

Abstract

In 2018, an astonishing 98% of all Americans still consumed animal products regularly (Reinhart, 2018). Life stock-raising accounts for 27% of the available fresh water (Hoekstra & Mekonnen, 2012) and 83% of all farmland, which in itself adds up to 26% of the total land area on the planet (Poore & Nemecek, 2018). However, only 3% of all the calories exhausted in the process ends up in the meat (Shepon, et al., 2016) whilst contributing, at almost every level, to Earth's environmental burden (Poore & Nemecek, 2018). This unbelievably disappointing ratio makes meat consumption one of the least efficient ways to feed humans.

In 2015, only 9.1% of plastic material generated was recycled despite the fact that according to the American Chemistry Council (Environmental Protection Agency, 2015) more than 80% of Americans have access to different plastic recycling programs and receive substantial education towards sustainability by the time they receive their high school diplomas (Smith, et al., 2015). The motives given for such a poor display of planetary care are shared amongst all first world countries. Having too many other issues to worry about and a lack of financial incentive are two of the common arguments people give when asked about their lack of involvement (Eom, et al., 2016). The legitimacy of such reasoning may be debatable, but it is often difficult to witness the impact our individual efforts have on a planetary scale.

Efforts to close the gap between one's actions and their real-world repercussions must be made. We have entered a new phase in environmental care. One where awareness on its own is no longer the priority but where the effects of our individual actions can be seen and understood simply. If the first step towards sustainability is the call to action, the second must be action. It is critical to come up with new solutions better equipped to deal with this new stage of global preservation and this research will attempt to do just that. By helping people understand their own personal impact on the environment, we hope to initiate the shift from awareness to a change in behaviour more effectively.

Introduction & significance

A Study from HP Australia and Planet Ark, using data from the Australian Bureau of Statistics, (Australian Bureau of Statistics, HP Australia, Planet Ark, 2018) has found that *"over 90% of Australian consumers and businesses are concerned about environmental sustainability"* yet *"only half believe they are doing their fair share to protect the planet."* This data alone shows that awareness is no longer a priority as the great majority of people have already received the necessary education on the crucial need for environmental action (Eom, et al., 2016). Therefore, we must be clever with the way we spread awareness on topics that are slowly becoming common knowledge, as being constantly reminded of good behaviour is often positive but it can also lead to undesirable side-effects such as the feeling of being patronized. In fact, studies suggest that the repetition of known facts can lead to detrimental results (Depue, et al., 2006), potentially making current awareness methods, such as TV advertisement or the handing out of leaflets on the street, work against their cause.

In addition, most environmental support methods have underestimated the power of willful ignorance. It is only natural and much easier to avoid a problem rather than spend the time and effort to fix it (Alicke, 2007). This is especially true for problems that do not affect us personally in the short term such as environmental degradation. The impacts of which are sometimes only perceivable after one or two generations.

One of the primary purpose of this project is to disrupt the bias towards convenience we have over issues which do not affect us personally. Alicke, in 2007, describes willful ignorance as something that *"occurs when individuals realize at some level of consciousness that their beliefs are probably false, or when they refuse to attend to information that would establish their falsity"* (Alicke, 2007). However, for willful ignorance to occur, the subject must be able to evade the evidence. The hook of this project will reside in its unusual approach on awareness through the power of virtual images¹ combined with playful VR interactions. We thus hope to address the problem of willful ignorance by not only linking action to consequence directly, leaving little time for a bias to establish, but also through the judicious use of positive reinforcement.

¹ In this context: The representation of a statistic, shown virtually using fictional environments.

Related work

Gamifying sustainability is nothing new. Many applications have tackled the issue in many creative ways. VR for Impact is a multi-year program which provides grants to VR projects in support of the Sustainable Development Goals (VR for Impact, 2018). VR for Impact has given its support to many projects and their recognition grew to the point that the platform no longer focuses solely on the environmental matters but extends its reach to serious gaming in general: Games designed for a primary purpose other than pure entertainment. Most environmentally oriented applications are 'teleportation based', meaning the user is able to virtually visit a real or fictional location where the effects of poor sustainability are perceptible. Projects like "The extraordinary Honey bee", a joint project with Häagen-Dazs aiming to educate people about the alarming rate at which the bee population is shrinking (Häagen-Dazs, 2018), or "Tree", a virtual reality application where the viewer can witness the tragic fate that befalls a rainforest tree (Zec & Winslow, 2018) are only some of the many creative entries showcased by this platform.

In a 2017 study by Li, et al., "Measuring the Learning Effectiveness of Serious Gaming for Training of Complex Manufacturing Tasks" (Li, et al., 2017), the researchers concluded that their training game was more effective for learning procedural knowledge than using a paper manual. They also found a much higher level of engagement when using the training game which, in turn, transformed the chore that was learning into an entertaining task employees were willing to participate in.

"Last Island", a computer assisted board game where players must work cooperatively to create a sustainable environment was first published as part of a research project presented at ACSW in 2019 (Garcia, et al., 2019). It demonstrates the benefits gamification has over other means of awareness when it comes to capturing attention and creating incentives.

Many recent studies in the field of cognitive science links elements introduced by the gamification process, such as entertainment and surprise (wonder), with clear learning benefits, viz: The opening and increase of brain functions related with: Plasticity, focus and self-control, memory, structure and many more (Dehaene, 2015). Such benefits are heavily studied lately with the advancements in Magnetic Resonance Imaging and the recent employment of neural probing (e.g. Silicon-Based Microfabrication). We can hope to gather valuable data from these findings and design a tool which profits from them.

This research will thus learn from the benefits and drawbacks that reside in the previous attempts made at gamifying awareness and determine whether the immersive properties of virtual reality engage users with sustainability topics more so than traditional techniques and thus result in a more significant change in behaviour.

Objectives & Method

Objectives:

The primary objectives of this research are:

- Understanding the problems with current awareness methods. Both the more traditional (non-gamified) and the gamified techniques on the topic of sustainability.
- Learning and incorporating the latest teaching methods recommended by current neuro(cognitive)-sciences.
- Creating a more up-to-date and future-proof call-to-action system using a Virtual Reality prototype
- Finally, assess results gathered via testing and evaluate whether or not the proposed solution is indeed an improvement over a defined control environment

To understand the problem, we will be investigating the pros and cons of other awareness methods through an extensive literature review as well as the latest advancements made in the field of cognitive sciences. Gamification is an approach to awareness that represents the idea of making a tedious task more engaging through entertainment and positive reinforcement. Today's businesses are embracing gamification at an increasing rate: *"It's the hottest new strategy in business, and for good reason--it's helping leading companies create unprecedented engagement with customers and employee"* (Zichermann & Linder, 2013). As a result, our research will benefit from an exhaustive number of examples to learn from. Although still relatively limited in the realm of sustainability, the cannons of gamification remain valid regardless of topic.

As we have established, current awareness methods are not able to satisfactorily convince everyone of the impact individual actions have as a whole or in the short term. We believe immersion may be the key to solving this problem. Virtual reality allows total control over the user's environment and thus enables us to link the user's actions to their consequences instantly and free of outside distractions. Not only that, but it would allow us to create fictional situations where alarming statistics about our current level of sustainability could be displayed in a confrontational, fantastical, or exaggerated way (Virtual images). For example, we could represent the amount of non-recycled plastic in the US per year by having the subject virtually stand in front of 37 virtual Empire State Buildings ("*13 Million Tons*") (Environmental Protection Agency, 2015) made of plastic bottles or sit on a chair floating in the middle of the great pacific garbage patch. Whether or not virtual images are more effective at conveying a message than other methods will drastically impact the results of this research.

Method:

We will be using the Agile Game Development framework which alters the 'standard' development method and adapt it to fit research development instead:

Standard → Discover → Design → Develop → Test

Adapted → Discover → Design → Collect & Analyze → Adapt

This recognized design method makes sense in our case as the project may vary drastically along the way and thus having a design capable of adjusting course every 2 to 4 weeks is essential. It also assures fast and regular iterations over the prototype application. The success or failure of the research will be determined by how effective at changing the behaviour of the test subject the prototype will be.

Research Plan

Semester	Plan phase
1 – Literature Review	<ul style="list-style-type: none"> • Determine the limits of today's awareness methods • Learn from today's findings and breakthroughs in the cognitive sciences
2 – Build, learn, adapt	<ul style="list-style-type: none"> • Design a prototype • Test the prototype • Collect results and Documentation
3 – Re-build, learn, adapt	<ul style="list-style-type: none"> • Re-design the prototype • Re-test the prototype • Collect results and Documentation
4 – Thesis	<ul style="list-style-type: none"> • Draw conclusions from the collected results • Finalize thesis

References

- Alicke, M., 2007. *Culpable control and the psychology of blame.* s.l.:American Psychological Association.
- Australian Bureau of Statistics, HP Australia, Planet Ark, 2018. [Online]
Available at: <https://planetark.org>; <https://www.abs.gov.au/ausstats/>
- Belch, G. E., 1982. *The Effects of Television Commercial Repetition on Cognitive Response and Message Acceptance* , s.l.: JCR.
- Dehaene, S., 2015. *Fondements cognitifs des apprentissages scolaires. L'engagement actif, la curiosité et la correction des erreurs.* s.l.:s.n.
- Depue, B. E., aanich, M. T. & Curran, T., 2006. *Suppression of Emotional and Nonemotional Content in Memory: Effects of Repetition on Cognitive Control* , s.l.: Psychological Science.
- Environmental Protection Agency, 2015. *EPA.GOV*. [Online]
Available at: <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/advancing-sustainable-materials-management>
- Eom, K., Kim, H. S., Sherman, D. K. & Ishii, K., 2016. *Cultural Variability in the Link Between Environmental Concern and Support for Environmental Action.* s.l.:APS.
- Garcia, J. A. et al., 2019. *Last Island, Exploring Transitions to Sustainable Futures through Play*, s.l.: ACSW.
- Häagen-Dazs, 2018. *The extraordinary honey bee*, s.l.: s.n.
- Hoekstra, A. Y. & Mekonnen, M. M., 2012. *The water footprint of humanity*, s.l.: s.n.
- Li, K. et al., 2017. *Measuring the Learning Effectiveness of Serious Gaming for Training of Complex Manufacturing Tasks*, s.l.: s.n.
- NW, M. & DJ., P., 2013. *The negative repetition effect.*, s.l.: Epub.
- Poore, J. & Nemecek, T., 2018. *Reducing food's environmental impacts through producers and consumers.* s.l.:Science .
- Poore, J. & Nemecek, T., 2018. *Reducing food's environmental impacts through producers and consumers*, s.l.: Science.
- Reinhart, R., 2018. *Gallup.com*. [Online]
Available at: <https://news.gallup.com/poll/238328/>
- Shepon, A., Eshel, G., Noor, E. & Milo, R., 2016. *Energy and protein feed-to-food conversion efficiencies in the US and potential food security gains from dietary changes*, s.l.: IOP Science.
- Smith, K., Rowe, D. & Vorva, M., 2015. *The Status of Education for Sustainable Development (ESD) in the United States: A 2015 Report to the US Department of State.* s.l.:International Society of Sustainability Professionals.
- VR for Impact, 2018. [Online]
Available at: <https://vrforimpact.com/>
- Zec, M. & Winslow, P., 2018. *Tree*. [Online]
Available at: <https://www.treeofficial.com/>
- Zichermann, G. & Linder, J., 2013. *The Gamification Revolution: How Leaders Leverage Game Mechanics to Crush the Competition.* s.l.:s.n.