



Come in please: a virtual reality study on entrance design factors influencing the experience of hospitality

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ABSTRACT

This study aims to explore how entrance design aspects impact the experience of hospitality. In Virtual Reality, the embodied effects of entrance design (visual transparency and door opening) on the experience of hospitality in a utilitarian dental practice and in a hedonistic hotel setting were examined. Mental ease of access and visual aesthetics served as mediators. The experience of hospitality was measured using the EH-scale, measuring the factors *inviting*, *care* and *comfort*. Multivariate analysis showed that the door opening speed did not affect the experience of hospitality. However, transparency increased the experience of all hospitality factors. Structural Equation Modelling showed (partial) mediation of mental ease of access, which suggests embodiment as one of the underlying mechanisms. However, also other disembodied mechanisms seem to play a role, since amongst others, the visual aesthetics of the building also mediated the effects. The study revealed that a building can express hospitality just by having a transparent, visually appealing entrance. Furthermore, the study shows that Virtual Reality offers opportunities to study research in which interactive immersive embodied experiences can be realized in a controlled realistic setting, in which design features can be modified that cannot be manipulated in real-life situations.

1. Introduction

Organisations offering services - hotels and restaurants, but also other sectors such as healthcare - eminently understand the importance of being hospitable to guests throughout the customer journey to give visitors a sense of personal attention and to make them feel well (e.g. Berry et al., 2006; Brunner-Sperdin et al., 2012). To a certain extent, the industry knows how to do that, thereby mainly focusing on hospitable attitude and behaviour of staff (Altinay et al., 2023; Blain & Lashley, 2014; Tasci & Semrad, 2016). However, service organisations still lack full understanding of what people experience as hospitable, especially when it comes to the role of the environment.

Hospitality is a broadly studied subject, examined from different academic disciplines such as history, philosophy, theology, politics, linguistics, economics and sociology (Lynch et al., 2021; Pijls, 2020). Only little academic attention has been paid to the meaning of the concept of hospitality, especially when it comes to defining the concept from the perspective of guests experiencing hospitality at service organisations (Brotherton & Wood, 2008; Lynch et al., 2021). What do

customers experience when they experience hospitality? A few studies delved into the meaning of hospitality from a consumer's perspective, however with a primary focus on service staff behaviour (Ariffin & Maghzi, 2012; Blain & Lashley, 2014; Tasci & Semrad, 2016). Pijls et al. (2017) took a broader perspective by taking the whole servicescape into account, including the physical dimensions of the service environment. Their research resulted in the EH-Scale, consisting of three factors of the experience of hospitality in service environments: *inviting*, *care* and *comfort*. *Inviting* refers to the experience of inviting, openness and freedom, *care* is about experiencing empathy, servitude, and acknowledgement. *Comfort* refers to feeling at ease, relaxed and comfortable.

The present study focuses on the environmental factors of the entrance of a building that influence the experience of hospitality, predominantly the *inviting* factor of hospitality. Virtual Reality (VR) was used to manipulate entrance design characteristics to experimentally study the influence of entrance design characteristics of a healthcare setting (dentist) and a commercial service setting (hotel) on people's (embodied) experience of hospitality. When a building is physically easily accessible, it is expected to give a more inviting impression than

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when it takes more effort to go inside. Two design aspects concerning the accessibility of the entrance were studied: visual transparency and the opening speed of the entrance doors.

1.1. Hospitality and embodiment

Theory of embodied cognition forms the starting point of the present research. In short, this theory is based on the fact that a physical sensation evokes mental associations via the meaning of the underlying concept, and thus influences our experience. A physical or bodily sensation activates a mental concept associated with that sensation (Lobel, 2014). Vice versa, most abstract mental concepts tend to be grounded in concrete physical experiences (Asch, 1958; Lobel, 2014).

There is growing consensus on the idea that our bodies are an important factor in how people perceive their environment. According to this view of the “embodied mind”, the mind affects the body, and the body affects the mind (Dijkstra, et al., 2014; Littlemore, 2019). The physical interactions with the environment influence how our mind perceives the environment.

Embodied cognition research has for example provided support for relationships between physical and mental warmth (Fay & Maner, 2014; IJzerman et al., 2013), verticality and power (e.g., Giessner & Schubert, 2007), and physical weight and importance (Jostmann, Lakens, & Schubert, 2009). Furthermore, the experience of physical space impacts one’s experienced psychological space or freedom (Meyers-Levy & Zhu, 2007; Okken et al., 2012).

Hospitality also may be such a mental concept that is grounded in concrete physical experiences. To illustrate, the factor *care* (Pijls et al., 2021) seems related to the embodied concept of warmth. Furthermore, the experiential factor *comfort* seems related to the embodied concept of comfort; physical comfort is expected to activate mental comfort, which subsequently leads to the experience of hospitality (Pijls et al., 2019).

What about the *inviting* factor of the experience of hospitality; Is there also an embodied concept that is related to the experience of *inviting*? The *inviting* factor of the experience of hospitality refers to the experience of inviting, openness, and freedom (Pijls et al., 2017). It can be described as an implicit invitation to come in and to feel free to walk in without any restrictions. A related mental concept is of ease of access (Ju & Takayama, 2009); a service organisation can be easily accessible, in both a physical and a mental sense. For commercial services, an inviting and easily accessible entrance is important in attracting customers. For healthcare facilities, it may help people feel welcome and at ease. According to the theory of embodied cognition, a service organisation that is physically open and easy to enter (physical ease of access) might lead to increased mental ease of access, which in turn influences the extent to which the service organisation is perceived as inviting.

Ju and Takayama (2009) showed a relationship between physical approachability and feeling welcome, an equivalent of the inviting factor of the experience of hospitality. In their paper they describe that a doorman can offer to open a door for passers-by, thereby inviting them into a building. Ju and Takayama examined whether automatic doors are able to convey this sense of welcome. The researchers stress the (embodied) relationship between the movement of the door and the mental ‘gesture’ of being welcome to guests by being both physically and psychologically open to visitors. Results showed that people interpret door movement as a gesture. A door that opened with a pause was judged as more welcoming than a door that opened and quickly closed. Furthermore, a door gesture ‘swinging open’ was experienced as more approachable than a door that opened and then closed. Higher door speed intensified this effect. It may be argued that the way a door opens may be a way to express physical ease of access.

Another way to express physical ease of access is visual transparency. Although not yet labelled as an embodied concept, visual transparency in relation to ease of access has already been subject of research. Vilnai-Yavetz and Koren (2013) found that transparency transferred accessibility to a product; a transparent packaging was perceived as

easier to open than an opaque packaging. In an environmental context, Stamps (2010) showed that a space appears to be more open when the boundary has more visual permeability (represented by holes in solid surfaces). Pijls and Groen (2012) examined verbal and visual association methods to translate *inviting* into tangible sensory characteristics in hotels. Results showed, that inviting was, amongst others, associated with visual transparency.

Together, this literature provides sufficient grounds to examine both door opening speed and visual transparency as ways of expressing the embodied (physical) experience of accessibility. This leads to the following hypotheses.

H1. A transparent entrance, as opposed to an opaque entrance, positively influences the inviting factor of the experience of hospitality.

H2. Entrance doors that open quickly, as opposed to doors that open slowly, positively influence the inviting factor of experience of hospitality.

H3. The effects of physical ease of access (both of transparency and door opening) on the inviting factor of experience of hospitality are mediated by the experience of mental ease of access of the service organisation.

There are no indications in academic literature that the effects of transparency and door opening are mutually reinforcing, so no specific interaction effects of these two independent variables are expected.

1.2. Hospitality and aesthetics

Literature on the effects of design characteristics of buildings on people’s experience of hospitality suggests that aesthetics is a related factor in attracting people to buildings. When designing service environments, attention to aesthetics is particularly important (Kirillova & Chan, 2018). Designers may focus on visual design, with the main objective of increasing attractiveness (Grewal, Baker, Levy, & Voss, 2003; Kirillova & Chan, 2018; Orth & Wirtz, 2014), especially when applied in exterior design of the building (Baker et al., 2020, Lecointre-Erickson, Adil, Daucé, & Legohérel, 2021). Kim and Moon (2009) show that an attractive environment will lead to more positive emotions than an unattractive environment. Orth and Wirtz (2014) state that an appealing service environment captures attention, triggers approach behaviours, strengthens consumer attachment and enhances the customer experience. In attracting people, visual aesthetics may be specifically related to the inviting-factor of hospitality, because they, just like the *inviting* factor of the experience of hospitality, entice people to come in. Visual transparency, one of the variables studied in the present research, was found to be positively related to the attractiveness of buildings (Gjerde, 2010; Jiang et al., 2017). This effect may be embodied.

Aesthetics furthermore affect positive emotions in general (Kim & Moon, 2009; Orth & Wirtz, 2014). Furthermore, Weinberger et al. (2021) showed that hominess - feelings of warmth, comfort and cosiness - is related to aesthetic appraisal of exterior architecture, suggesting also effects of aesthetics on the hospitality-factors *care* and *comfort*. Embodiment is a less logical explanation here. Inference theory, such as the halo effect (Thorndike, 1920) that means that positive impressions of an environment can positively influence one’s opinion or feelings in other related areas, may be another mechanism involved.

The literature on the role of aesthetics in the attractiveness of buildings lead to the following hypothesis.

H4. The effect of transparency on the inviting factor of experience of hospitality (H1) is mediated by the aesthetics of the building.

1.3. Service setting: utilitarian versus hedonic services

Variables may be work out differently on utilitarian versus hedonic

services (Wakefield & Blodgett, 1999). Healthcare can be generally characterised as utilitarian (Ai et al., 2022; Altinay et al., 2023; Jiang & Lu Wang, 2006; Ladhari et al., 2017) because people's visits are compulsory and predominantly functional. Entertainment, tourism, restaurants and hotels are examples of hedonistic services (i.e. Ladhari et al., 2017), because it meets the needs of pleasure (if the mindset is leisure).

In a pleasure-oriented environment, such as hotels, a transparent building may be experienced as accessible and inviting predominantly because of its visual attractiveness (Gjerde, 2010; Jiang et al., 2017). On the other hand, in a service environment that involves visits that are compulsory and generally more stressful and less pleasant, such as an annual dental check-up, a transparent entrance may be hospitable when entering the building because it is comfortable to see what is inside. However, once you are inside and take a seat to wait, a transparent facade may not be as pleasant because of privacy concerns.

Based on this literature, the following hypothesis can be formulated.

H5. The effect of transparency on the inviting factor of the experience of hospitality (H1) applies specifically to the hedonic service environment, not the utilitarian service environment.

Concerning door opening, doors that open quickly may be hospitable particularly in a hedonistic service environment, as such doors facilitate the ease of going inside. For a utilitarian service in a healthcare setting quick door opening may be not that hospitable, as in the case of slower door opening visitors get more time to estimate assess the situation and prepare to enter the building, which may even be pleasant in compulsory visits that people do not look forward to.

This leads to the following hypothesis.

H6. The effect of door opening (H2) on the inviting factor of the experience of hospitality is stronger in a hedonic than in a utilitarian service environment.

1.4. Virtual reality and embodiment

Experimental research on transparency and doorway speed is difficult to study in real life contexts, as those variables are difficult to manipulate. The rapidly increasing technological possibilities of VR enable behavioural researchers to test hypotheses in a manner and scale that were previously unfeasible (Brookes et al., 2020; Flavián, Ibáñez-Sánchez, & Orús, 2020; Gaggioli, 2001; Wei, 2019). VR technology has increased the integration between devices and the human senses and is applicable in a hospitality context (Flavián et al., 2020), which makes it a suitable technique for varying these design characteristics and to let people experience the corresponding embodied experiences. Flavián, Ibáñez-Sánchez, and Orús (2019) discern technological embodiment, which includes immersion and sensory stimulation. Higher levels of technological embodiment create a sense of proximity between the technology and the senses and generate more immersive experiences. Flavián et al. (2019) additionally propose the 'EPI Cube,' in which different technologies can be placed based on the three axes of the cube: technological embodiment, perceptual presence and behavioural interactivity. For Virtual Reality, technological embodiment, virtual presence and behavioural interactivity are all high, indicating a high impact on the customer experience.

Also, others discern classifications of virtual environments, varying in the level of immersion, which influence people's sense of presence in VR (i.e. Mol, 2019; Parmar, 2017). At the one end there are low-immersive virtual environments. Interaction with the virtual environment is indirect and not natural, as it takes place via a keyboard and a mouse. At the other end, there are the high-immersive virtual environments, where the user experiences a virtual environment in 3D using more complex and expensive equipment. Additionally, interactivity allowing direct interaction with the VR environment and/or self-avatars will enhance the embodied experience in virtual environments (Boletsis

& Cedergren, 2019; Parmar, 2017; Rietzler et al., 2020).

Fully immersive VR equipment furthermore offers a sense of embodiment, as users see themselves as parts of the virtual environment, and physically move and act in that environment as if it were real (Ahn et al., 2014; Flavián et al., 2019; Shin & Biocca, 2018). Moreover, people's sense of presence in virtual environments may be enhanced by a stronger match between proprioceptive information from human body movements and sensory feedback from the computer-generated displays. This will also enhance the embodied experience in VR (Slater et al., 1995).

Wei (2019) shows that specifically in tourism and hospitality contexts VR and AR is amongst others used to study effects of environmental stimuli on service experiences. VR offers the opportunity to carry out ecologically valid or 'real-world-like' experiments, while still maintaining control over the experimental situation. All in all, the literature implies that VR is a suitable technique for varying these design characteristics and to let people experience the corresponding embodied experiences.

Furthermore, Boletsis and Cedergren (2019) provides an overview on locomotion techniques for VR. Moving around in VR can amongst others be done by using controllers or joysticks, teleportation, walking in place by using step-like and real walking whereby the user walks freely inside a limited physical space. The position and orientation of the user is determined, usually by tracking the position of the Head Mounted Display. Besides allowing people to physically walk around in the virtual environment, recent developments in hardware and software make it possible to create interactive virtual environments that respond to human behaviour (i.e., Deb et al., 2017). In the present study this is needed to create and to study the desired embodied experience while entering the building.

To summarise, for the current study a highly immersive interactive virtual environment with the locomotion technique of real walking is essential to create a virtual environment in which people experience a strong sense of presence and the physical, bodily experience of the transparency of the entrance and the effect of the speed at which the door opens on their bodily sensations – including hampering of the walking speed - when entering the building. The virtual environment must also be interactive; the opening of the door needs to react to the position of the visitors of the virtual building.

2. Material and methods

2.1. Participants and design

An experimental study using a virtual service environment was designed to test the hypotheses. The experiment employed a $2 \times 2 \times 2$ factorial design with *transparency* (transparent versus opaque), *door opening* (early and fast versus late and slowly) and *type of service environment* (hotel versus dental practice) as between-subject variables. The experiment was conducted over 18 different measuring moments in the spring of 2019, so pre-covid. The sample ($n = 454$) consisted of students and employees of a University of Applied Sciences ($N = 314$), supplemented with employees of a health care organisation ($N = 42$), a cleaning company ($N = 34$), a public library ($N = 35$), an insurance company ($N = 21$) and a conference location ($N = 8$). Non-probability sampling was used; no specific selection criteria were applied. However, the different types of service environments ensured a diverse sample. The participants were randomly assigned to the experimental conditions. The minimum was 50 respondents per condition. The final number of valid participants per condition were as follows: Hotel-transparent-fast ($n = 50$), hotel-transparent-slow ($n = 55$), hotel-opaque-fast ($n = 53$), hotel-opaque-slow ($n = 59$), dentist-transparent-fast ($n = 67$), dentist-transparent-slow ($n = 60$), dentist-opaque-fast ($n = 60$), hotel-opaque-slow ($n = 50$). Mean age of the total sample was 32.4 years ($SD = 14.8$), 66% was female. Participants had normal or corrected-to-normal vision; the VR glasses could be worn with glasses.

Gender, age, educational background, and fear of the dentist did not influence the results. The reported vertigo was rather low (mean = 2.38 on a scale from 1 to 7, $SD = 1.72$) and when included as covariate in the analysis it did not affect the results.

2.2. Experimental manipulation

An entrance and reception area was created in VR (see Fig. 1). The portable VR equipment was installed on site in an empty space with minimum dimensions of 7×12 m. The equipment included an Acer AH101 HMD Mixed Reality VR Headset and a JBL E45BT headphone, both connected to a laptop with Mixed Reality software. The participants physically walked a route, starting outside the building and then entering the hotel or dental practice. The software continuously monitored the position of the participant and responded by opening the entrance doors upon arrival, and by having a virtual employee respond when participants approached the desk to register. Matching sounds for outside (traffic), the entrance (sounds of opening and closing of the doors) and inside (soft background music) were added to make the virtual environment as realistic as possible.

Transparency was manipulated by the visual transparency of the entrance of the virtual building. In the transparent condition, the entrance, including the two automatic access doors, consisted mainly of glass. People were able to look inside the building while approaching it. In the opaque condition, the entrance and both access doors were made opaque by using frosted glass.

The study was submitted to the institution's ethics committee and has been approved to be conducted.

Light could still enter the building, but participants were not able to look inside. Fig. 2a and Fig. 2b present the two experimental conditions, seen from the starting point of the scenario outside the building.

Door opening was manipulated by the timing and the speed at which the two automatic doors opened when participants physically approached the entrance while wearing the VR glasses. In the fast-opening condition the doors opened in 3 s, starting immediately when participants approached the doors. Both sets of doors opened smoothly one by one, so participants could walk right through, without having to stop their walking. In the slow-opening condition the first door opened in 6 s, after participants had been standing still for 5 s at the entrance door. After entering, the first door closed first (in 4 s) and then the second automatic door opened (also opening in 6 s and closing in 4 s).¹ Participants again had to wait before they could continue entering the



Fig. 1. The entrance to the virtual service environment seen from the outside.



Fig. 2a. The transparent entrance of the virtual service environment.



Fig. 2b. The opaque entrance of the virtual service environment.

building. So, in this condition participants were hampered in their walking pace while walking in.

Type of service environment served as moderator and was manipulated by framing the virtual environment either as a hotel or as a dental practice. The environment was framed as either a waiting room at a dental practice (utilitarian) or as a hotel lobby (hedonic). The hotel served as an environment for an enjoyable visit during which participants came to plan for a private party, while in the dental practice participants came for their compulsory annual check-up. The company was called "The Golden Crown", a suitable name for both service environments.

2.3. Procedure

Participants were told they would participate in a VR study of 10–15 min about the first impression of a hotel lobby or waiting room of a dental office. Participants first filled out the informed consent form and the questions on demographics. Subsequently, they were instructed about the VR-task, took place on a seat and the VR glasses were installed. After a test walk to become acquainted with physically walking around in VR, the actual scenario started. Participants received further instructions in VR by an avatar. In the case of the hotel, they were told to imagine that they were searching for a location for a party and that they were looking for the general manager to discuss options. In the case of

¹ The optimal settings for the moments and speed of the doors for both conditions were pre-tested to get the maximum difference between the conditions without the situations becoming unnatural.

the dental practice, they were told to imagine that they had an appointment with a dentist for an annual check-up.

The virtual scenario started outside the building (see Fig. 3). Participants were then instructed to walk to the entrance of the hotel or dental practice, enter the building and register at the desk. When they arrived at the reception a virtual employee, represented as an avatar (see Fig. 4), told the participants to take place on an indicated seat. This seat was also present in reality at that spot, so they could actually sit down. Fig. 5 gives an impression of the experimental situation. At several moments during the scenario, participants were asked to take a good look around and let the surroundings soak in for a while. Once they were seated on the designated spot, the participants could take off the VR glasses and completed the questionnaire on their first impression of hospitality, the mental ease of access, aesthetics, and questions to check the manipulations. Finally, they were thanked and debriefed via a written document or link to a video in which the aim of the experiment was explained.

2.4. Measures

For all statements in this study the participants indicated on a seven-point Likert scale the degree to which they agreed with the statement (ranging from 1 = *strong disagreement* to 7 = *strong agreement*).

The *experience of hospitality* was measured by the EH-Scale (Pijls et al., 2017), consisting of 13 items measuring three factors of the experience of hospitality: *care*, *comfort* and *inviting*. The factor *care* was measured by seven items on the *experienced support*, *involvement*, *effort*, *relief* and *interest of the organisation*, as well as *being treated as king/queen and feeling important* (Cronbach's $\alpha = 0.90$). The factor *comfort* was measured by *feeling comfortable*, *at ease* and *relaxed* (Cronbach's $\alpha = 0.93$). The factor *inviting* consisted of items on experiencing *openness*, *freedom* and *feeling invited* (Cronbach's $\alpha = 0.83$). For the complete questionnaire, see appendix A in Pijls et al. (2017).

The *mental ease of access* was measured by the *approachability*, *accessibility* and *transparency of the atmosphere of the organisation*, the *experience of low threshold* and the *ease with which participants dared to enter* the hotel or the dental practice (5 items, Cronbach's $\alpha = 0.90$).

Visual aesthetics was measured by the degree to which the building was *beautiful* and had an *attractive*, *modern*, and *luxurious atmosphere* (4 items, Cronbach's $\alpha = 0.85$).

Additionally, demographics (gender, age and educational background) were registered. In the final part of the questionnaire, eight questions served as manipulation checks, such as: 'when I entered the building, I could see what was behind the door', 'the entrance was transparent', 'the entrance doors hindered me in my walking pace' and 'I could easily walk inside'. Participants were further asked for advice on



Fig. 4. The avatar representing an employee at the reception desk.



Fig. 5. Impression experimental situation.

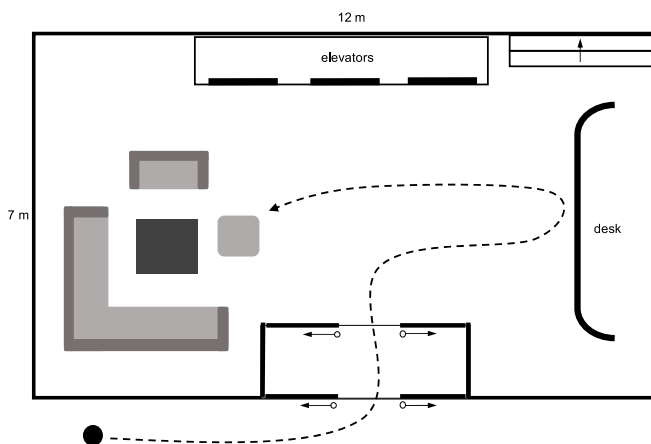


Fig. 3. Plan of the entrance and waiting area with the route participants followed during the experiment.

improving the customer experience at the hotel or dental practice, and to estimate how realistic the virtual scenario was experienced.

3. Results

Regarding the sense of presence in the virtual service environment, participants indicated that they experienced the virtual environment as realistic ($M = 5.81, SD = 1.26$) and had the feeling that they really entered the environment ($M = 5.64, SD = 1.52$). In addition, some people remarked at the end of the questionnaire ‘*the environment in VR provides a good and realistic impression of the environment*’ and ‘*very nice experience, it just seemed real!*’. Concerning the interaction with virtual people, participants perceived the social presence (i.e., contact with the avatars) as pretty natural ($M = 4.64, SD = 1.75$).

3.1. Manipulation check

The manipulations were successful. Factorial MANOVA showed significant effects for both transparency, $Wilks's \Lambda = 0.43, F(8,443) = 74.42, p < .001, (\eta_p^2 = 0.57)$ and door opening ($Wilks's \Lambda = 0.55, F(8,443) = 44.91, p < .001, \eta_p^2 = 0.45$). All questions that served as manipulation checks showed significant effects in the expected directions. In the transparent condition, as opposed to the opaque condition, the participants perceived the entrance as more transparent (measured on a 7-point scale, $M = 5.94, SD = 1.26$ versus $M = 3.12, SD = 1.90, F(1,450) = 356.67; p < .001; \eta_p^2 = 0.44$) and indicated that they could better look inside ($M = 5.51, SD = 1.67$ versus $M = 2.18, SD = 1.63, F(1,450) = 466.08; p < .001; \eta_p^2 = 0.51$). In the fast door opening condition, as opposed to the slow door opening condition, the participants indicated that the doors hindered them less in their walking pace ($M = 3.10, SD = 1.89$ versus $M = 5.47, SD = 1.78, F(1,450) = 188.11; p < .001; \eta_p^2 = 0.30$) and they could enter the building more easily ($M = 4.96, SD = 1.73$ versus $M = 2.99, SD = 1.77, F(1,450) = 146.87; p < .001; \eta_p^2 = 0.25$).

3.2. Correlations factors EH-scale, mental ease of access and aesthetics

Table 1 shows the overall correlations between the factors of the experience of hospitality scale (EH-Scale), mental ease of access and visual aesthetics. The factors *care*, *comfort* and *inviting* of the EH-Scale are related, but the correlations between the factors are lower than the threshold of 0.85 (Kline, 2005), which confirm the discriminant validity that was rigorously tested in Pijls et al. (2017). Additionally, all hospitality factors significantly correlate with mental ease of access and visual aesthetics. Based on these correlations, mental ease of access does not seem to relate particularly to the experience of *inviting*, as was expected, but also to the experience of *comfort* and *care*.

3.3. Effects of transparency, door opening and type of service environment

A 2 (transparency) x 2 (door opening) x 2 (type of service environment) MANOVA was performed to test hypotheses 1 and 2. For transparency the MANOVA was significant ($Wilks's \Lambda = 0.93, F(3,444) = 11.97, p < .001, \eta_p^2 = 0.08$). Univariate ANOVAs showed effects of

Table 1
Pearson Correlation between the factors of the EH-Scale, mental ease of access and visual aesthetics.

Variable	1	2	3	4
1. Care				
2. Comfort	.68			
3. Inviting	.68	.77		
4. Mental ease of access	.59	.73	.73	
5. Visual aesthetics	.60	.64	.75	.52

transparency on all hospitality factors. Transparency positively influenced the *inviting* factor ($F(1,446) = 30.22, p < .001, \eta_p^2 = 0.06$), the *comfort* factor ($F(1,446) = 12.72, p < .01, \eta_p^2 = 0.03$) and the *care* factor ($F(1,446) = 4.29, p < .05, \eta_p^2 = 0.01$). As can be seen in Table 2, the transparent entrance provided a more hospitable experience compared to the opaque entrance: the organisation was experienced as significantly more *inviting*, *caring* and *comfortable*; the effect of transparency was most pronounced on the *inviting* factor, which corresponds to Hypothesis 1. However, transparency also significantly affected the experience of the other hospitality factors, which is in line with the correlations presented in Table 1.

Regarding the door opening, the results did not show any significant effect on any of the hospitality factors ($p's > 0.10$). This means no support for Hypothesis 2, Hypothesis 3 regarding the door opening, and Hypothesis 6. Also, no interactions were found between transparency and door opening. Because of the absence of effects, door opening has not been included in further analyses.

3.4. Mediation of mental ease of access and visual aesthetics

Structural equation modelling (SEM) using SPSS AMOS v.28 was used to test whether mental ease of access and visual aesthetics mediated the effects of transparency on the experience of hospitality factors, as hypothesised. A structural model was tested using maximum likelihood estimation, with transparency as an exogenous variable, mental ease of access and visual aesthetics as mediators and the experiential factors of hospitality of *inviting*, *care*, and *comfort* as endogenous variables. To start with, the full mediation model was tested, which resulted in a poor model fit ($\chi^2 = 146.66, DF = 4, P\text{-value} = .000, CFI = 0.910, NFI = 0.908, TLI = 0.663, RMSEA = 0.281$). The model was modified not only assuming full mediation effects but allowing partial mediations as well. Fig. 6 presents the significant (standardized) estimates of the final structural model. Table 3 gives an overview of the direct and indirect effects of transparency on the experience factors. Examination of the overall fit indices of the final structural model indicated a good fit ($\chi^2 = 2.149, DF = 2, P\text{-value} = .341, CFI = 1.000, NFI = 0.999, TLI = 0.999, RMSEA = 0.013$). The criteria of a non-significant Chi-square, $CFI > 0.95, NFI > 0.95, TLI > 0.95$ and $RMSEA < 0.05$ for a good model fit (Marsh et al., 2004; Matsunaga, 2010) were met.

Firstly, as can be seen in Fig. 6, the final model shows that visual aesthetics played an important mediating role in the effects of visual transparency on the experience of hospitality factors. The transparency of the façade increased the attractiveness of the building and subsequently increased the experienced hospitality. This effect is largest for the *inviting* factor, which was hypothesised in hypothesis 4. However, these effects also apply to *care* and *comfort*.

Secondly, the model shows that mental ease of access of the organisation mediated the effect on the *inviting* factor via visual aesthetics. This is in line with Hypothesis 3 (regarding visual transparency) and provides support for the assumption that the effect of visual transparency of the experience of hospitality is embodied. However, the model also shows that there are other routes without mental ease of

Table 2
Effects of transparency on EH-factors.

EH-factor	Transparent	Opaque	F	Significance (p)	Partial Eta Squared
	Mean (SD)	Mean (SD)			
Overall	5.26 (.88)	4.90 (1.19)	13.45	.00	.03
EH					
Inviting	5.44 (1.06)	4.79 (1.42)	30.22	.00	.06
Comfort	5.31 (1.14)	4.88 (1.42)	12.72	.00	.03
Care	5.16 (.91)	4.95 (1.20)	4.38	.04	.01

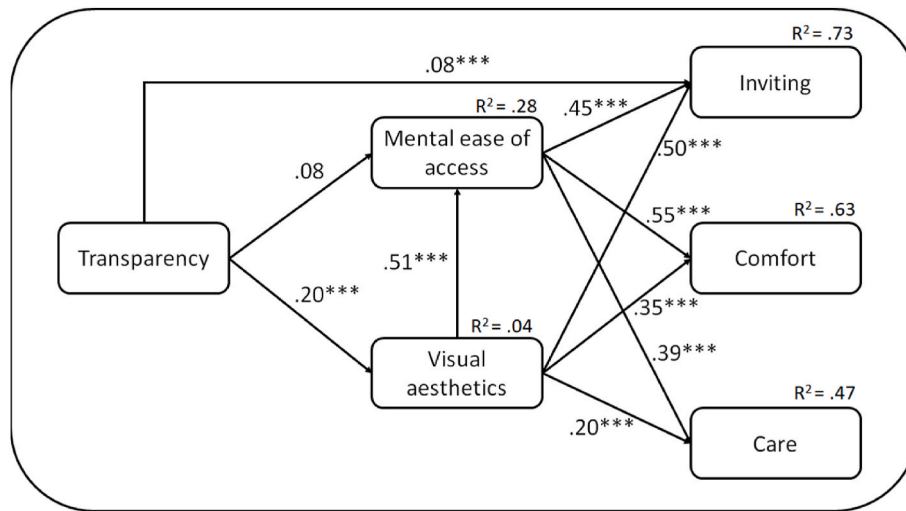


Fig. 6. Final structural model for the mediating effect of mental ease of access and visual aesthetics. Standardized regression weights (**p < .001) and squared multiple correlations are given.

Table 3
Mediated effects for visual aesthetics + mental ease of access.

Endogenous variable	Standardized indirect effect	Lower bound	Upper bound	Type of mediation
Inviting	.177*** (.037)	.108	.254	Partial mediation
Comfort	.164*** (.036)	.098	.242	Full mediation
Care	.145*** (.031)	.086	.211	Full mediation

Note. Standardized effects with standard errors between brackets and bootstrap lower bounds and upper bounds (2000 samples) are presented. ***p < .001.

access as mediator: a direct route to inviting and routes via visual aesthetics. This suggests that not only embodied cognition, but also other mechanisms are involved.

Furthermore, mental ease of access mediated not only the effect on the *inviting* factor, but also the *comfort* factor and the *care* factor. The embodied concept of ease of access may be not only conceptually close to the experience of inviting, but also to the other factors of the experience of hospitality. Thus, mental ease of access makes people feel invited, but also makes them feel comfortable and provides the experience that the organisation takes care of you.

3.5. Moderation by service context: utilitarian versus hedonic services

A multigroup analysis was used to test for the moderating role of service context. To verify the moderating impact of service context, the unconstrained model (i.e., baseline model in which the parameters were left free across the service contexts) and the fully constrained model (i.e., the paths in the model were constrained to be equal across the two service contexts) were compared using the Chi-square difference test (Byrne, 2004). The unconstrained model ($\chi^2 = 4.340$, DF = 4, P-value = .362, CFI = 1.000, NFI = 0.997, TLI = 0.998, RMSEA = 0.014) fitted the data well. Multigroup analyses showed that the fully constrained model ($\chi^2 = 41.884$, DF = 17, P-value = .001, CFI = 0.984, NFI = 0.974, TLI = 0.973, RMSEA = 0.057) was significantly different from the unconstrained model (χ^2 difference = 37.544, DF = 13, P-value = .00034). This indicates a moderating effect of service context at model level.

Table 4 presents the specific standardized estimates of the parameters for the dentist context (N = 237) and the hotel context (N = 217). It was hypothesised that visual aesthetics might be more relevant in the hotel than in a dental practice (Hypothesis 5). Firstly, as can be seen in

Table 4
Moderating effects of service context on specific paths in the model.

Path	Utilitarian context (dental practice)		Hedonic context (hotel)		Chi-square
	Standardized estimate	p	Standardized estimate	p	
Transparency -> Mental ease of access	.04	.51	.12	.04	40.08
Transparency-> Visual aesthetics	.22	***	.16	.016	41.65
Transparency-> Inviting	.11	***	.05	.12	40.50
Mental ease of access-> Inviting	.43	***	.48	***	32.35
Mental ease of access-> Comfort	.59	***	.50	***	34.17
Mental ease of access-> Care	.46	***	.29	***	26.31
Visual aesthetic-> Mental ease of access	.56	***	.44	***	35.89
Visual aesthetic-> Inviting	.47	***	.53	***	35.16
Visual aesthetic-> Comfort	.37	***	.33	***	35.38
Visual aesthetic-> Care	.48	***	.36	***	27.24

Note. The numbers in bold indicate that the chi-square value is significantly different from the fully constrained model (based on the Chi-square threshold of 38.001 for a test with 1 degree of freedom). This demonstrates that the service contexts differ on this path. *** indicates a p value < .001.

Table 4, the direct effects of transparency on mental ease of access, visual aesthetics and inviting were similar across both contexts. Secondly, in the dental practice the mediators ease of access and visual aesthetics had stronger effects on the experience of *care* and *comfort* than in the hotel context. These findings provided no evidence for Hypothesis 5. However, in the hedonic hotel context, both mediators (visual aesthetics and mental ease of access) had stronger effects on *inviting* than in the dental practice.

To summarise, door opening speed did not influence the experience

of hospitality. However, visual transparency positively influences the experience of *inviting*, and also *care* and *comfort*. Mental ease of access via visual aesthetics mediated these effects, albeit that only partly mediation was found for the effect of transparency on the experience of *inviting*. Furthermore, in contrast to our expectations, visual aesthetics seems to be more relevant for the experience of hospitality in a dental practice than in a hotel, at least for the *care* and *comfort* factors. As for the *inviting* factor of hospitality, both visual aesthetics and mental ease of access seem more relevant in the hedonic hotel context. Finally, the structural model with appropriate fit showed that visual transparency influences the experience of hospitality through different routes, and through different mechanisms. Embodied cognition seems one of the mechanisms involved. However, the model also suggests other disembodied mechanisms.

4. General discussion and conclusion

The experience of hospitality is still an underexplored area, especially regarding the influence of the environment. This research can be seen as one of the first studies examining the role of environmental factors in the experience of hospitality. With the technology of Virtual Reality (VR), it is now possible to perform experiments on variables such as door opening and visual transparency of buildings. VR seems an appropriate technique for combining the realism of field experiments with the controlled environment of laboratory experiments. Furthermore, immersive VR, allowing moving around and interacting with in the virtual world in a natural way, makes it possible to have embodied experiences in VR. Moreover, VR allows manipulation of variables that are difficult to investigate experimentally in the real world, such as visual transparency and the speed at which doors open. Without embodied technology in VR the present study could not have been performed.

Concerning the effects that have been studied, the results show that design characteristics of an entrance influence people's experience of hospitality. The results show that transparency of an entrance of a building has an impact on people's experience of hospitality, whereas the speed of opening doors has no effect.

Based on embodied cognition theory, it was expected that transparency, which is an expression of physical ease of access, would specifically lead to a more inviting service organisation by triggering mental ease of access. In line with these expectations, the effect on the *inviting* factor was indeed the strongest effect. However, transparency also improved the experience of the other hospitality factors *comfort* and *care*. This is understandable; mental ease of access makes you feel invited, but also makes you feel comfortable and provides the experience that the organisation takes care of you and is willing to help you. Yet embodiment may not be the most obvious mechanism underlying these effects on the other hospitality factors, since according to the theory of embodied cognition, only an effect on *inviting* was expected on the basis of triggering the concept of accessibility both visually and mentally.

Also, other findings suggest that embodied cognition seems indeed involved in the effect of transparency on people's experience of hospitality, but that it is not the only mechanism. Besides the effects mediated by mental ease of access, the results showed effects directly impacting the experience of *inviting*, and indirect effects via the visual aesthetics of the entrance. Inferences such as the halo effect (Thorndike, 1920), the phenomenon that people transfer their feelings about a certain feature to other features, may also play a role in the effects. According to this mechanism a transparent entrance is attractive, and the positive emotions associated with that attractive entrance are transferred to a positive appraisal of the organisation, in this case by associating the organisation with *inviting*, *care* and *comfort*.

The mechanisms explaining the results may furthermore depend on the service context. Transparency seems to directly affect the experience of *inviting* at the dental practice. While modern hotels tend to be transparent, healthcare environments are usually less transparent,

probably for privacy reasons. Transparency at the entrance of the dental practice may have been a surprise directly leading to feeling invited, without firstly triggering mental ease of access. The effect can be due to the fact that the organisation simply shows itself; they have nothing to hide. This may be experienced as *inviting*. Furthermore, literature suggested that the aesthetics of the building would be more relevant in a pleasure-oriented environment (hedonic, hotel in the case of organising a private party) than an environment you do not visit for pleasure (utilitarian, dental practice) (Reimer & Kuehn, 2005; Wakefield & Blodgett, 1994, 1999). However, the current study suggests the opposite: aesthetics seems to contribute more to the experience of hospitality in the dental practice than in the hotel. Possibly, the attractiveness of the building did not just trigger the pleasure of an appealing environment at the dental practice, as was suggested by the literature. After all, the aesthetics particularly led to more *comfort* and *care* at the dental practice, which is relevant in a service that people usually do not look forward to. Visual aesthetics was in this study measured by the perceived luxury, modernity, attractiveness and beauty of the building; luxury and modernity may convey quality and trust, and the beauty of the surroundings may be an indication that the organisation cares for its customers.

Which other mechanism(s) may play a role? Li et al. (2019) showed results comparable to our study, but instead of effects of the aesthetics of a building, they found effects of the attractiveness of service employees. An experimental lab study in a restaurant setting and a field study in a Chinese shopping mall showed that the physical attractiveness of service employees predicts customers' social distance perceptions, which in turn affects customer satisfaction and service quality perceptions. These social distance perceptions resemble our construct of mental ease of access, which gives strength to our findings that visual attractiveness leads to mental ease of access. The studies performed by Li et al. (2019) were, amongst others, based on the selective accessibility process model (Mussweiler, 2003). According to that model, similarity testing takes place by judging how well you and the other fit together, which stimulates a 'move-towards process' (Li et al., 2019). So, more similarity leads to a smaller social distance. Perhaps this also applies to how we relate to the building of an organisation. A transparent building may be more attractive, which increases people's experienced fit with the service organisation and subsequently leads to more mental ease of access. All in all, there is no strong evidence for embodied cognition as core mechanism explaining the effects of visual transparency in this study. The results suggest an interplay of different psychological mechanisms.

Door opening, the other expression of physical ease of access, did not affect the hospitality associated with the service organisation. An entrance that allows to easily walk through appears not more *inviting* than an entrance that hinders the walking pace. It's imaginable that a quick entry is appreciated if you are in a hurry, or if you are already familiar with the building. However, in our study, participants had no time pressure and visited the virtual building for the first time. Holding back for a while before entering a building in new situations can even be appreciated because then people have some time to absorb the new building they are about to enter. A next step would be to investigate whether door opening might affect the experience of hospitality when people are in a hurry or know the building well.

In conclusion, the way that a consumer's experience of hospitality is created is a complex process. Multiple processes seem to take place simultaneously. However, although more research is needed to understand further the cognitive processes involved, this study shows that organisations are able to influence the experience of its visitors by characteristics of their building. Manipulation of the transparency and visual aesthetics in general influences the hospitality that visitors experience when entering the building. The study further shows that effects and the underlying processes may differ dependent on the context (in this case a hedonistic hotel setting and a utilitarian health-care setting).

5. Limitations and practical implications

The use of VR is promising for further research on the customer experience of buildings and services, including studies on embodied experiences. However, the immersive embodied experience may be further enhanced by using recent technology of embodied VR by means of virtual self-avatars, which make people better experience their own body in VR (Parmar, 2017) and by virtual environments which more detailed and therefore more realistic (Newman et al., 2022). In the present study it was deliberately decided to keep the environment basic, because the software would otherwise be too heavy, increasing the likelihood of the system to stutter in combination with the necessary software for the door opening and position tracking.

Regarding the relevance for the industry, this study highlights the role of building design in people's experience and impression of an organisation. Building characteristics, in this case the transparency and attractiveness of the building, influence how a building and even the organisation housed in it is perceived. The study shows that a building can express hospitality just by having a transparent, visually appealing entrance. Furthermore, aesthetics seems to contribute more to the experience of hospitality in the dental practice than in the hotel. So, in a healthcare setting paying attention to the aesthetics of an environment seems especially relevant. This is knowledge that is useful for amongst other architects, designers, marketers, facility managers and the hospitality and service sector in general.

Author statement

The authors made the following contributions to the creation of this manuscript: Ruth Pijls: conceptualisation, methodology, conducting research, analysis, writing. Mirjam Galetzka: conceptualisation, methodology, analysis, reviewing. Brenda H. Groen: conceptualisation, methodology, reviewing. Ad T. H. Pruynb: conceptualisation, methodology, supervision.

Declaration of competing interest

None.

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