How Virtual Reality Offers a Different Perspective: An Approach to Stimulate Connectedness by Eliciting Awe

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ABSTRACT

The global issue of social isolation leads people to experience a sense of being alone, which in turn increases one's self-centredness. This thesis examines whether people who are exposed to either a natural or an urban scenery through virtual reality are more, or less, inclined to let go of their 'self' and focus more on the collective and whether the degree of their perspective-taking tendency influences that feeling. This study follows a between-subjects design and was conducted among 100 Dutch participants. To test the effects of awe, participants were exposed to either a natural or an urban scenery using a virtual reality headset. The results are based on analyses of variances and moderation analyses. Results showed that the natural, compared to the urban, scenery induced higher levels of self-diminishment and perceived small self, and awe is marginally increased. Additionally, marginally significant interaction effects indicate that awe (in terms of self-diminishment) is moderated by one's perspective-taking tendencies. Moreover, results showed that the urban, compared to the natural, scenery induced higher levels of identity orientation. Implications for future research were discussed.

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1. INTRODUCTION

"Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO, 2014, p.1)." An ongoing global threat for humanity is social isolation, which can be seen as a determinant of one's social well-being, therefore we need connectedness with others to survive and prosper (Cacioppo & Hawkley, 2003; Cacioppo et al., 2011). To illustrate, with the current developments of COVID-19, it has been proven that more and more people feel 'alone' as they become increasingly isolated from the outside world (Banerjee & Rai, 2020). Social connections are greatly reduced, which also leads to a reduction in our social activities such as travelling and going out for a drink (Banarjee & Rai, 2020; De Vos, 2020). People are alone at home and eventually experience mental health issues, resulting in the feeling of loneliness, stimulating social isolation (Killgore et al., 2020). According to Cacioppo et al. (2017), loneliness is a disparity in the degree of social connections sought and accomplished by an individual and may increase one's level of self-centredness—i.e., to what extent an individual is primarily concerned with his or her own interests and welfare (Dambrun & Ricard, 2011; Cacioppo et al., 2017; Ivanhoe, 2018). The feeling of being alone often prevents people from revealing themselves to others about their social isolation, which often makes it difficult to quantify and define (Karnick, 2004). Hence, being isolated from the outside world is seen as an unpleasant emotional state.

Self-centredness frequently causes us to make irresponsible decisions that isolate and alienate us from the people and things we care about, as well as from groups, organizations, traditions, and cultures that are integral to our identities (Ivanhoe, 2018). Social relationships (e.g., family and friends) are necessary to counteract this (social) isolation (Ernst & Cacioppo, 1999; Cacioppo et al., 2011), in other words, connection with others should be stimulated. As described in Cacioppo & Hawkley, 2003; Cacioppo et al., 2011; and Van Houwelingen-Snippe et al. (2020), the feeling of connectedness with others positively affect our (mental) health. The

feeling of connectedness is inherent in the emotion of awe, defined as a positive emotion that makes it possible to inspire the 'small self' by causing a decrease in self-interest and self-importance (Bonner, 2015; Piff et al., 2015; Bai et al., 2017; Allen, 2018).

There is a substantial body of research revealing the positive effects of natural environments on (mental) health (Velarde, Fry, & Tveit, 2007; Bratman et al., 2019; Van Houwelingen-Snippe et al., 2020). Nature has the potential to restore attention, improve moods and positive emotions such as awe (Velarde, Fry, & Tveit, 2007; Piff et al., 2015; Allen, 2018), and also has the potential to reduce feelings of loneliness, stimulating social support (Joye & Bolderwijk, 2015). Nature is not easily accessible for everyone (Bratman, 2019), for example in a period of social distancing, when measures imposed by the Dutch government to decrease the spread of COVID-19 limits the ability to travel. Recent research shows that the effects on (mental) health are quite similar for simulated natural environments as it applies to real-life natural environments (Kjellgren & Buhrkall, 2010; Browning et al., 2020; Van Houwelingen et al., 2020). On the contrary, urban environments have a negative influence on our well-being because they often result in sadness and stress (Ulrich, 1979; Laumann, Gärling, & Stormark, 2003; Lederbogen et al., 2011), therefore this research will make a distinction between a natural scenery and an urban scenery.

Therefore, an upcoming technology such as virtual reality (hereinafter also referred to as "VR") offers the possibility to experience nature in an alternative way (Suh & Prophet, 2018; Browning et al., 2020). VR is a technology that reduces the gap between our own reality and artificial reality (Suh & Prophet, 2018). Since awe can be aroused by depicting a vast environment, VR can be seen as an outcome, because with VR one can enable people to become part of a simulated environment (Suh & Prophet, 2018). VR is a form of immersive technology, which is changing our perspectives towards the common use of technologies. Immersive technology is a technology that narrows the gap between real (physical) and simulated

(artificial) environments, enabling users to experience a feeling of immersion (Suh & Prophet, 2018). A study by Van Loon et al. (2018) showed that the effectiveness of VR may depend on one's perspective-taking tendencies as it requires taking the perspective of a person immersed in the VR environment.

To address gaps in existing research (i.e., lack of research on VR concerning awe, and lack of insights into virtual sceneries that stimulate perspective-taking), this current research focuses on diminishing self-centredness and increase a person's connectedness with others and tests whether one's perspective-taking tendencies positively affect the extent to which one perceives their own 'self'. Therefore, this research utilizes simple VR environments, wherein one only perceives his/her environment, but cannot interact with it (i.e., only 360-degree videos).

2. THEORETICAL FRAMEWORK

Through VR, this research aims to diminish self-centredness and increase connectedness with others. The theories and concepts provided in this section together form a theoretical framework that forms the basis for the research. This study will elaborate on the concepts of awe, identity orientation, spatial presence, and perspective-taking, and addresses the following research question: What impact does a natural (high awe) scenery, opposed to an urban scenery (low awe), have on self-centredness and to what extent is this effect dependent on people's perspective-taking tendencies to others and the world at large? In this study, distinction is made between two different sceneries, on the one hand, a natural (high awe) scenery and on the other hand, an urban (low awe) scenery.

2.1 Awe

Dambrun & Ricard (2011) define self-centredness as the central point of reference taken by the self, concerning many psychological activities (e.g., motivation, cognition, conation,

attention, behaviour, and emotion). Herein, one perceives his or her own interests to be superior to another's interests (Cacioppo et al., 2017). Awe is a positive emotion that makes it possible to inspire the *'small self'* by causing a decrease in self-centredness and moves the centre of attention of the individual towards the interest of the other and the collective (Bonner, 2015; Piff et al., 2015; Bai et al., 2017; Allen, 2018). Awe makes people feel part of a larger group and motivates them to get into situations that promote the behaviour of others (Keltner & Haidt, 2003; Piff et al., 2015; Bai et al., 2017; Allen, 2018). Individuals who have a higher degree of dispositional awe are inherently less self-important, which ultimately causes their attention to be drawn to the larger collective (Shiota et al., 2007), their self-centred tendencies to decline, and their collective identity to strengthen (Piff et al., 2015; Bai et al., 2017), hence awe leads to self-diminishment and a decrease in self-centredness.

According to Rudd et al. (2012), awe can be defined as the feeling that occurs when you see something so extraordinarily vast that it causes a desire to refresh one's mental schemes. Perlin & Li (2020) stated that awe-inducing activities could be one of personal change and growth's fastest and most potent methods. Awe can be either looked at from an interpersonal perspective, or a natural perspective, but since the interpersonal perspective is less effective in inducing awe (Graziosi & Yaden, 2019), this study focuses on the natural perspective. Chirico et al. (2017; 2018; 2019) explain that awe can be induced by demonstrating panoramic scenes of natural beauty, such as experiencing a mountain range ringed by tall trees or travelling through the universe. Hence, awe can be induced by experiencing a scenery in which one feels small in relation to something vast other than him or herself.

The extent to which an individual exerts a positive influence on others or the collective, is seen as prosocial behaviour (Bartlett & DeSteno, 2006). Actions that illustrate prosocial behaviour are sharing, donating, helping, and self-sacrifice (Penner et al., 2005; Bartlett & DeSteno, 2006; Eisenberg et al., 2015). Prosocial behaviour is becoming increasingly important

in today's society, and it is therefore of great importance for human development to identify factors that promote prosocial behaviour (Hysek et al., 2014). According to a study by Li et al. (2019), prosocial behaviour is a consequence of awe. Former research has shown that experiencing awe causes changes in self-concept, causing people to alter their cognitive behaviour patterns (Piff et al., 2015; Prade & Saroglou, 2016; Yang et al., 2016; Bai et al., 2017).

Another concept described by Dambrun & Ricard (2011) that represents the opposite of self-centredness is selflessness, in which an individual focuses on the other. This can refer to psychological activities, such as empathy, respect, or compassion. How one is able to process and react to the unique affective feelings of others is referred to as empathy (Lamm et al., 2007). As described in Lamm et al. (2007), people have the capacity to transpose themselves into another's feeling and thinking, which is described as top-down processing and can be used to trigger empathy. Empathy can be seen as a psychological activity associated with the degree to which one distances oneself more from the self and focuses more on society (Dambrun & Ricard, 2011; Dambrun, 2016). Previous research (Eisenberg & Miller, 1987; Lockwood et al., 2014) has shown that empathy does lead to (improved) prosocial behaviour, which in turn will make people feel more connected with others since connectedness can be expressed in terms of empathy, as Lang-Takac & Osterweil (1992) explained in their study.

H1: A natural scenery, rather than urban scenery, diminishes self-centredness.

H2: In a natural scenery, rather than urban scenery, the feeling of awe is expected to be higher.

H2a: In a natural scenery, rather than urban scenery, the sense of connectedness with others is expected to be higher.

H2b: In a natural scenery, rather than urban scenery, self-diminishment is expected to be higher, and self-centredness is expected to be lower.

H2c: In a natural scenery, rather than urban scenery, one is expected to feel very small compared to everything around him/herself.

2.2 Identity Orientation

Identity refers to the concept that determines who or what an individual is (Meca et al., 2015). Former research shows that a person's identity orientation focuses on the individual on the one hand—personal identity orientation—and on society on the other hand—social identity orientation (Cheek & Briggs, 1982; Cheek, 1989). Later, two more aspects were added to identity orientation as described by Cheek & Briggs (1982), which were relational and collective identity orientation (Cheek et al., 1994; Cheek et al., 2002). These four aspects describe the extent to which an individual is aware of his being, but also the being of someone else (Robins, Norem, & Cheek, 1999). Aylett & Louchart (2003) examined the use of VR as a narrative medium, to eventually look at the effect on one's identity. They state that, because of interactivity and other characteristics, VR may more readily induce identity changes compared to other (narrative) media. Since people can be immersed in a virtual scenario (Aylett & Louchart, 2003), one can construct his or her identity as a self-narrative (McAdams 1985; 2011) to make sense of their identity, hence VR can impact our self. Therefore, VR might be able to manipulate one's identity orientation, so that either the self or the collective becomes more important (or relevant) to them.

According to Pearce et al. (1997), the advantage of VR as a (narrative) medium is that the sequence of events is much easier to construct than with other forms of (narrative) media. Using VR as an experimental tool can bring along advantages, like the ability to track the behaviour of participants while exercising a high degree of control on the stimuli provided to

the user. Additionally, many forms of VR allow interacting with the virtual environment to navigate through it (Chirico et al., 2017). The physical reality and one's previous experiences before the emergence of VR used to limit one's identity development (Webb, 2001). However, the emergence of VR enabled users to engage in a variety of virtual interactions, much of which would not be feasible or practical in the solely physical real world (Yee et al., 2011; Nagy & Koles, 2014).

H3: In a natural scenery, rather than urban scenery, a person's identity is focused on the collective rather than the individual.

2.2.1 Personal Identity Orientation

The private development of one's self, as well as feelings of continuity and uniqueness, are all part of one's personal identity orientation (Cheek & Briggs, 1982; Robins, Norem, & Briggs, 1999; Meca et al., 2015). In personal identity, one's private self-consciousness is important. The act of focusing attention on the internal or hidden facets of one's self is known as private self-consciousness (Cheek & Briggs, 1982).

"Other things being equal, private self-conscious people emphasize the individual aspects of their identity. They attend more to the unshared idiosyncrasies of their particular experiences, fantasies, and feelings…" – (Cheek & Briggs, 1982, p. 402)

H3a: In a natural scenery, rather than urban scenery, one is less oriented towards personal identity.

2.2.2 Social Identity Orientation

The social roles and reputation of an individual are part of one's social identity orientation (Cheek & Briggs, 1982; Robins, Norem, & Cheek, 1999; Meca et al., 2015). In social identity, public self-consciousness is important. The tendency to be self-conscious of one's appearance and anxious about developing a great reputation among others is known as

public self-consciousness (Cheek & Briggs, 1982). To become a member of a society, a person must first gain social identity, and then begin to see himself or herself as part of the collective (Nagy & Koles, 2014).

> "…Public self-conscious people tend to identify with groups. They see themselves as social beings, sharing attitudes and affiliations with others… These public identities, important for most people, are especially important for people high in public self-consciousness." – (Cheek & Briggs, 1982, p. 402)

> **H3b**: In a natural scenery, rather than urban scenery, one is less oriented towards social identity.

2.2.3 Collective Identity Orientation

The social categories to which an individual belongs are part of one's collective identity orientation (Cheek et al., 1994; Robins, Norem, & Cheek, 1999; Meca et al., 2015). Previous research by Gardner & Garr-Schultz (2017) on collective identity states that when a person is aware of the social categories he or she belongs to, one is more likely to improve his or her individual well-being. A distinct difference between social and collective identity is how one perceives oneself as part of a group. The social identity orientation refers to one's (own) public image or reputation, whereas the collective identity orientation refers to one's group memberships or social categorizations (Cheek & Cheek, 2018). In virtual environments, group membership is seen as the key gateway to belonging to a larger society (Riberio, 2009). By depicting a vast environment, i.e. a natural scenery, one's feeling of awe should be higher (Chirico et al., 2017; Chirico et al., 2018; Chirico et al., 2019; Van Houwelingen-Snippe et al., 2020), and since the feeling of awe diminishes one's self-centredness and enhances one's sense of belonging to a larger society (Keltner & Haidt, 2003; Piff et al., 2015; Bai et al., 2017; Allen, 2018), one's collective identity orientation is expected to be higher.

H3c: In a natural scenery, rather than urban scenery, one is more oriented towards collective identity.

### 2.2.4 Relational Identity Orientation

The development of one's intimacy and relationships (e.g., manager-subordinate) with whom we have direct personal contact are part of one's relational identity orientation (Cheek et al., 2002; Meca et al., 2015). According to Sluss & Ashforth (2007), individuals are interdependent, and the essence of interaction, as well as the capacity for personal connection and affection, are valued. Relational identities are what bind a social system's network of responsibilities and role incumbents together (Brewer & Gardner, 1996).

H3d: In a natural scenery, rather than urban scenery, one is more oriented towards relational identity.

2.3 Perspective-taking Tendencies

According to Davis (1980), one's interpersonal reactivity can be explained in terms of (amongst others) empathic concern and perspective-taking. Social contact and interaction are fundamental elements in perspective-taking. People who are involved in social relationships often (partly) base their actions on how they interpret others' perspectives (Epley et al., 2004). Previous research has already shown that perspective-taking with VR has a positive effect to which people perceive others (Herrera et al., 2018). A study by Van Loon et al. (2018) has shown that the effectiveness of VR perspective-taking is dependent on the extent on which people are immersed in the VR environment. According to Herrera et al. (2018), VR is a very useful method to elicit empathy, since it enables users of VR to look at a scenario from a different point of view, which in turn might lead to increased perspective-taking tendencies.

H4: The described effects are expected to be stronger for people with high perspective-taking tendencies, as opposed to people with low perspective-taking tendencies.

Figure 1

A Conceptual Model of the Effect VR & PT have on Self-centredness
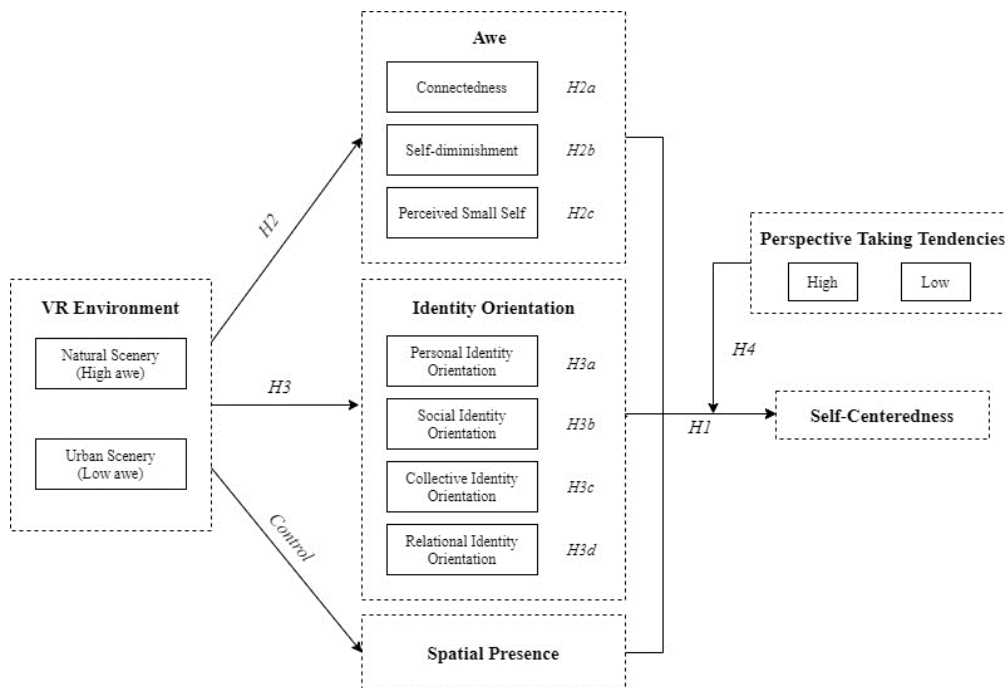
3. METHOD

This research has received ethical approval from the Behavioural, Management, and Social sciences (BMS) faculty's ethics committee (ethics code no.: 201432).

3.1 Pre-test

The pre-test aimed to verify the effectiveness of environmental manipulation. To this end, six fly- & walkthrough videos (four regular: London, Vienna, Baker River, Bryce Canyon; two 360 degrees VR: Angels Falls, Prague) were selected which were rated (N = 10) on the extent to which they triggered a feeling of awe, impressiveness, mundanity, ordinariness, and whether the videos elicited fear. The participants were exposed to these videos through the use of Oculus VR glasses. Using single items for each of these constructs, participants evaluated (using 7-point rating scales) the environments on the extent to which the environments came across as awe-inspiring, impressive, mundane, and ordinary.

3.1.1 Pre-test results

Elaborating on the aim of the pre-test, on the one hand, was to find a video that was awe-inspiring and not at all mundane and, on the other hand, to find a video that was incredibly mundane and not at all awe-inspiring. Moreover, fear was a control variable, because it had to be guaranteed that the participants did not develop anxiety during exposure to the videos. The videos were chosen based on the items' means. Three videos were clearly selected in advance as 'awe-inspiring' and three as 'mundane'. A criterion for choosing the videos was that the presentation formats for both videos were identical, i.e., that both were either 360-degree videos or regular HD videos. The results[1] were as follows: The video that had the highest mean for 'impressive' and 'awe,' and low in 'mundane' and 'common,' was the flight through the Angel Falls in Venezuela (360-degree VR; high in awe [M = 5.60; SD = 1.838]; low in mundanity [M = 1.60; SD = 1.265]). The video that had the highest mean for 'mundane' and 'common,' and low in 'impressive' and 'awe,' was the walkthrough of London (regular video; low in awe [M = 2.60; SD = 1.578]; high in mundanity [M = 5.80; SD = 1.135]). However, in order to enhance the effect of VR and because the presentation formats were supposed to be the same, we chose the Prague walkthrough since the results for this video (Awe [M = 1.70; SD = .675] versus mundane [M = 4.60; SD = 2.119]) do not differ much from those of London. For both videos (Figure 1), the participants needed to have little or no fear. This was confirmed by the low mean for 'frightening' for both videos.

3.1.2 Type of Scenery Manipulation

The participants were first exposed to a 2-and-a-half-minute video through VR goggles. The participants were either exposed to a natural scenery video or an urban scenery video. The natural scenery displayed the highest waterfall in the world, called Angel Falls in Venezuela. In this video the respondent made a flight up and downhill, surrounded by the Amazon

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[1] See Appendix A

rainforest and tall mountains (Airpano VR; YouTube; https://youtu.be/L_tqK4eqelA?t=240). The urban scenery displayed a street in Prague, the capital of the Czech Republic. In this video the respondent walked through the street, surrounded by buildings, cars, and (few) people (TravelGuide360; YouTube; https://youtu.be/mfn38jZ0_ak). The sounds of the videos were muted, and external noises were muffled by earmuffs, to let participants fully immerse themselves in the environment. Accordingly, focusing attention on the environment only may cause people to sense more spatial presence (Witmer & Singer, 1998).

Figure 2

Screenshots from both Sceneries
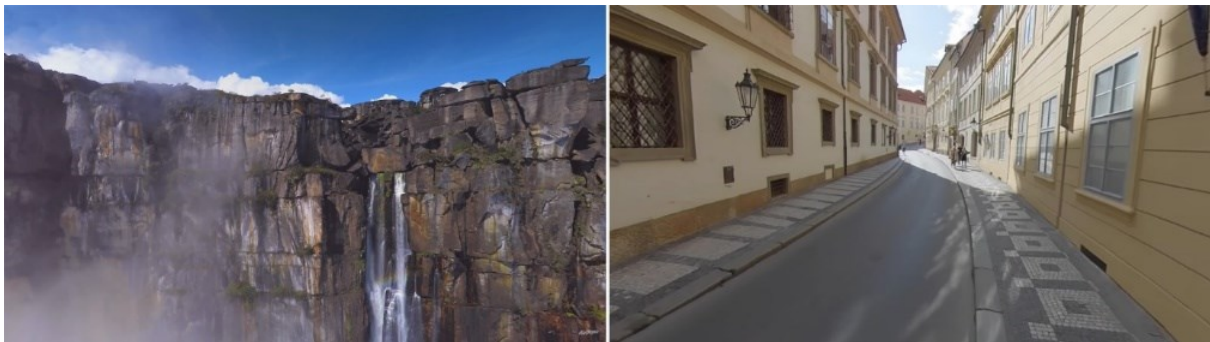
Note. Left Angel Falls, Venezuela, right Prague, Czech Republic.

3.2 Experimental Design

The experiment used a 2 (Environment: Natural scenery, Urban scenery) x2 (perspective-taking: low, high) between-subjects design. Each respondent saw just one of the experimental condition videos, varying in terms of awe (the video either displayed an awe-inspiring/natural scenery or a mundane/urban scenery), see *Figure 2*.

3.3 Participants

One hundred participants (N = 100; Male 54.0%; Female 46.0%) were enrolled in this study in March and April 2021. This study was conducted in the Netherlands, only including subjects with a Dutch nationality, who were randomly selected, within an age range from 20 to 50 years old (Age: M = 32.19; SD = 10.550).

3.4 Procedure

All participants were presented with instruction before they were exposed to the video. This instruction involved a short text that allowed the participants to feel more immersed in the scenery they were about to experience and trigger them to take on a different perspective. According to a study by Oswald (1996), it is an effective way of using instructions to get people to empathise with a perspective-taking scenario. "You will soon find yourself in a place on earth other than where you are now. Imagine yourself going on holiday to the place you will see. Try to imagine what it is like to be there. Think of the sounds you would hear there, the smells you would smell there, and the wind you would feel there. Try to focus on the place as much as possible." They were afterwards asked to complete a questionnaire, which took approximately 10 to 15 minutes.

3.5 Measures

The participants were asked to complete a survey using both 5 and 7-point Likert scales, which consisted of a total of 63 questions. The independent variables were the virtual environment and perspective-taking. The dependent variables were awe, identity orientation, and spatial presence. An overview of the questionnaire can be found in the appendix.

3.5.1 Awe

To measure the degree of awe experienced by the participants, this study used three single items from the Awe Experience Scale of (Yaden et al., 2018). The constructs used are based on a study by Van Houwelingen-Snippe et al. (2020) and concern connectedness (i.e., 'I felt closely connected to humanity'), self-diminishment (i.e., 'I felt small compared to everything else'), and perceived small self (i.e., vastness: 'I perceived something that was much larger than myself').

3.5.1.1 Connectedness

In addition to the construct from the Awe Experience Scale (i.e., 'I felt closely connected to humanity') this study used two visuals to measure the extent to which people are more or less connected to their environment: The Perceived Body Boundaries (Figure 3) by Dambrun (2016) and the ICS Scale (Figure 4) by Mashek, Cannadey, & Tangney (2007) were used. By asking the participants which 'body boundary' suits their current body state, it could be determined whether the participants felt part of a larger whole (arising from awe), by indicating whether their body boundary is either imperceptible or salient. Additively, asking participants which of the circle combinations suits their relationship with the community at large, showed the extent to which they feel connected to others(For PBB & ICS it applies that the higher one scores, the stronger their connection is to others/community at large).
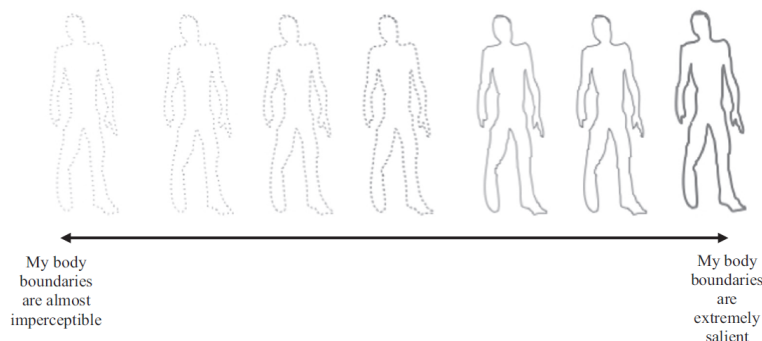
Figure 3

Perceived Body Boundaries[2]

Figure 4

Inclusion of Community in Self Scale[3]

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[2] By Dambrun, M. (2016).
[3] By Mashek, D., Cannaday, L.W., & Tangney., J.P. (2007).

3.5.2 Identity Orientation

The aspects of identity questionnaire (AIQ-IV), used in a study by Cheek & Briggs (2013), measured the relevance of someone's identity orientation. Items that are discussed here represent one's personal identity orientation (PIO; $\alpha = .74$), collective identity orientation (CIO; $\alpha = .71$), social identity orientation (SIO; $\alpha = .86$), and relational identity orientation (RIO; $\alpha = .91$). The AIQ-IV consists of 35 questions.

3.5.3 Spatial Presence

To measure the extent to which the participants felt immersed into the virtual scenarios, the Spatial Presence Experience Scale (SPES), as proposed by a study of Hartmann et al. (2016) was used. Spatial presence is used as a control variable, to check whether participants really felt physically present in the virtual scenario. Spatial presence is a concept that is becoming increasingly common in studies examining new media (Lombard & Ditton, 1997), for the concept arose from observations in which VR users felt physically present in a virtual environment (Slater & Steed, 2000). In a nutshell, spatial presence is the user's subjective sense of "being there" in the environment shown by a (virtual) medium (Hartmann et al., 2016). This research activates people to focus on either a natural or an urban scenery, in which people ought to experience spatial presence. According to previous research by Witmer & Singer (1998), focusing attention on a specific environment causes an individual to become more immersed in the environment and, as a result, enhance the level of presence. In order to follow the aim of this study, we used a subscale of the SPES: Self-Location (SP; $\alpha = .90$). From this subscale, 5 items were used that reflect on one's presence in the virtual environment; including questions such as 'I felt as though I was physically present in the environment of the presentation.'

3.5.4 Perspective-taking

The Interpersonal Reactivity Index by Davis (1980) was used to measure to what extent participants have concern for others by taking on a different perspective including the subscales

of perspective-taking (PT; α = .69) and empathic concern (EC; α = .72). This questionnaire consists of 14 questions, including questions such as: 'I sometimes find it difficult to see things from the "other guy's" point of view' and 'Sometimes I don't feel very sorry for other people when they are having problems (reversed).'

3.6 Data Analysis

In order to test the hypotheses, moderation regression analysis and an analysis of variances (ANOVA) were conducted. All data is analysed using SPSS. For the moderation regression analysis, we used Hayes' PROCESS Macro.

3.6.1 Moderation analysis

Using the Process Macro by Hayes, the direct effect of the independent variable (X) on the dependent variables (Y), via a moderator variable (W) was tested, see Figure 4. In moderation analysis (see Figure 5) according to Rockwood & Hayes (2020) three effects are measured: (a) the effect from X on Y, (b) the effect from W on Y, and (c) the effect from X via W on Y.

Figure 5

Model 1 for Moderation[4]

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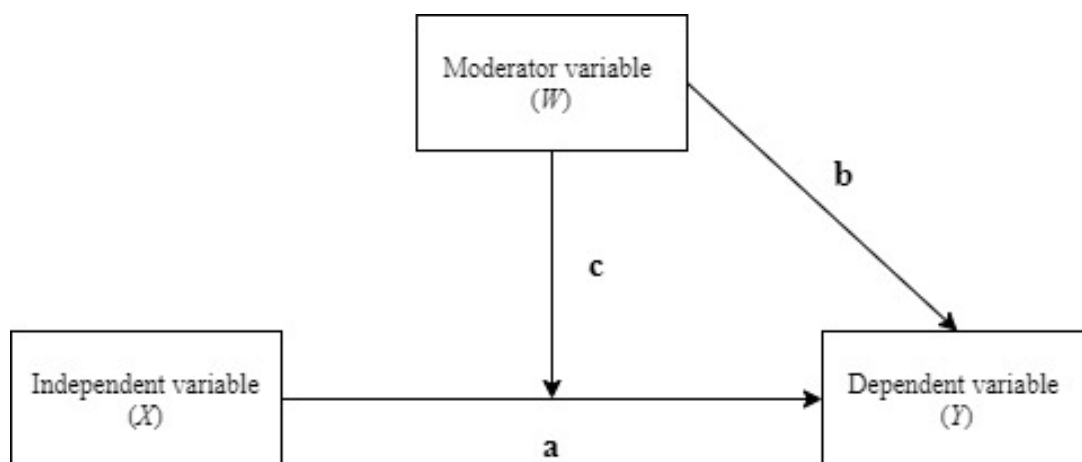
[4] By Rockwood, N.J., & Hayes, A.F. (2020)

3.6.2 Analysis of Variances

To examine whether there is a comparison between the VR groups (natural versus urban scenery), an analysis of variances (ANOVA) is conducted. This involves testing whether there is a comparison in the means of the two VR environments. For this test, Levene's test of homogeneity should be $p \leq .05$ (95% Confidence Interval), then equal variances are assumed. If equal variances are not assumed, the degree of freedom is corrected using a Brown-Forsythe test.

Table 1

Reliability Estimates for each Construct

Construct	Cronbach's α	Items
Personal Identity Orientation (PIO)	.74	10
Social Identity Orientation (SIO)	.71	7
Collective Identity Orientation (CIO)	.86	8
Relational Identity Orientation (RIO)	.91	10
Spatial Presence (SP)	.90	5
Perspective-taking (PT)	.69	7
Empathic Concern (EC)	.72	7

Note. All constructs show an acceptable α. Hence, all constructs are included in the data analysis.

4. RESULTS

The results of the moderation regression analysis, and the analysis of variances (ANOVA) will be discussed in this chapter. These analyses looked at whether the effect of the independent/predictor variable (natural scenery, urban scenery) on the dependent variables (awe; identity orientation; & spatial presence) depends on the moderator variable 'perspective-taking tendency'. All measures were conducted to test H1 and H4.

4.1 Awe

To test H2, this section elaborates on the effects of the VR environment on awe, expressed in terms of connectedness, self-diminishment, and perceived small self. Hereby, we examined whether the effect between the VR environment and awe depends on a person's perspective-taking tendency.

Table 2

Descriptive Statistics Awe

	N	Min.	Max.	Mean	Std. Deviation
Connectedness	100	1	5	2.76*	1.147
Self-diminishment	100	1	5	2.93*	1.653
Perceived Small self	100	1	5	3.54*	1.410
Perceived Body Boundary (PBB)	98	1	7	4.01**	1.516
Self-Connected to Community (ICS)	96	2	6	3.97***	1.100
Valid N (listwise)	94				

*. Based on 5-point Likert Scale
**. Based on 7-point Likert Scale
***. Based on 6-point Likert Scale

4.1.1 Connectedness

To test H2a three single-item constructs concerning connectedness with others were measured. The first of these constructs was connectedness 'I felt closely connected to humanity' (on a scale from 1 = Strongly disagree to 5 = Strongly agree). To investigate whether there is a comparison between groups, an ANOVA was conducted. The F-test showed a statistically significant difference in the mean connectedness between the VR environments [$F(1, 94.351)$ = 4.535; $p \leq .05$]. The mean connectedness for the natural scenery [M = 2.52; SD = 1.233] was lower than the mean connectedness for the urban scenery [M = 3.00; SD = 1.010], this indicates that the natural scenery leads to a lower score on connectedness, than an urban scenery does. To examine whether PTT affects the manipulation, a simple moderator analysis was performed

using PROCESS. This construct was the outcome variable for analysis (N = 100; M = 2.76; SD = 1.147). The predictor variable for the analysis was the VR environment (natural versus urban scenery). The moderator variable evaluated for the analysis was Perspective-taking tendency (high versus low). The interaction between the VR environment and PTT was found to be statistically insignificant [B = .109, 95% C.I. (-.365, .584), p = .648]. These results identify PTT as a non-moderator of the relationship between the VR environment and connectedness. According to the moderation analysis, the VR environment also has a direct effect on connectedness [B = .486, 95% C.I. (.038, .935), p ≤ .05].

The second of these constructs was the PBB scale, in which participants indicated which body boundary (on a scale from 1 = extremely salient to 7 = extremely imperceptible) most applied to them. To investigate whether there is a comparison between groups, an ANOVA was conducted. The F-test showed an insignificant difference in the mean connectedness based on the PBB scale between the natural and the urban scenery [F(1, 96) = 1.284; p = .260]. This indicates that the VR environment does not affect the extent to which participants see their body boundary. To examine whether PTT affects the manipulation, a simple moderator analysis was performed using PROCESS. This construct was the outcome variable for analysis (N = 98; M = 4.01; SD = 1.516). The predictor variable for the analysis was the VR environment (natural versus urban scenery). The moderator variable evaluated for the analysis was Perspective-taking tendency (high versus low). The interaction between the VR environment and PTT was found to be statistically insignificant [B = -.438, 95% C.I. (-1.074, .198), p = .175]. These results identify PTT as a non-moderator of the relationship between the VR environment and PBB.

The third of these constructs was the ICS scale, in which participants indicated which circles (on a scale from 1 = no overlap to 6 = full overlap) best represented the connection between their 'self' and the community at large. To investigate whether there is a comparison between groups, an ANOVA was conducted. The F-test showed an insignificant difference in

the mean connectedness based on the ICS scale between the natural and the urban scenery [F(1, 94) = 1.957; p = .165]. This indicates that the VR environment does not affect the extent to which participants see their 'self' connected to the community at large. To examine whether PTT affects the manipulation, a simple moderator analysis was performed using PROCESS. This construct was the outcome variable for the analysis (N = 96; M = 3.97; SD = 1.100). The predictor variable for the analysis was the VR environment (natural versus urban scenery). The moderator variable evaluated for the analysis was Perspective-taking Tendency (high versus low). The interaction between the VR environment and PTT was found to be statistically insignificant [B = .024, 95% C.I. (-.443, .490), p = .920]. These results identify PTT as a non-moderator of the relationship between the VR environment and ICS. Therefore, based on these three single-item constructs we can reject hypothesis H2a.

4.1.2 Self-Diminishment

To test H2b one single-item construct was measured. This construct was self-diminishment 'I felt small compared to everything else' (on a scale from 1 = Strongly disagree to 5 = Strongly agree). To investigate whether there is a comparison between groups, an ANOVA was conducted. The F-test showed a statistically significant difference in the mean self-diminishment between VR environments [F(1, 98) = 63.233, p ≤ .001]. The mean self-diminishment for the natural scenery [M = 3.96; SD = 1.277] was higher than the mean self-diminishment for the urban scenery [M = 1.90; SD = 1.313]. This indicates that in a natural scenery one felt smaller, whereas in an urban scenery one felt larger. Therefore, we can support hypothesis H2b. To examine whether PTT affects the manipulation, a simple moderator analysis was performed using PROCESS. This construct was the outcome variable for analysis (N = 100; M = 2.93; SD = 1.653). The predictor variable for the analysis was the VR environment (natural versus urban scenery). The moderator variable evaluated for the analysis was Perspective-taking tendency (high versus low). The interaction between the VR

environment and PTT was found to be marginally significant [B = -.5043, 95% C.I. (-1.043, .035), p ≤ .10]. The conditional effect of VR on self-diminishment showed corresponding effects. At low moderation [PTT = -.953], the conditional effect = -1.583, 95% C.I. (-2.307, -.860), p ≤ .001. At middle moderation [PTT = .000], the conditional effect = -2.064, 95% C.I. (-2.574, -1.554), p ≤ .001. At high moderation [PTT = .953], the conditional effect = -2.545, 95% C.I. (-3.269, -1.820), p ≤ .001. These results identify PTT as a (marginal) moderator of the relationship between the VR environment and self-diminishment. The model also showed that the direct effect VR has on self-diminishment is statistically significant [B = -2.064, 95% C.I. (-2.574, -1.554), p ≤ .001]. This does not apply for the direct effect PTT has on self-diminishment [B = -.087, 95% C.I. (-.356, .1825), p = .523]. This indicates that the VR environment does affect self-diminishment, and this effect is also moderated by participants' PTT. For the natural scenery it indicates that the higher PTT one had, the smaller one felt. For the urban scenery it indicates that the higher PTT one had, the bigger one felt (see *Figure 9- Appendix C*).

4.1.3 Perceived Small Self

To test H2c one single-item construct was measured. This construct was perceived small self 'I perceived something much larger than myself' (on a scale from 1 = Strongly disagree to 5 = Strongly agree). To investigate whether there is a comparison between groups, an ANOVA was conducted. The F-test showed a statistically significant difference in the mean small self between the VR environments [F(1, 97.824) = 10.690; p ≤ .05]. The mean 'small self' for the natural scenery [M = 3.98; SD = 1.317] was higher than the mean 'small self' for the urban scenery [M = 3.10; SD = 1.374], this indicates that the natural scenery leads to a higher score on perceived small self, compared to an urban scenery. Therefore, we can support hypothesis H2c. To examine whether PTT affects the manipulation, a simple moderator analysis was performed using PROCESS. This construct was the outcome variable for analysis (N = 100; M

= 3.54; SD = 1.410). The predictor variable for the analysis was the VR environment (natural versus urban scenery). The moderator variable evaluated for the analysis was Perspective-taking tendency (high versus low). The interaction between the VR environment and PTT was found to be statistically insignificant [B = .203, 95% C.I. (-.366, .771), p = .481]. These results identify PTT as a non-moderator of the relationship between the VR environment and the perceived small self. According to the moderation analysis, the VR environment also has a direct effect on the perceived small self [B = -.882, 95% C.I. (-1.420, -.343), p ≤ .05].

4.2 Identity Orientation

To test H3, this section elaborates on the effect of the VR environment on one's identity orientation, expressed in terms of personal identity orientation (PIO), social identity orientation (SIO), collective identity orientation (CIO), and relational identity orientation (RIO).

Table 3

Descriptive Statistics of Identity Orientation

	N	Min.	Max.	Mean	Std. Deviation
Personal Identity Orientation (PIO)	100	22.00	48.00	39.41	5.007
Collective Identity Orientation (CIO)	100	10.00	36.00	24.25	5.068
Social Identity Orientation (SIO)	100	7.00	34.00	24.93	5.119
Relational Identity Orientation (RIO)	100	13.00	50.00	43.40	5.827
Valid N (listwise)	100				

4.2.1 Personal Identity Orientation

To test H3a the PIO construct of the AIQ-IV questionnaire was measured. To investigate whether there is a comparison between VR groups, an ANOVA was conducted. The F-test showed an insignificant difference in the mean PIO between the VR environments [F(1, 85.514) = 2.661; p = .107]. Therefore, we can reject hypothesis H3a. To examine whether PTT affects the manipulation, a simple moderator analysis was performed using PROCESS. This construct

was the outcome variable for analysis (N = 100; M = 39.41; SD = 5.007). The predictor variable for the analysis was the VR environment (natural versus urban scenery). The moderator variable evaluated for the analysis was Perspective-taking tendency (high versus low). The interaction between the VR environment and PTT was found to be statistically insignificant [B = .140, 95% C.I. (-1.871, 2.151), p = .890]. These results identify PTT as a non-moderator of the relationship between the VR environment and PIO. However, according to this model the direct effect of the VR environment on PIO was marginal significant [B = 1.690, 95% C.I. (-.213, 3.594), p ≤ .10]. The direct effect of PTT on PIO was statistically significant according to the model [B = 1.537, 95% C.I. (.532, 2.543), p ≤ .01].

4.2.2 Social Identity Orientation

To test H3b the SIO construct of the AIQ-IV questionnaire was measured. To investigate whether there is a comparison between VR groups, an ANOVA was conducted. The F-test showed a statistically significant difference in the mean SIO between the VR environments [F(1, 79.416) = 4.886; p ≤ .05]. The mean SIO for the natural scenery [M = 23.82; SD = 6.117] was lower than the mean SIO for the urban scenery [M = 26.04; SD = 3.608], this indicates that in a natural scenery one scores lower on SIO than one does in an urban scenery. Therefore, we can support hypothesis H3b. To examine whether PTT affects the manipulation, a simple moderator analysis was performed using PROCESS. This construct was the outcome variable for analysis (N = 100; M = 24.93; SD = 5.119). The predictor variable for the analysis was VR environment (natural versus urban scenery). The moderator variable evaluated for the analysis was Perspective-taking tendency (high versus low). The interaction between the VR environment and PTT was found to be statistically insignificant [B = 1.610, 95% C.I. (-.492, 3.713), p = .132]. These results identify PTT as a non-moderator of the relationship between the VR environment and SIO. However, the direct effect of the VR environment on SIO was according to the model also statistically significant [B = 2.231, 95% C.I. (.241, 4.221), p ≤ .05].

4.2.3 Collective Identity Orientation

To test H3c the CIO construct of the AIQ-IV questionnaire was measured. To investigate whether there is a comparison between VR groups, an ANOVA was conducted. The F-test showed an insignificant difference between the VR environments [$F(1, 98) = 2.340$, $p = .129$]. This indicates that the VR environment does not affect the extent to which people are oriented to their collective identity. Therefore, we can reject hypothesis H3c. To examine whether PTT affects the manipulation, a simple moderator analysis was performed using PROCESS. This construct was the outcome variable for analysis ($N = 100$; $M = 24.25$; $SD = 5.068$). The predictor variable for the analysis was VR environment (natural versus urban scenery). The moderator variable evaluated for the analysis was Perspective-taking tendency (high versus low). The interaction between the VR environment and PTT was found to be statistically insignificant [$B = -.683$, 95% C.I. (-2.782, 1.416), $p = .520$]. These results identify PTT as a non-moderator of the relationship between the VR environment and CIO. The model also showed that there is no significant direct effect of the VR environment on CIO [$B = 1.580$, 95% C.I. ($-.406$, 3.566), $p = .118$].

4.2.4 Relational Identity Orientation

To test H3d the RIO construct of the AIQ-IV questionnaire was measured. To investigate whether there is a comparison between VR groups, an ANOVA was conducted. The F-test showed an insignificant difference in the mean RIO between the VR environments [$F(1, 81.780) = 2.531$; $p = .115$]. Therefore, we can reject hypothesis H3d. To examine whether PTT affects the manipulation, a simple moderator analysis was performed using PROCESS. This construct was the outcome variable for analysis ($N = 100$; $M = 43.40$; $SD = 5.827$). The predictor variable for the analysis was VR environment (natural versus urban scenery). The moderator variable evaluated for the analysis was Perspective-taking tendency (high versus low). The interaction between the VR environment and PTT was found to be statistically

insignificant [B = .930, 95% C.I. (-1.405, 3.264), p = .431]. These results identify PTT as a non-moderator of the relationship between the VR environment and RIO. However, according to the moderation model, the direct effect of the VR environment on RIO was marginal significant [B = 1.923, 95% C.I. (-.285, 4.132), p ≤ .10]. The direct effect of PTT on RIO was statistically significant according to the model [B = 1.822, 95% C.I. (.655, 2.989), p ≤ .01].

4.3 Spatial Presence

The spatial presence variable was used as a control variable to check whether people felt physically present in the VR environment they experienced. Using the self-location subscale of the SPES, we measured one's spatial presence [N = 100; M = 3.45; SD = .966]. To examine whether there are differences between VR groups, an ANOVA was conducted. The F-test indicated that there is an insignificant difference between groups, which in this case is good [F(1, 98) = .176, p = .666]. This indicates that the groups (the natural scenery & the urban scenery) both felt about equally physically present in the virtual environment.

Table 4

Overall Results Analysis of Variances (ANOVA)

Dependent Variable	Levene's Test p	ANOVA SS	df	Mean Square	F	p
Connectedness	.034	5.760	1, 94.351*	5.760	4.535	.036
PBB	.509	2.943	1, 96	2.943	1.284	.260
ICS	.391	2.344	1, 94	2.344	1.957	.165
Self-diminishment	.678	106.090	1, 98	106.090	63.233	.000
Perceived Small self	.051	19.360	1, 97.824*	19.360	10.690	.001
Personal Identity Orientation	.025	65.610	1, 85.514*	65.610	2.661	.107
Social Identity Orientation	.003	123.210	1, 79.416*	123.210	4.886	.030
Collective Identity Orientation	.647	59.290	1, 98	59.290	2.340	.129

Relational Identity Orientation	.083	84.640	1, 98	84.640	2.531	.115
Spatial Presence	.398	.176	1, 98	.176	.187	.666

*. Brown-Forsythe's Robust Test of Equality of Means.
Note. Predictor variable was VR environment (natural versus urban scenery).

Table 5

Overall Results Moderation Regression Analysis

	Interaction Effect			Model Summary			
Dependent Variable	**β**	**t**	**p**	**F**	**df**	**p**	**R^2**
Connectedness	.109	.458	.648	2.005	3, 96	.118	.059
PBB	-.438	-1.367	.175	1.596	3, 94	.196	.049
ICS	.024	.101	.920	1.496	3, 92	.221	.047
Self-diminishment	-.504	-1.858	.066	22.689	3, 96	.000	.415
Perceived Small self	.203	.707	.481	3.723	3, 96	.014	.104
Personal Identity Orientation	.140	.138	.890	4.022	3, 96	.010	.112
Social Identity Orientation	1.610	1.520	.132	2.448	3, 96	.068	.071
Collective Identity Orientation	-.683	-.646	.520	1.888	3, 96	.137	.056
Relational Identity Orientation	.930	.790	.431	4.228	3, 96	.008	.117

Note. The predictor variable was VR environment (natural versus urban scenery) and the moderator variable was Perspective-taking Tendency (high versus low).

Table 6

Overview of Hypotheses

Hypothesis	**Status**	**Remarks**
H1 – A natural scenery, rather than urban scenery, diminishes self-centredness.	Rejected	
H2 – In a natural scenery, rather than urban scenery, the feeling of awe is expected to be higher.	Supported	Partially
(a) Connectedness	Rejected	
(b) Self-diminishment	Supported	
(c) Perceived Small self	Supported	
H3 – In a natural scenery, rather than urban scenery, a person's identity is focused on the collective rather than the individual.	Rejected	Negatively related
(a) Personal Identity Orientation	Rejected	

(b)	Social Identity Orientation	Supported	
(c)	Collective Identity Orientation	Rejected	Negatively related
(d)	Relational Identity Orientation	Rejected	Negatively related
H4 – The described effects are expected to be stronger for people with high perspective-taking tendencies, as opposed to people with low perspective-taking tendencies.		Rejected	Only marginal effect for self-diminishment

5. DISCUSSION

Inspired by previous research concerning Awe and Identity Orientation, and the extent to which people take on different perspectives when using VR, the present study aimed to find a way to diminish one's self-centredness, hence stimulating connectedness with others. An obvious example that could enforce the way of diminishing self-centredness is the Covid-19 crisis and the resulting social isolation of people, since people are more isolated which is disastrous for one's well-being and (mental) health (Velarde, Fry, & Tveit, 2007; Bratman et al., 2019; Van Houwelingen-Snippe et al., 2020). Based on the literature presented in the theoretical framework, the expectations were such that there would be a positive intended effect of the VR manipulation on self-centredness (i.e., caused by social isolation). In other words, it was expected in advance that in a natural VR environment people would let go of their 'self' and focus more on everything around them, i.e., the collective.

Following up on research stressing awe (Piff et al., 2015; Prade & Saroglou, 2016; Yang et al., 2016; Bai et al., 2017; Allen, 2018; Van Houwelingen-Snippe et al., 2020) and perspective-taking (Epley et al., 2004; Herrera et al., 2018), as important to VR, virtual scenarios varying in a high degree of awe (natural scenery) and a low degree of awe (urban scenery) were presented utilizing Oculus VR glasses. Participants felt much smaller, as well as experiencing something much larger, in the natural scenery rather than in the urban scenery. Hence, in a natural scenery one experienced more awe, as opposed to an urban scenery in which people experienced less awe. The first part of this research has thus been confirmed: a natural environment slightly diminishes self-centredness, based on the feeling of awe that was

generated among the participants. These results are in line with previous research (Piff et al., 2015; Allen, 2018; Van Houwelingen-Snippe et al., 2020).

However, previous research concerning VR & identity orientation (Cheek & Briggs, 1982; Cheek, 1989; Cheek et al., 1994; Robins, Norem, & Cheek, 1999; Cheek et al., 2002; Aylett & Louchart, 2003; Meca et al., 2015) in combination with the awe-environment (natural versus urban scenery), is not consistent with the present study. Where previous research stated that by eliciting awe, people were more prone to the collective, and less to the individual ((Piff et al., 2015; Prade & Saroglou, 2016; Yang et al., 2016; Bai et al., 2017; Allen, 2018), the present study shows that there are insignificant differences between the natural (high awe) and the urban scenery (low awe) concerning PIO, CIO, and RIO. Although the results of identity orientation are not in line with expectations, the results are interesting. Because the different approaches are mutually exclusive, i.e., someone might score higher on PIO and lower on SIO, but since these are very different concepts, one can only consider the concepts independently of each other. Hence, the results must be examined concept by concept, so one can state that in the field of SIO, there is a significant difference between a natural scenery and an urban scenery. Furthermore, one can see the effects of eliciting awe on one's SIO, since the smaller/more self-diminished participants felt, the lower their SIO was. This indicates that they were at that moment less occupied with categorizing their 'self' in the community and more occupied with the collective as a whole.

5.1 Future Research

This thesis examined whether people who are exposed to a natural (awe-inspiring) scenery through VR are more likely to let go of their 'self' and focus more on the collective, and to what extent perspective-taking moderates the manipulation effect. This research fits well within the psychological sciences; however, the subjects will have to be examined in further detail since there is no sufficient information on which aspects of VR and perspective-taking

contribute to therapeutic applications. There are several practical applications for this research. For example, you can encourage people who find it difficult to put themselves in other people's shoes to adopt someone else's perspective. For psychological applications in which one has to assess oneself, one can build on this study, for example. Individual self-assessments of performance are primarily driven by social comparison (Yperen & Leander, 2014). This is where awe-inspiring environments can play a major role in the future. For example, it could be examined whether the extent to which one compares oneself to another can be reduced by eliciting awe through VR.

The role of aspects of human-computer interaction remains unclear in this study, therefore, qualitative research could be conducted to observe people's reactions when interacting with VR technology. As the development of VR technology continues to grow, in future it will be possible to make someone even more immersed in a virtual environment. However, because many participants were not yet familiar with the use of VR glasses, the effect of immersion was fairly strong. Additively, future research will have to focus on further developing the manipulation, for example by adding multi-sensory stimuli to the VR manipulation. Think of hearing, smelling, touching and tasting. An example study by Annerstedt et al. (2013) showed that adding sounds of nature in a VR forest positively affects one's recovery from stress, hence contributing to improved (mental) health. Adding to this, it will also be beneficial for future research to look deeper into immersion through interactivity, which is an important topic when regarding immersion according to Mütterlein (2018). If someone can move around in the virtual environment (i.e., walk, touch, pick up), that person might be even more immersed in the environment. This was not considered in this study.

Moreover, especially on the subject of identity orientation and VR, more research is needed, since there were only significant effects concerning the manipulation on one's social identity orientation. For example, the development of a virtual identity (e.g., using avatars) in

a virtual environment could be taken into account, according to a study by Nagy & Koles (2014).

5.2 Limitations

The most crucial limitation of the study relates to the measures concerning Covid-19. It was impossible to examine larger groups at the same time, which made the final study took longer than expected and made it impossible to examine many more people. Of course, this would not have been the case if more was possible in terms of group-gathering. Hence, the results would be more generalizable if a larger group of people had participated in the study. However, the current group was large enough to indicate significance. Another limitation was that for some participants it was quite difficult to understand how to use the VR goggles, therefore some of them accidentally were exposed by the video which they should not have seen before filling in the questionnaire. This might have weakened the effect of the manipulation somewhat. Because it was ultimately impossible to get people to come to one place, the research was also a logistical challenge. We had to deal with unfamiliar environments, which sometimes meant that we could not take into account external distractions, such as sounds that people might have heard during the manipulation, even though sounds were completely muffled for them.

5.3 Conclusion

The study found that awe and spatial presence were induced among the participants. It is proven that the natural scenery generally achieved the expected scores concerning the feeling of awe, so it is the case that a natural scenery makes one feel very small, and self-diminishment is also involved. However, it was shown that only for social identity orientation there is a (positive) difference between the natural scenery and the urban scenery. Overall, it can be said that, based on the feeling of awe, a natural scenery does affect the impact on one's self-centredness. Hence, the diminishment of self-centredness was effective concerning awe, but

combined with one's identity orientation, the effect was not sufficient due to the equalities between the natural and the urban scenery when regarding an identity orientation that is either focused on the individual or focused on the collective. Apart from the interaction effect of perspective-taking tendencies on self-diminishment, all other effects were not dependent on one's perspective-taking tendencies to others and the world at large.

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APPENDICES

Appendix A

Table 7

Crosstabulation Descriptive Statistics

Construct	London		Vienna		Baker River		Bryce Canyon		Angel Falls*		Prague*	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Impressive	1.90	1.370	2.40	1.350	5.10	1.524	4.90	1.792	5.70	1.418	3.20	1.549
Awe	2.60	1.578	2.40	1.647	4.80	1.619	4.90	1.792	5.60	1.838	1.70	.675
Mundane	5.80	1.135	4.60	1.776	2.30	1.337	1.90	1.287	1.60	1.265	4.60	2.119
Common	6.40	.699	5.90	1.449	3.20	2.044	2.70	2.163	2.10	1.853	5.30	1.947
Frightening	1.20	.422	1.10	.316	1.50	.972	2.20	1.476	2.50	1.716	1.10	.316

*. Virtual Reality 360-degree video.

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Appendix B

Table 8

Variable Measurement Items

Construct	Item	Source
Awe & Connectedness	I felt closely connected to humanity.	Yaden et al. (2018);
Awe & Self-Diminishment	I felt small compared to everything else.	Van Houwelingen-Snippe et al. (2020)
Awe & Small Self	I perceived something much larger than myself.	
PIO	My personal values and moral standards.	Cheek and Briggs (2013)
	My dreams and imagination.	
	My personal goals and hopes for the future.	
	My emotions and feelings.	
	My thoughts and ideas.	
	The ways I deal with my fears and anxieties.	
	My feeling of being a unique person, being distinct from others.	
	Knowing that I continue to be essentially the same inside even though life involves many external changes.	
	My self-knowledge, my ideas about what kind of person I really am.	
	My personal self-evaluation, the private opinion I have of myself.	
SIO	My popularity with other people.	
	The ways in which other people react to what I say and do.	
	My physical appearance: my height, my weight, and the shape of my body.	
	My reputation, what others think of me.	
	My attractiveness to other people.	
	My gestures and mannerisms, the impression I make on others.	
	My social behaviour, such as the way I act when meeting people.	
CIO	Being a part of the many generations of my family.	
	My race or ethnic background.	
	My religion.	
	Places where I live or where I was raised.	
	My feeling of belonging to my community.	
	My feeling of pride in my country, being proud to be a citizen.	
	My commitments on political issues or my political activities.	
	My language, such as my regional accent or dialect or a second language that I know.	
RIO	My relationships with the people I feel close to.	

	Being a good friend to those I really care about. My commitment to being a concerned relationship partner. Sharing significant experiences with my close friends. Having mutually satisfying personal relationships. Connecting on an intimate level with another person. Developing caring relationships with others. My desire to understand the true thoughts and feelings of my best friend or romantic partner. Having close bonds with other people. My feeling of connectedness with those I am close to.	
Spatial Presence	I felt like I was actually there in the environment of the presentation. It seemed as though I actually took part in the action of the presentation. It was as though my true location had shifted into the environment of the presentation. I felt as though I was physically present in the environment of the presentation. I experienced the environment in the presentation as though I had stepped into a different place.	Hartmann et al. (2016)
Empathic Concern	I often have tender, concerned feelings for people less fortunate than me. Sometimes I don't feel very sorry for other people when they are having problems. (-) When I see someone being taken advantage of, I feel kind of protective towards them. Other people's misfortunes do not usually disturb me a great deal. (-) When I see someone being treated unfairly, I sometimes don't feel very much pity for them. I am often quite touched by things that I see happen. (-) I would describe myself as a pretty soft-hearted person.	Davis (1980)
Perspective-Taking	I sometimes find it difficult to see things from the "other guy's" point of view. (-) I try to look at everybody's side of a disagreement before I make a decision. I sometimes try to understand my friends better by imaging how things look from their perspective. If I'm sure I'm right about something, I don't waste much time listening to other people's arguments. (-) I believe that there are two sides to every question and try to look at them both. When I'm upset at someone, I usually try to "put myself in his shoes" for a while. Before criticizing somebody, I try to imagine how I would feel if I were in their place.	

Note. (-) = reversed scored.

Appendix C

Figure 6

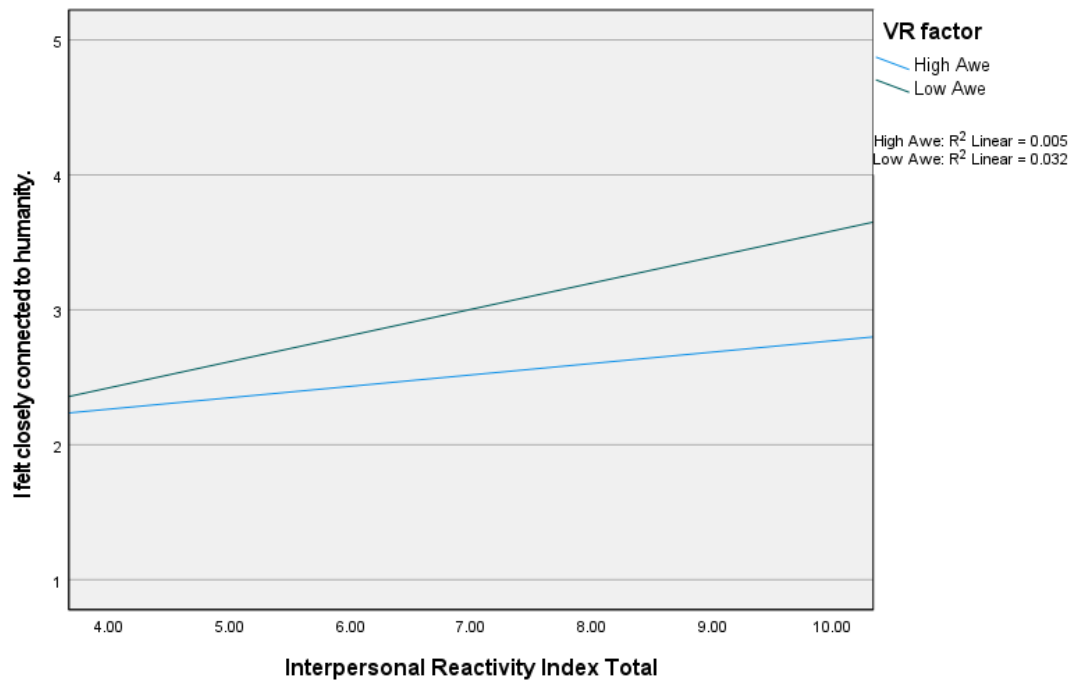*Moderation analysis Awe & Connectedness*
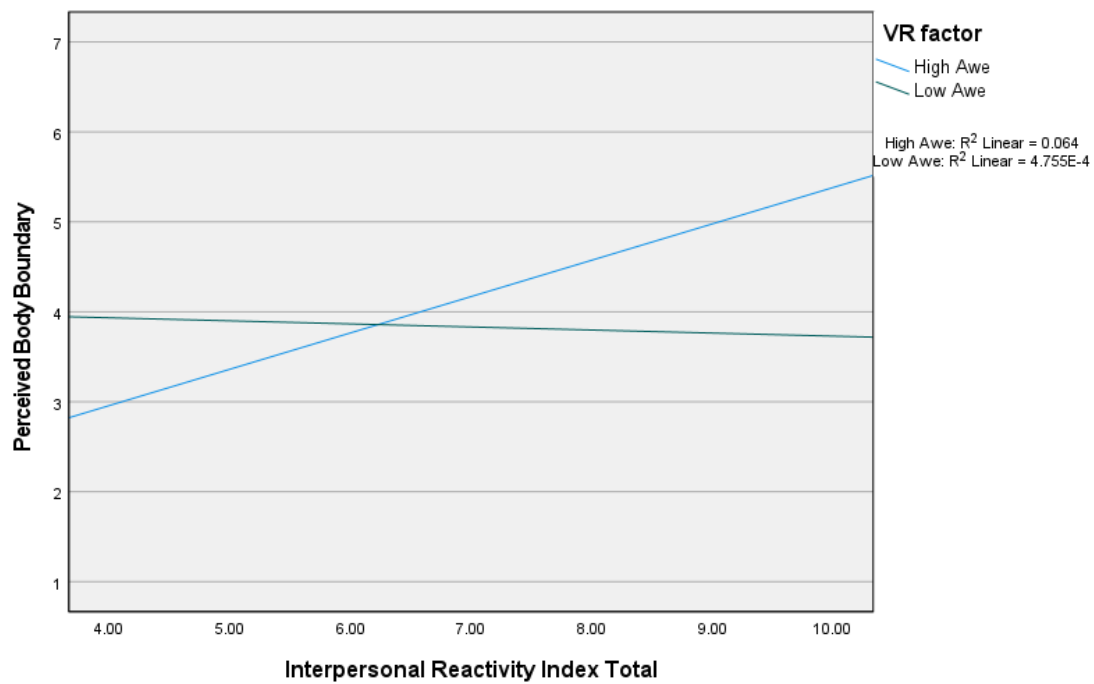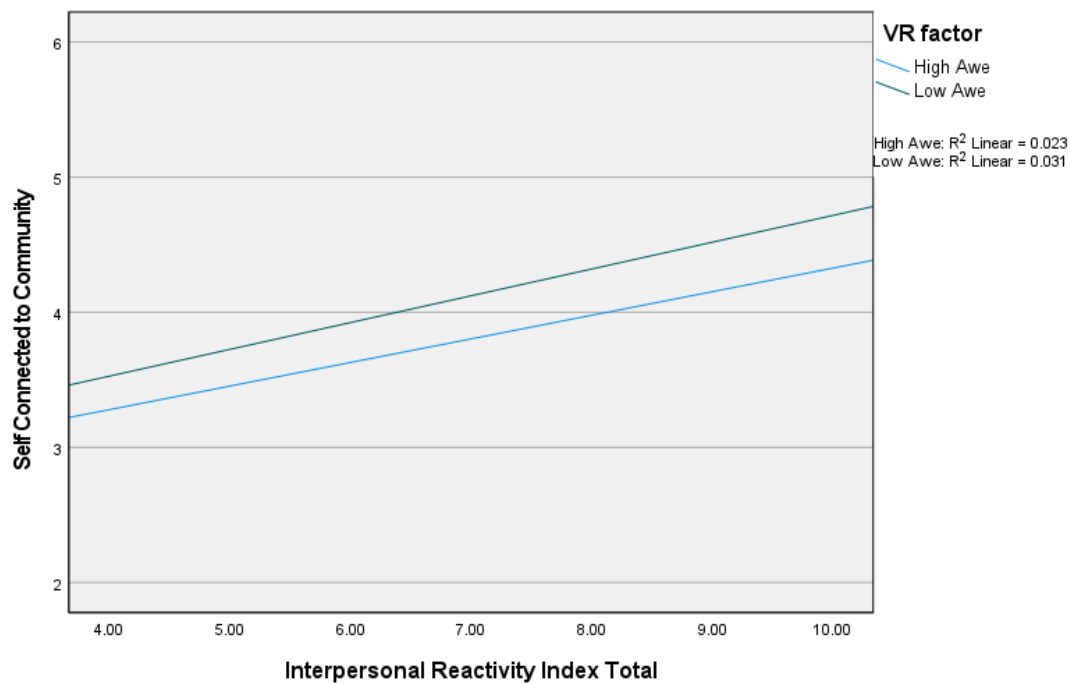

Figure 7
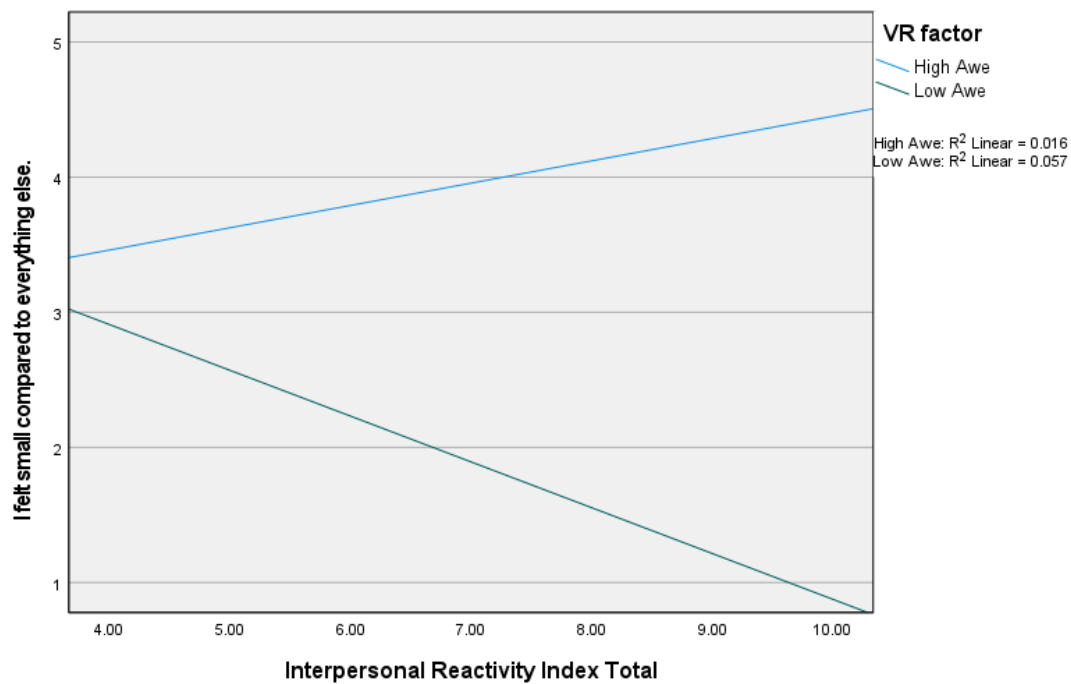
Moderation analysis PBB

Figure 8

Moderation analysis ICS

Figure 9
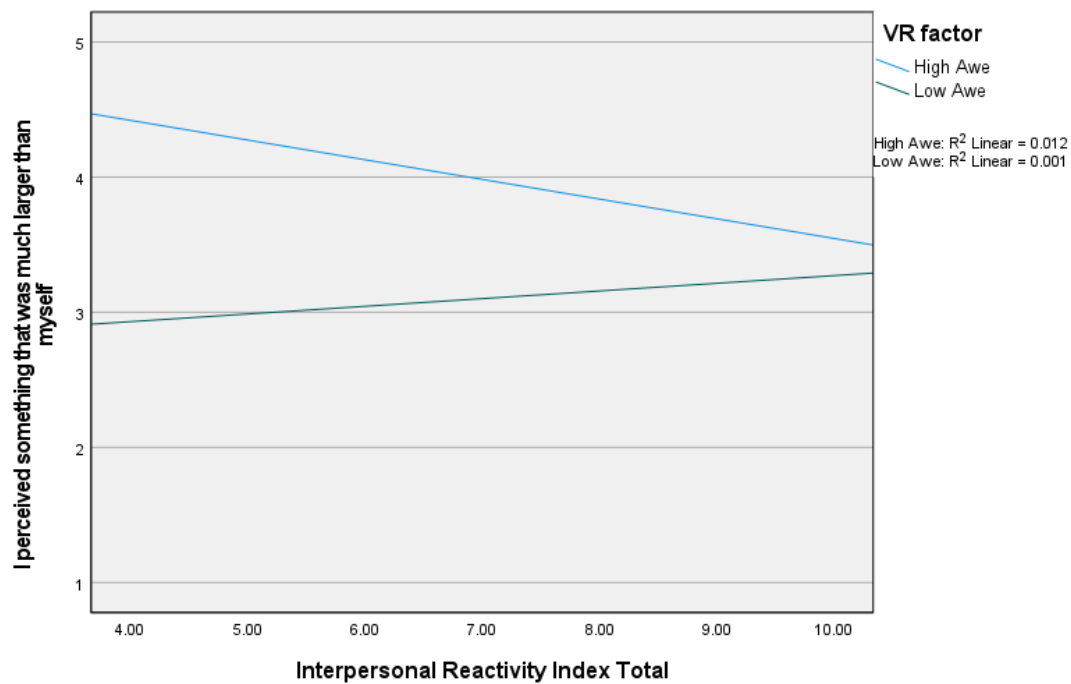
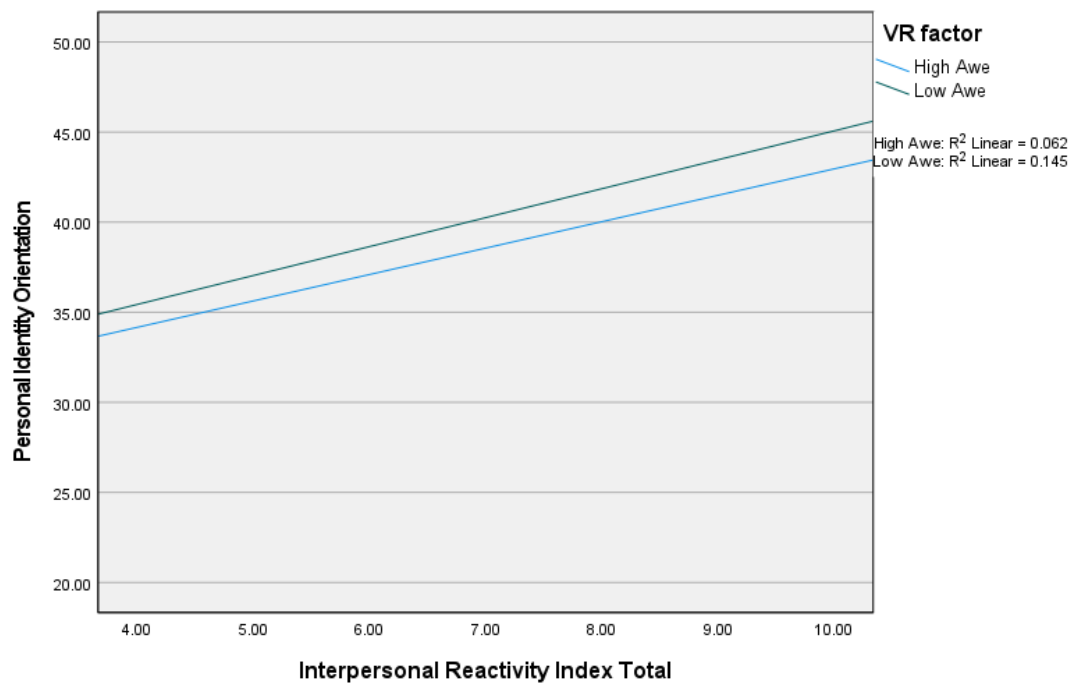*Moderation analysis Awe & Self-Diminishment*

Figure 10

Moderation analysis Awe & Small Self

Figure 11
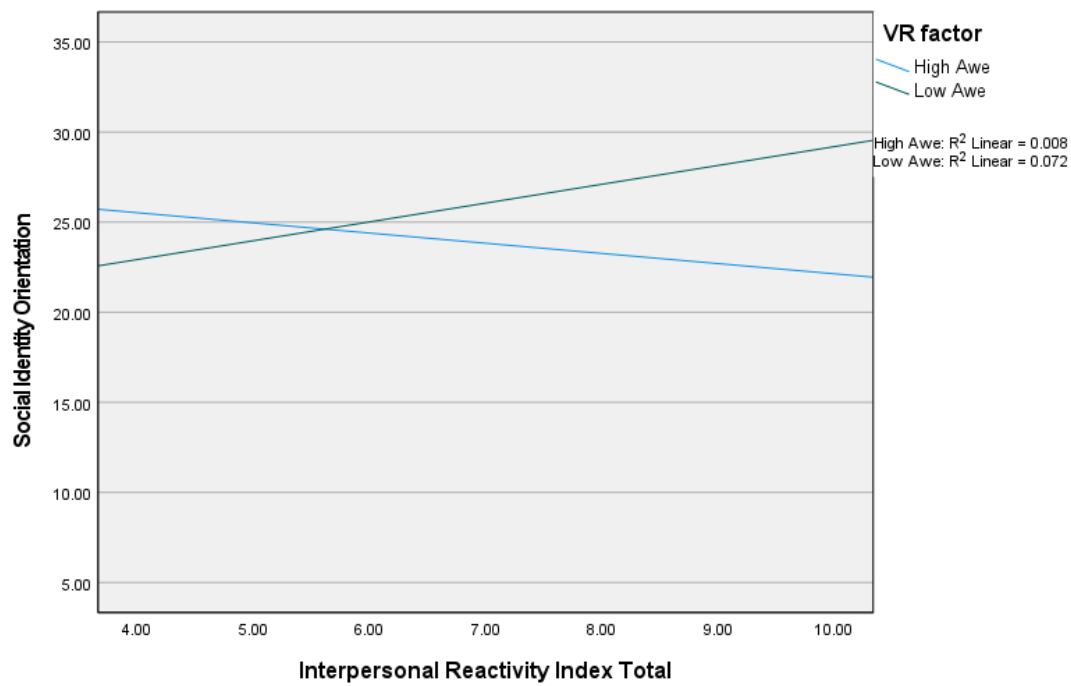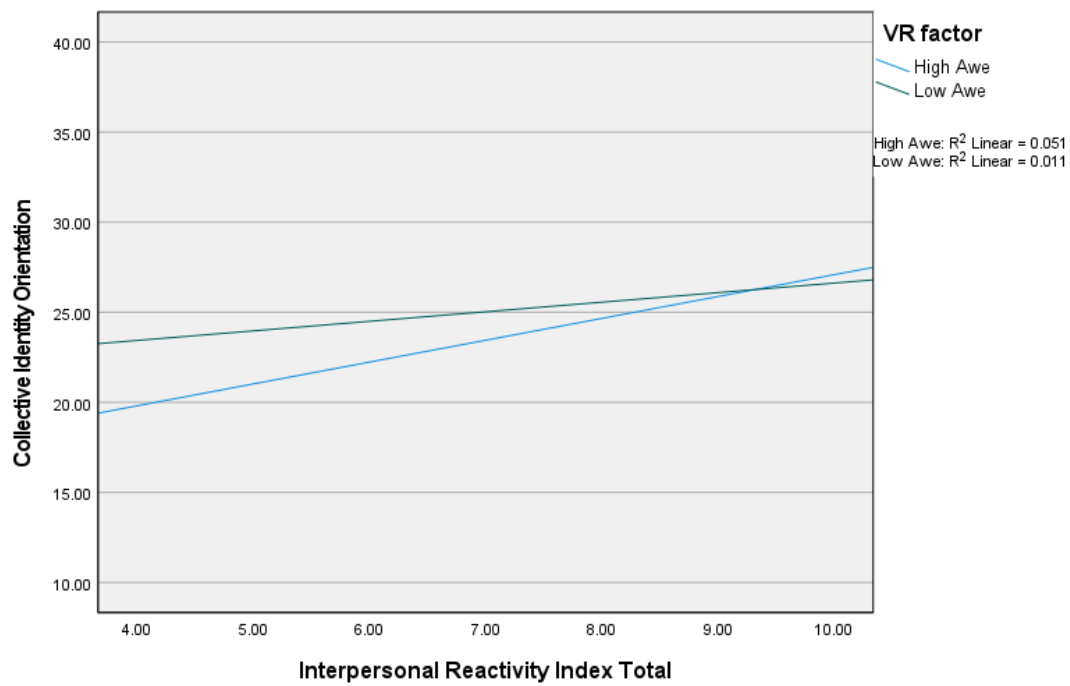
Moderation analysis Personal Identity Orientation

Figure 12

Moderation analysis Social Identity Orientation

Figure 13

Moderation analysis Collective Identity Orientation

Figure 14

Moderation analysis Relational Identity Orientation