Awesome impact

Research on awe, prosocial and pro-environmental behaviour

Abstract

Inspired by research that demonstrates the positive influence of awe on prosocial behaviour and research on the effectiveness of VR to elicit awe, the current research aims to study elicitors of awe in VR and find out if awe also has a positive influence on pro-environmental behaviour. To this end a pre-test was designed to find a suitable awe-eliciting environment in VR which was then incorporated in a 2 (type of awe: awe-eliciting environment and urban environment) x 2 (type of medium: VR or 2D) research design. The survey, which was to be completed after the awe manipulation, included measures for awe and the small-self feeling, presence, prosocial behaviour, pro-environmental behaviour. The results showed that, in line with previous research, awe positively influenced prosocial behaviour and VR provided a more intense feeling of presence and awe than 2D. Moreover, VR was found to have a positive effect on prosocial and pro-environmental behaviour. These findings confirm VR's potential to elicit emotional responses in experiments and awe's ability to lessen polarising tendencies in the world and warrant future research using awe and VR.

Keywords: Awe; prosocial behaviour; virtual reality; pro-environmental behaviour

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Introduction

Imagine, after a day's hike through the upper jungle over the ancient Inca trails, you finally reach the Sun gate. Here you can see the valley wherein lies the majestic lost Inca city: Machu Picchu. One can be overwhelmed by the feeling to protect the earth and its treasures. This effect has also been observed among astronauts, who experience feelings of heightened awareness and joyous ecstasy when looking at the earth from outer space (Ferreira, 2016). This 'overview effect' includes awe, which is a mix of multiple feelings and has recently been studied to have a positive influence on behaviour.

A study by Piff, Dietze, Feinberg, Stancato, and Keltner (2015) has shown that awe as an emotion can alter one's self-concept and encourage other-oriented, prosocial behaviour. One experiences awe when confronted with vast stimuli that are beyond one's frame of reference (Keltner & Haidt, 2003). This can be stimulated through art, panoramic views, natural wonders, man-made wonders or even grand ideas. Awe can consist of deep feelings of wonder, excitement and even fear, and it can be both uncomfortable and pleasurable at the same time. Awe partly comes from feeling diminished in the presence of something greater than yourself, an experience known as the 'small-self feeling' (Keltner & Haidt, 2003). The small-self feeling makes for a realisation that one is not alone in the world and thus motivates being good to others. Since ego is diminished, awe produces tendencies to collaborate in social groups and take collective action (Chirico & Yaden, 2018). Furthermore an increase in sharing, caring and assisting enables individuals to function more effectively in sight of the collective. Differences in personality can lead to a different level of experienced awe, therefore it is important to find a universal elicitor of awe. This study is concerned with finding the most intense stimulus for awe among awe-inducing videos in VR in a pre-test and showing its positive effect on prosocial and pro-environmental behaviour.

Studies about awe have experimented with the stimulation of intense feelings of awe. Along with recalling an awe-inspiring experience or presenting fine art or architecture, natural landscapes seem to be effective (Piff et al., 2015). Because natural landscapes invoke awe and pro-environmental behaviour is partly prosocial, since improving the environment has a positive effect on local social communities and the global population, one might wonder if awe can stimulate people to be more environmentally responsible as well. Previous studies (Piff et al. 2015) suggest research on awe and pro-environmental behaviour , yet there is lack of actual research of the question, and this paper will investigate the possibility.

The study field is relatively young, thus research toward awe and its benefits can be expanded. Recently, virtual reality (VR) has been an upcoming medium to support research and induce awe. VR is not yet a widely adopted tool because the technology itself is relatively young. The high expectations caused by the introduction hype in 2016 have not been met. Especially the high costs and problematic set-up experience for mass market customers have stunted development. Tethered head mounted displays (HMDs) which need a powerful computer to operate and screenless viewers (for example: Google Cardboard) have suffered the most because of this. The former provides high quality experiences yet is expensive and immobile, the latter is easy to use but offers very limited experience. The third and final head-mounted display, the standalone HMD (like the Oculus Go) , has grown most and is expected to lead the VR market. The combination of mobility, decent quality and expansive possibilities along with decreasing costs are promising. (Kangpan, 2018) VR is

beneficial because it can simulate complex and real situations. This in turn offers opportunities to investigate behaviour within well controlled experiments (Diemer et al., 2015, Chirico et al., 2017). Finding out how effective VR really is and if it has any influence on awe or other emotions and behaviours is unknown terrain as of yet. This paper aims to change that.

In sum, this paper will address the ongoing research on awe, prosocial behaviour and pro-environmental behaviour using VR by asking the questions: Which stimuli are most effective in inducing awe? Can awe increase prosocial behaviour and pro-environmental behaviour? How can VR support research into awe and both behaviours?

Eliciting awe

Not everyone will experience awe the same way. Differences in intensity can be partially explained by the big five personality traits (neurotisicm, extraversion, conscientiousness, openness to experience and agreeableness). One study found that people who are more open to experience and are more extravert have a greater tendency to feel awe in general. (Shiota et al., 2006). Furthermore, people who need cognitive closure and are uncomfortable with ambiguity report a lesser tendency to experience awe. (Shiota et al., 2007). To overcome these differences in intensity a universal way to elicit awe has to be found.

Awe can be inspired by a range of sources. Critical for awe is that the stimuli inspiring it are vast and that they transcend one's current frame of reference, so that there is a need to accommodate what is being perceived (Keltner & Haidt 2003).When an image or an action exceeds our everyday understanding of the world it can instigate an attempt to realign mental structures used to understand the world around us. For instance, seeing water fly up again at towering waterfalls challenges current theories of the world and stimulates the adjusting of those theories. Vastness can be explained in different ways: immense in size, scope or complexity (Piff et al., 2015). Immense in complexity relates to the perception of vastness: a close-up of intricate patterns from coloured waterdrops falling in milk elicited awe and a sense of vastness (Piff et al., 2015). Immense in size is the most notable cause for feeling small, because it directs attention away from the self and toward the environment (Shiota, 2007). This can lead to diminishing concerns for self-interests and personal concerns.

Typical elicitors of awe are nature, music, art and architecture where according to a study done by Cohen, Gruber, & Keltner (2010) nature ensures the highest level of awe. The reason natural scenes are such great elicitors of awe could be evolutionary: Chirico and Yaden (2018) propose the 'nature-first' view. The safest shelters consist of a protected side and an overview side where man can easily spot predators, enemies or other threats. It might be that the urge to protect our habitat still remains and that it can be stimulated through awe. At a larger scale, this may help make people feel more responsible for our planet.

In a key paper related to awe, Keltner and Haidt (2003) proposed five 'flavours' of awe, which could explain the range of awe-related states: Threat, beauty, ability, virtue and supernatural causality. Respectively they encompass awe in combination with fear, aesthetic pleasure, exceptional talent or skill, admiring strength of character and something inexplicable by science. These flavours are not validated categories but theoretical variations that open research directions, according to the authors. For example finding out which

flavour has the most intense awe effect or if a combination of flavours can work even better. Take the world wonders: they are a combination of human ability, as humans designed and built them, and beauty. Furthermore, the world wonders are vast in size and unlike anything most people have experienced first hand, meaning they could fit the awe-inspiring role. The architectural complexity, beauty and vastness are less influenced by personal bias than the other flavours: people have different personal fears and different perspectives on ability. Someone who appreciates music instead of sports will find playing a difficult piece more impressive than achieving a new world record. Thus the world wonders seem suitable general awe elicitors. Natural wonders even more so, since architecture can still be found ugly or unnecessary. The present research aims to investigate, with a pre-test, if man-made wonders have a similar influence on awe as natural environments.

Previous research used 'normal' urban environments and compared them to natural environments and showed that natural environments are the better elicitors of awe (Chirico et al., 2017). This is in line with a study by Shiota et al (2007), where students asked to write about an awe-inspiring event were more likely to describe situations related to nature, art or music than students who were asked to write about a situation that inspired happiness. The latter were more likely to describe social events. Another study (Piff et al. 2015) found that looking up at towering trees elicited awe and looking up at tall buildings did not. Hence, in this study it is proposed that:

H 1: Vast natural environments will elicit a significantly more intense feeling of awe than urban scenery

Awe, prosocial and pro-environmental behaviour

Prosocial behaviour can be encouraged in multiple ways, from incentives and punishments to the recall of positive experiences or emotions. However, providing incentives and punishments can sometimes lead to unintended reverse effects (Benabou & Tirole, 2004). For example; a study by Gneezy and Rustichini (2000) found that giving children incentives to collect more actually leads to a decrease in received donated money. Besides this Benabou and Tirole (2004) mention that social pressure plays a big part in performing good deeds and refraining from selfish ones. Prosocial behaviour is also influenced by the self-image people desire and the opinion other people have of them. Since the above mentioned stimulations are caused mostly by external, social factors, research has branched off to find internal stimulations for prosocial behaviour. Positive emotions like awe seems to increase gratitude (Bartlett & DeSteno, 2006) and prosocial behaviour (Piff et al., 2015; Prade & Saroglou, 2016).

According to Prade & Saroglou (2016) elicitors of awe are impersonal and can thus exclude other persons and social pressure. This circumvents the above-mentioned barriers to act prosocial. In other words, the stimuli of awe are not linked to other people, which is why awe is not seen as a social emotion. Awe seems to have social effects nonetheless. This makes it a very suitable stimulation for controlled laboratory experiments, even on a small scale. Building on this awe has been used to diminish ego and attention to personal concerns. Multiple studies found elicitors of awe (e.g.: vast nature or art) can dissuade individuals from thinking about their materialistic concerns and personal objectives. (Rudd et al. 2012; Prade & Saroglou 2016) Awe can foster charity in terms of spontaneous generosity and willingness to help a person in need (Prade & Saraglou, 2016). In this study participants were asked to

distribute hypothetical lottery-winnings and react to interpersonal situations. The participants scoring high on awe gifted away more of their winnings and acted more prosocially in hypothetical situations. Furthermore awe can lessen impatience, expand time perception and so increase willingness to spend time on others (Rudd, Vohs, & Aaker, 2012). This is because awe makes people live in the moment and cause people to perceive they have more time, which they are then more likely to spend on helping others.

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Prosocial behaviour through awe can also be explained from an evolutionary perspective. Individuals usually accomplish tasks, like hunting and waging war, better in groups under a powerful leader. The more cohesive and stable, the more successful the group can be. This means that individual goals should be cast aside (Stellar, Gordon, Piff, et al., 2017). Awe accomplishes just that and through increased prosocial behaviour and connectedness ensured the survival of our species: Firstly awe toward a powerful leader leads to greater willingness to sacrifice, loyalty and devotion to the group (Stellar, Bai et al., 2017). Secondly awe generates feelings of interconnectedness and common humanity which in turn promotes group coordination and cohesiveness. (Shiota et al., 2007) Lastly, awe helps individuals revise their status vis-à-vis a more powerful other and reduce self-importance. Another reason for the ego diminishing effect awe can have.

Another study found varied evidence that awe relates to prosocial behaviour: participants in this study where asked to recall proud, neutral or awe-related memories. People in the awe condition gave away significantly more raffle tickets, more money and more points in multiple parts of the study. Furthermore, they reacted more ethically to hypothetical scenarios involving amoral and/or selfish behaviour. Interestingly, the small-self rating predicted their behaviour (Piff et al., 2015). In this study, among others, pro-environmental behaviour is mentioned as an interesting future direction for awe. Since it is only mentioned and no current research has been found, this paper will try to find evidence that awe increases pro-environmental behaviour.

The appreciation of nature and the realisation that we are interconnected within a universe can foster gratitude and a positive orientation toward other people (Prade & Saroglou 2016). The same appreciation of nature could be used to improve pro-environmental behaviour. Bamberg and Moser (2007) explain pro-environmental behaviour as a mixture of self-interest (own health risk) and concern for other people, later generations, other species and whole ecosystems. As prosocial behaviour has been shown to be influenced by awe and pro-environmental behaviour being partly prosocial it follows that awe's ability to influence pro-environmental behaviour is probable. Besides, grand natural scenes can lead to the instinct that the Earth and our universe is too vast to comprehend and we should co-operate to ensure our own safety and the health of our habitat and thus act more pro-environmentally. The realisation that one person cannot change the world alone contributes to co-operation and prosociality.(Chirico & Yaden, 2018) Furthermore, our environment is a collective good and as such needs to be protected by us all. Getting people to broaden their perspective from their own lives to local communities or even international flora and fauna reservoirs can increase environmental engagement. Awe can diminish ego and increase group cohesion which is needed to broaden perspective and support important local and global environmental initiatives.

Taking all the above into account, this paper is concerned with using awe as a stimulation to increase prosocial and pro-environmental behaviour. This paper aims to investigate the following hypotheses:

H 2.1 : Awe-eliciting environments can significantly increase pro social behaviour.

H 2.2: Awe-eliciting environments can significantly increase pro environmental behaviour.

Virtual Reality

Virtual reality is an upcoming medium for behavioural research. "In virtual reality (VR), researchers can simulate intricate real-life situations and contexts to investigate complex human behaviours in highly controlled designs in a laboratory setting". (Diemer et al., 2015 page 1). VR is realised in an interactive 3D-visualization system supported by one or more position trackers and a head-mounted display. (Riva et al., 2016 B) The individual using the system can look around, the trackers will track their movement, report the collected data and the visualization system will update the scene in real time. VR distinguishes itself from other media because it is so immersive, it induces the sense of presence.

Presence describes the extent to which a user feels present in a VR environment (Diemer et al., 2015; Botella et al., 2009). Schubert et al., (2001) found three distinct dimensions of presence: spatial presence, involvement and realness. Presence is important to reduce awareness of the simulation and so enhance the emotional response. Peperkorn and Mülhberger (2013) have found that a background narrative can enhance emotional experience as well. Because people are unfamiliar with the technology, attaining the sense of presence has been difficult. People might be distracted or impressed by the use of the technology instead of the shown environment. Nevertheless a VR headset will provide a more intense feeling of presence (and thus a better emotional awe response) then recalling an awe-inspiring event or a 2D video shown on a laptop: Chirico et al. (2017 A) found that using 3D VR videos, compared to normal 2D videos, created a more intense experience of awe in a lab environment. Moreover, VR increased the perception of vastness, the sense of physical space and the sense of engagement, each of which increased self-reported awe. This leads us to the hypotheses:

H 3: Cues shown in VR will produce a significantly more intense feeling of awe than those shown in 2D.

Methods

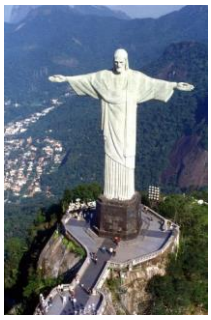
Pre-test

Participants for the pre-test were selected randomly from a sample of volunteers. This sample was collected through university contacts and other friendly ties. The sample is restricted by the requirements: 'the participant speaks near-native English.' and 'the participant has no history of motion sickness.'

To determine the most effective visual cue, or video, to inspire awe and test whether man-made wonders have a similar intensity of awe as natural wonders, a pre-test was conducted. 25 participants were shown six different VR videos, each with an approximate duration of 2 minutes, on the Oculus Go (provided by the University of Twente). All these cues were selected on fulfilling awe requirements established by Keltner and Haidt (2003) (stimulates

need for accommodation, transcends ones frame of reference and being vast) and include aspects of the different flavours. Half of the videos were man-made wonders; Petra, Barcelona and Christ the redeemer. The others were natural wonders: Grand Canyon, the Alps and an underwater scene with hammerhead sharks. The images below show a still representation from the respective videos.

Man made



Natural

A short-form PANAS was used to determine general affect before and after the manipulation, awe was included to check self reported awe scores. Individuals answered the question: 'In general this past week I've been feeling (list of emotions and awe)' and "after this video I feel". These scores ranged from 1 – not at all to 7 - all the time. Items for the feeling of presence were included in the questionnaire as well: 'Forgot real world surroundings', 'felt engaged in the shown environment', 'desire to explore more of the environment'. Scores ran

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from 1 – I strongly disagree to 5 - I strongly agree. Besides self-reported awe, the item: 'I felt small in front of what I was seeing' was used to measure awe.

The results are shown below, the Grand Canyon scored highest on all items related to presence and awe and was therefore selected for the main experiment. 84 percent of respondents selected a natural wonder as most impactful or 'favourite' video. Most (11) selected the Grand canyon while the sharks and the alps both were selected five times. While Petra scored the best for man-made wonders it was not selected at all. Furthermore the natural landscapes scored generally better than the man-made wonders, in the items shown below, except for Petra.

Table 1 – *Pre-test results*

Visual cue	Forgot real-world		Felt engaged		Felt small		Desire to explore		Awe	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Barca	3.04	1.40	3.28	1.37	2.52	1.01	3.12	1.36	4.48	1.33
Sharks	3.48	1.23	3.40	1.19	2.92	1.08	3.44	1.61	4.76	1.72
Petra	3.00	1.25	3.33	1.24	3.67	1.31	3.71	1.22	4.83	1.61
Alps	3.50	1.25	3.46	1.25	3.37	1.17	3.71	1.20	5.04	1.20
Christ	3.08	1.41	3.12	1.30	3.32	1.28	2.96	1.37	4.28	1.49
Grand Canyon	3.88	.93	3.96	.98	3.72	.98	4.12	1.20	5.32	1.28

Main research

Participants

The main research sample consists of university students and staff, approached through direct contact and SONA: the university's test subject pool. The number of respondents that completed the survey was 48[1], where 54.2 percent were male and the other 45.8 where female. 29 % of the participants reported a religious background (Christianity). The ages ranged from 18 through 26 with a mean of 22.13. Similar to the pre-test the sample was restricted by two requirements: 'the participant speaks near-native English.' and 'the participant has no history of motion sickness.' Using a independent sample t-test with equal variances assumed (appendix 3) showed that females had a significantly higher mean score on awe: 0.037 two tailed significance with an alpha of 0.05. This indicates that females have a higher tendency to feel awe or feel awe more intensely.

Procedure

Firstly, a short introduction led the participants to believe the research aims to explore the experience and feelings related to 360º and VR- videos, to select appealing marketing material for sustainable organizations or charities. This was chosen to prevent socially acceptable bias in the answers. Secondly the participants where asked to fill in a consent form regarding the handling of data and risks of motion sickness. Thirdly, participants were divided into one of four groups and shown a visual cue without sound for two minutes. The four groups were divided according to the 2 x 2 design: type of awe, natural environment

[1] Research was conducted shortly before COVID-19 epidemic and sample size was limited because of quarantine measures.

(high awe) and urban environment (low awe) and type of medium, VR and laptop. Group one watched the Grand Canyon (GC) using the VR-headset, group two watched the Grand canyon using the laptop, group number three watched a video of Utrecht using VR and finally group 4 watched Utrecht using the laptop. Participants using the VR headset were informed as to how to use it correctly. After the visual cue they were asked to fill in the survey. A check for actual behaviour in the form of a online newsletter on Justdiggit, an organisation used as an example in the introduction, and if the participants were interested in receiving it was the final question. Afterwards participants where able to comment on their experience.

Materials

Research was conducted with the VR system Oculus Go and an Asus laptop. Working with VR posed some obstacles to overcome. Firstly, the research setup should be matched carefully with the intended goals because some set ups might be needlessly expensive. Secondly, VR can cause motion sickness so it is vital the duration of the experiment is not over extended. Lastly, subjects will need to be informed of the kind and level of intensity of the experience and give their consent. (Riva et al., 2016 A)

The awe-eliciting video will be the grand canyon video from the pre-test and the non-awe inspiring urban condition will be fulfilled by a VR video of Utrecht, as shown by the stills below.

Measures

A survey including items for measuring awe and the small self, prosocial behaviour, pro-environmental behaviour, a semi-open question on giving away lottery winnings and checks for VR presence. The items for prosocial behaviour, awe, small self and charitability have been validated and tested by Campos et al., 2013, Piff et al., 2015, Prade & Saroglou 2016 and Shiota et al., 2007. The visual questions, shown below, where taken from Bai et al (2017).

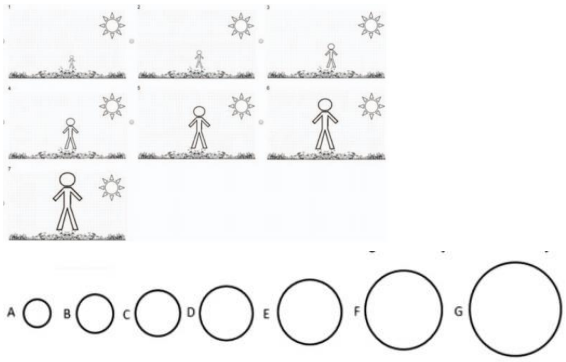
This study measures different constructs namely; Awe, sense of presence, prosocial behaviour and pro-environmental behaviour. The lottery task, where participants were asked to distribute 10,000 euros in lottery winnings between luxury goods, investing in stocks, savings account and gifting away, was a measure for prosocial behaviour on its own.

The construct of awe is a combination of three items measured with a 7 point likert scale, that is ‘I felt in awe of what I was seeing’ ‘I felt small compared to what I was seeing’ and ‘I felt part of a greater entity’ with a Cronbach’s alpha of .70.

The construct for presence includes ‘I felt engaged to the shown environment’ I forgot my real-world environment’ and ‘I felt connected to the shown environment’ and achieved an alpha of .70. For both awe and sense of presence the likert scale ran from 1- I strongly disagree to 7- I strongly agree. The item ‘the environment looked real to me’ was omitted from both above-mentioned constructs to provide a stronger alpha.

The prosocial construct consists of 7 items like, among others, ‘do volunteer work for charity’, ‘give up my time for people in need’ and ‘letting a stranger use my phone’. This construct scores an alpha of .79. In this case and in the case of pro-environmental behaviour all the scores are measured on a likert scale from 1 – extremely unlikely to 7 extremely likely.

Pro environmental behavioural intention was measured asking how likely are you to complete one of the following actions the coming months. With items like; ‘recycle’, ‘eat less meat’, ‘take shorter showers’ and ‘clean up stray garbage in places I visit’. With all 13 items this construct achieves a Cronbach’s alpha of 0,84. The visual questions are taken as constructs on their own, to measure the small self feeling.



Results

Awe

After exporting the data from Qualtrics, IBM SPSS statistical software was used to recode and analyse data. A 2 (type of awe, natural (high awe) or urban (low awe)) x 2 (type of medium, 2D or VR) univariate analysis of variance was used on all constructs to inspect the differences between the different conditions. First off the main effect of type of awe was significant (F (1,48) = 5.33 p < .05) on the dependent variable awe which shows that participants who where exposed to the natural environment (M = 19.19, SD = 4.7) experienced significantly more awe than exposed to the urban environment (M = 16.18 SD = 4.51). This is in line with existing research and confirms hypothesis 2.1. The main effect of type of medium was marginally significant: (F value (1,48) = 3.4, p = 0.072). The above-mentioned result indicates that participants using the VR headset scored (marginally) significantly (M= 18.93 SD = 4.1) higher on awe then participants using the laptop (M= 16.38 SD= 4.67) in line with Hypothesis 2.2 . Unlike the previous results, the interaction between type of awe and type of medium (F (1,48) = .44, p > .5) did not reach significance.

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Presence

Using the same type of analysis, now with presence as dependent variable, the main effect of type of medium yielded a significant result ($F(1, 48) = 10.78$, $p < .01$). Thus participants that used the VR headset felt significantly more present ($M = 15.63$ $SD = 3.12$) than those using the laptop ($M = 12.38$ $SD = 3.77$). Type of awe and the interaction between type of awe and type of medium did not reach significance (both $F < 1$ ns).

Prosocial intentions

Prosocial intentions as a construct yielded a marginally significant main effect of type of medium ($F(1,48) = 2.95$ $p = .093$) suggesting that participants using the VR headset have significant higher prosocial intentions than those using the laptop. This time the main effect of type of awe and the interaction between type of awe and medium did not reach significance ($F < 1$ ns) .

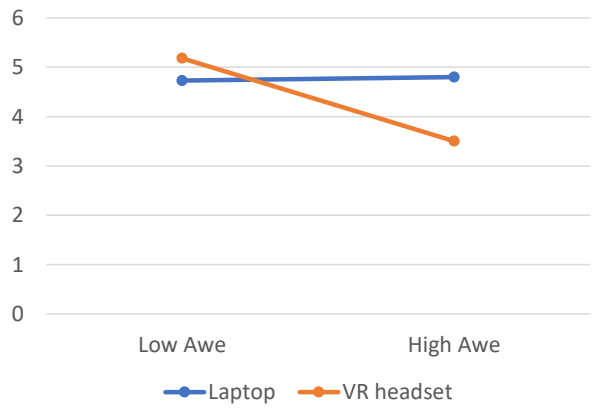
Pro environmental intentions

The results for pro-environmental are as follows. The main effect of type of awe on pro environmental intentions was not significant ($F(1, 48) < 1$ ns). The main effect of type of medium was found to be significant ($F(1,48) = 7.38$ $p < .01$). Thus indicating that participants who used the VR headset ($M = 62.07$ $SD = 11.94$) were significantly more likely to behave pro-environmentally then those using the laptop ($M = 51.71$ $SD = 13.94$). The interaction between type of awe and type of medium did not reach significance ($F(1,48) < 1$)

Small self questions

Using the same univariate analysis of variance, the person size questions yielded one marginally significant result: type of awe ($F(1,48) = 2.8$ $p = .10$) showing that participants who watched the awe eliciting video felt significantly smaller ($M = 2.7$ $SD = 1.4$) than those watching the low awe video ($M = 3.73$ $SD = 1.2$). Type of medium ($F(1,48)$ 2,18 $p = .146$) and the interaction ($F < 1$ ns) did not reach significance. On the contrary, the circle size question illustrated that the main effect of awe was significant ($F(1,48) = 4.06$, $p = .05$) meaning subjects that watched the natural scene ($M = 4$ $SD = 1.65$) felt significantly smaller than subjects that saw the urban environment($M = 4.95$ $SD = 1.09$). Although type of video did not yield significant results, the interaction between the two factors did. With an f-value of ($F(1,48) = 4.83$ $p < .05$) the interaction is shown in the plot diagram below. This interaction plot shows that the effect of exposure type (VR versus video) was particularly strong in the awe condition, and not so much in the control condition.

Figure 1 - *Marginal means of Circle size*



Remaining results

Table 2 – *lottery game results*

	Group 1	**Group 2**	**Group 3**	**Group 4**
Luxury goods	1618,75	2310,-	1272,73	818,18
Savings	5218,75	5670,-	5618,18	5136,36
Invest in stocks	1218,75	1110,-	1863,64	2863,64
Gift away	1943,75	910,-	1245,46	1181,82

Table 2 shows that group 1 (Grand Canyon in combination with VR) chose roughly double the amount of money for gifts as the other groups in this case, This illustrates that awe can lead to charitable behaviour. However, using an analysis of variance, these results did not reach significance.

Discussion

Building on recent research, this paper initially focused on bridging the gap concerning awe and pro-environmental behaviour. Additionally this paper focused on extending knowledge on VR in experimental environments and its suitability to induce awe. Overall this paper was concerned with finding the most effective trigger of the emotion awe, finding out if awe can influence prosocial and pro environmental behaviour and the effect of VR technology on all three. The pre-test and part of the main research proved, and thus confirmed previous research (Piff et al., 2015, Chirico et al., 2017), that natural environments are much more effective in eliciting awe than man-made wonders. This also means that the different flavours of Keltner & Haidt (2003) remain theoretical variations for future research. Further testing showed that using VR leads to an improved sense of presence and an improved emotional response compared to 2D videos or self reported awe experiences, which is in line with

previous research on awe and VR (Chirico 2017 A). Furthermore, the results showed that VR had a significant influence on pro-environmental and prosocial behaviour as opposed to the expected awe-eliciting environment. A finding that adds to recent research on VR and awe (Chirico 2017), research on prosocial behaviour (Prade & Saroglou, 2016, Stellar et al., 2017) and pro-environmental behaviour. This is probably caused by the outcome of another part of this research where VR has a marginally significant influence on awe. It appears VR technology could also induce awe on its own by being so advanced people need to accommodate what they experience. Adding the enhanced feeling of presence and improved emotional response lead to a wow-effect relating to VR. It could also signal an interrelatedness between presence and awe. Because of the environment being all around people have a lot to take in, most environments are also set up very spaciously and thus quite vast. Through this VR includes the two most important conditions to elicit awe. The circle size results show that the small self feeling was drawn out especially by the awe eliciting environment and strong in combination with VR. This is in line with previous studies on eliciting awe through nature and the small-self feeling (Piff et al., 2015).

Limitations

First off, the research sample could be much larger thus creating a fairer image of the whole population, unfortunately the Covid-19 lockdown limited further research. Using students and staff of the same university (and only three nationalities) limits the sample as well. What are the effects of awe on different cultures and societies? Arguably, awe experiences vary across cultures according to, among others, levels of collectivism versus individualism, extraversion versus introversion and level and sort of religiousness. One study (Razavi, Zhang, Hekiert, Yoo, & Howell, 2016) found participants from the U.S. reported the highest level of extraversion and dispositional awe and participants from Iran reported the lowest level of extraversion and dispositional awe. Culture shapes people's emotions and their perception and it is thus logical that the same awe manipulation used with different cultural subject pools will have different levels of intensity. Using VR and natural wonders could provide a solution to bridge intensity gaps in future research.

Secondly, some questions in this research where misinterpreted: some tall people commented on the visual questions "I am not used to feeling small so these questions felt weird" and some more in that fashion. One could wonder if physical length influences the feeling of the small self. Others commented on the quality of the videos, though it all 'looked real' some found it distracting that the image could become blurry. Using the latest cutting-edge technology could smooth over these bumps.

According to Doherty and Webler (2016) pro environmental visual impact messages can increase their efficiency by making sure subjects know other people are taking action already and increasing the individuals believe he or she is also able to engage in pro-environmental action. A message along with powerful visuals in VR might increase pro-environmental behaviour further. Tailoring the experiment by adding other senses like sound or scent could increase effectiveness and emotional response due to improved immersion as well.

Future research

Directions for future research are abundant; finding out if awe differs in varying cultures, designing experiments focused on awe or VR and pro-environmental behaviour, awe and

increased scientific learning in children and adults. Adding to this VR manipulations could increase helping and other pro-social behaviour on multiple scale levels.

A possibility to be studied is that living in such a technological era AR and VR developments can bring a shift from real life and natural wonders to traveling from home using technology. The mentioned 'nature-first' view might be influenced especially about protecting our 'habitat'. In the hunter-gatherer days finding the right habitat was a matter of life and death. The best suited natural habitats where covered high places with great views to spot enemies which is a reason awe is inspired by these vistas (Chirico etal., 2018). Nowadays our view of our habitat might be shifting from natural places provided by our earth to our own built houses and communities since survival (in the wild) is not relevant anymore. This might lead to more appreciation and awe for technological advancements to increase the comfort within our homes. The results of this study support this claim as VR technology was found to inspire awe and influence prosocial and pro-environmental behaviour. This might lead to less awe or appreciation for nature itself since technology could provide natural environments and experiences. Inversely, forgetting nature might make experiencing natural scenes all the more powerful. It begs questions like: Could people still care for preserving nature if it is available through technology? How strong is our connection with nature and how are difference in environmental engagement caused? Can awe help in shaping our future and make people more passionate about preservation?

To improve understanding of rapidly changing technologies like VR, our environment and what it takes to preserve our world other effects of awe should be investigated. Valdesolo, Shtulman and Baron (2017) found that awe might increase scientific reasoning and learning among children. People observe and form natural expectations regarding physics and how the world works. For example light objects fall slower than heavy one. Violating expectations, like seeing an anvil and feather in a vacuum fall at the same speed, goes against intuitive theories which triggers the need for accommodation associated strongly with awe. In other words, being surprised and not knowing the answer brings on explanation and exploration and increases scientific learning. Preparing our youth for a scientific and technologic future with the help of awe is another interesting research direction. Finding out if this works with adults in any degree could be a logical next step. Increasing curiosity and learning toward natural phenomenon could also increase environmental engagement and improve environmental behaviour.

Practical implications

The effect of awe on generosity can increase charitable organisations donations and help preserve nature. It might be interesting to compare the effect of awe and the usual compassion or pity tactics of charities and see if it is more effective. While this paper fails to confirm awe's other influence on prosocial behaviour, there are a plethora of directions that future research could take. Helping intentions and perspective taking are extremely useful in conflict situations. A small manipulation of a two minute VR video could increase cooperation between different business departments, different countries and even different races. After all we are all the same and the feeling of being small and alone can increase appreciation of being together. Can awe be the key to decrease polarisation?

Finally, creating VR platforms to share similar interests or provide VR environments for online shopping can increase VR's consumer base and provide new ways for marketing communication to reach targeted audiences in their homes.

In sum, this paper contributed to the growing research on awe and VR. It demonstrates that awe is better elicited through natural landscapes than man-made wonders and that VR technology is effective in inducing awe. Furthermore it provides some proof that VR technology can increase pro social and pro environmental behaviour. Going forward, multiple questions surrounding VR and awe will be answered. All in all they will have an awesome impact in our lives.

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Appendix

1. ANOVA - presence and awe

		Sum of Squares	df	Mean Square	F	Sig.
Engaged	Between Groups	20,214	3	6,738	3,064	,038
	Within Groups	96,765	44	2,199		
	Total	116,979	47			
Forgot real world	Between Groups	20,547	3	6,849	2,680	,058
	Within Groups	112,432	44	2,555		
	Total	132,979	47			
Looked real	Between Groups	14,534	3	4,845	2,199	,102
	Within Groups	96,945	44	2,203		
	Total	111,479	47			
In Awe	Between Groups	28,206	3	9,402	5,252	,003
	Within Groups	78,773	44	1,790		
	Total	106,979	47			
Felt small	Between Groups	30,652	3	10,217	3,769	,017
	Within Groups	119,265	44	2,711		

	Total	149,917	47			
Felt connected	Between Groups	12,358	3	4,119	1,922	,140
	Within Groups	94,309	44	2,143		
	Total	106,667	47			

2. ANOVA - pro-environmental

		Sum of Squares	df	Mean Square	F	Sig.
Recycle	Between Groups	6,839	3	2,280	,823	,488
	Within Groups	121,827	44	2,769		
	Total	128,667	47			
Sustainable products	Between Groups	4,716	3	1,572	,750	,528
	Within Groups	92,264	44	2,097		
	Total	96,979	47			
Prevent food waste	Between Groups	7,669	3	2,556	1,318	,280
	Within Groups	85,310	44	1,939		
	Total	92,979	47			
Stray garbage	Between Groups	14,005	3	4,668	1,966	,133
	Within Groups	104,474	44	2,374		
	Total	118,479	47			
Donate to env. org.	Between Groups	10,123	3	3,374	1,625	,197
	Within Groups	91,356	44	2,076		
	Total	101,479	47			
Volunteer env. org.	Between Groups	21,839	3	7,280	3,540	,022
	Within Groups	90,474	44	2,056		
	Total	112,313	47			
Eat less meat	Between Groups	4,375	3	1,458	,268	,848
	Within Groups	239,605	44	5,446		
	Total	243,979	47			
Public transport	Between Groups	2,127	3	,709	,157	,925
	Within Groups	199,123	44	4,526		
	Total	201,250	47			

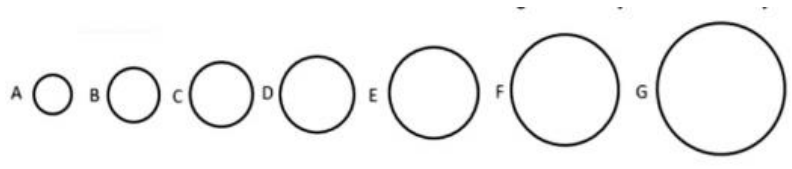
Biological products	Between Groups	13,926	3	4,642	1,424	,248
	Within Groups	143,386	44	3,259		
	Total	157,313	47			
Buy vegetarian	Between Groups	13,248	3	4,416	,962	,419
	Within Groups	202,065	44	4,592		
	Total	215,313	47			
Support env. org. social media	Between Groups	47,468	3	15,823	4,587	,007
	Within Groups	151,782	44	3,450		
	Total	199,250	47			
Reduce central heating	Between Groups	10,286	3	3,429	1,008	,398
	Within Groups	149,714	44	3,403		
	Total	160,000	47			
Shorter showers	Between Groups	9,940	3	3,313	,871	,463
	Within Groups	167,310	44	3,803		
	Total	177,250	47			

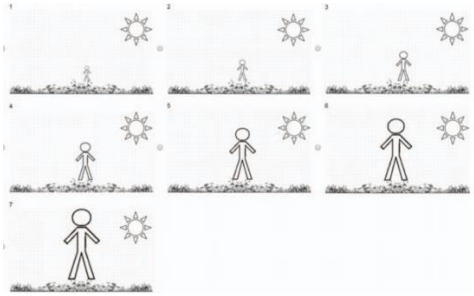
Appendix 3 –

	Gender	N	Mean	Std. Deviation	Std. Error Mean
In Awe	Male	26	4,23	1,557	,305
	Female	22	5,14	1,320	,281

									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
In Awe	Equal variances assumed	2,091	,155	-2,151	46	,037	-,906	,421	-1,753	-,058
	Equal variances not assumed			-2,181	45,999	,034	-,906	,415	-1,742	-,070

Appendix 4 – visual questions





5- ANOVA – Pro-social

		Sum of Squares	df	Mean Square	F	Sig.
Volunteer charity	Between Groups	17,243	3	5,748	1,656	,190
	Within Groups	152,674	44	3,470		
	Total	169,917	47			
Give up time to people in need	Between Groups	16,758	3	5,586	1,626	,197
	Within Groups	151,159	44	3,435		
	Total	167,917	47			
Lend out my phone	Between Groups	20,731	3	6,910	1,762	,168
	Within Groups	172,519	44	3,921		
	Total	193,250	47			
Help a stranger	Between Groups	2,076	3	,692	,256	,857
	Within Groups	119,174	44	2,708		
	Total	121,250	47			
Assist the elderly	Between Groups	1,693	3	,564	,191	,902
	Within Groups	130,286	44	2,961		
	Total	131,979	47			
Help with chores	Between Groups	3,748	3	1,249	,584	,628
	Within Groups	94,065	44	2,138		
	Total	97,813	47			
Volunteer for experiments	Between Groups	60,258	3	20,086	8,418	,000

Report

Groups		Volunteer charity	Give up time to people in need	Lend out my phone	Help a stranger	Assist the elderly	Help with chores	Volunteer for experiments
11,00	Mean	3,94	5,12	3,31	5,56	4,87	5,81	6,44
	Std. Deviation	1,731	1,821	2,056	1,315	1,544	1,377	,814
12,00	Mean	2,30	3,50	4,90	5,20	5,10	5,10	4,80
	Std. Deviation	1,567	2,121	2,025	1,932	1,853	1,853	1,751
21,00	Mean	3,00	4,73	4,73	5,55	4,91	5,36	6,09
	Std. Deviation	1,732	1,421	1,737	1,440	1,814	1,206	,944
22,00	Mean	3,18	4,45	4,00	5,09	4,55	5,27	3,64
	Std. Deviation	2,359	2,018	2,049	1,973	1,753	1,421	2,420
Total	Mean	3,21	4,54	4,13	5,38	4,85	5,44	5,38
	Std. Deviation	1,901	1,890	2,028	1,606	1,676	1,443	1,875

	Within Groups	104,992	44	2,386		
	Total	165,250	47			