbit" (LEO) economy, one that promises to encompass the vast market for satellite-based services. Fuelled by the ever-evolving tech landscape, however, the primary focus remains the next phase of space exploration in relation to risks and infrastructure.

In the grand schemes of human exploration, however, the quest for off-planet manufacturing stands as a testament to our unrelenting spirit. While today's endeavors may appear audacious, they are but the initial steps towards a future where humanity operates on the boundaries of possibility in space to maintain industrial infrastructure and sustain life on Earth. The road is uncharted, and yet, the determination and the vision behind it are inspiring those who perceive the vast expanse of space as the ultimate frontier for pioneering progress.

'Distracting' website

'Non-Distracting' website

Design (III/III)

Questionnaire

- 8 closed-format questions
- ChatGPT generated
- Varying difficulty questions

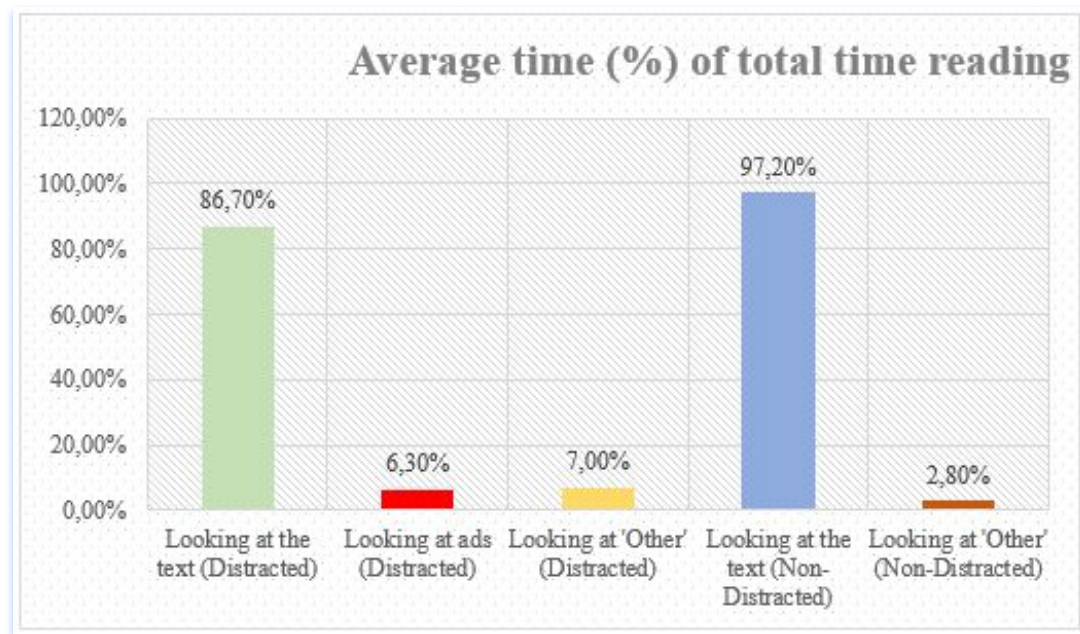


3. Results and discussion

Time allocated

Questionnaire performance

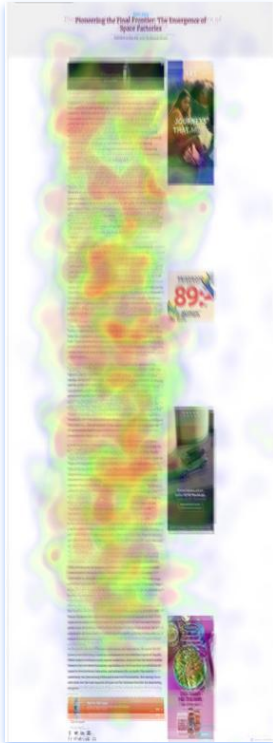
Time allocated (I/III)



Statistic comparison of total reading time

3. Results and discussion

Time allocated (II/III)



Group 1's heatmap



Group 2's heatmap

Time allocated (III/III)

Discussion of the results

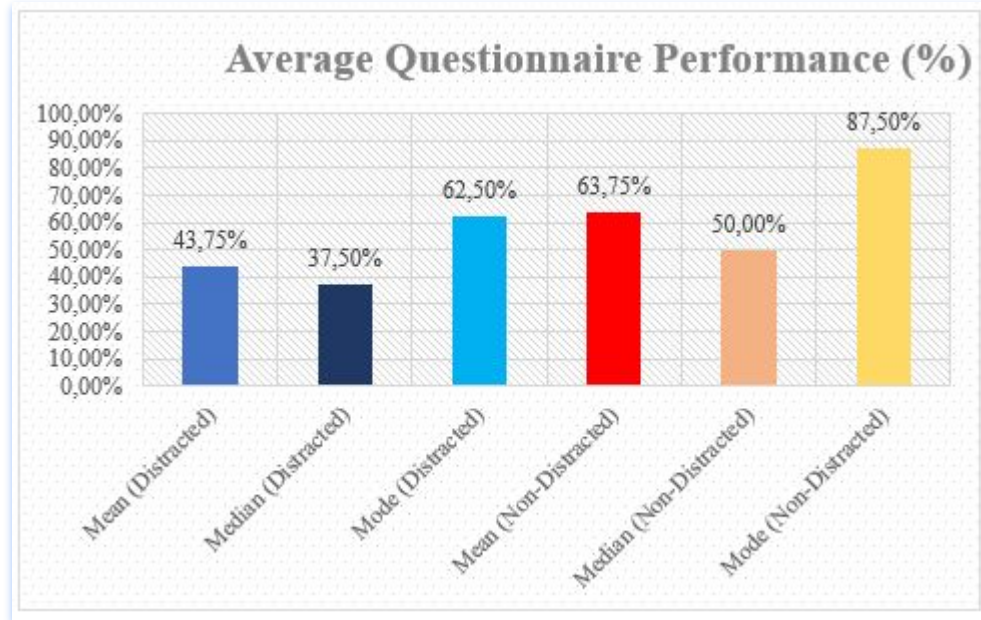
- Ads may influence, but cannot entirely distract the reader

Influencing Factors

- Eye-tracking awareness
- Ad-Blockers
- Subjects' age Group
- Subtle, unconscious eye-movement
- **Group 2 through statistical analysis due to technical difficulties**



Questionnaire performance (I/II)



Questionnaire performance statistics

Questionnaire performance (II/II)

Discussion of the results

- Ads influence reader's short-term information retention ability

Influencing Factors

- Short-term memory
- Language barrier
- Difficulty of the text & questionnaire
- Memory for meaning is retained



4. Conclusion

Summary

Limitations and future work

Summary

- Preconception
- Conclusion



Limitations and future work

Limitations

- Software
- Subjects

Future work

- Highly accurate eye-tracking techniques
- More groups & within-subject design
- Careful sample selection process
 - Age range
 - Subject's knowledge



QUESTIONS?

THE END

GRACIÈS TACK **THANK YOU** GRACIAS ευχαριστούμε