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Aesthetic-Interaction: Exploring the Importance of the Visual Aesthetic in the Creation of Engaging Photorealistic VR Environments

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Abstract

Nearly forty years since its conception, the medium of VR is still an enigma. In many ways, it is a medium that still lacks its own uniform language. VR, and particularly photorealistic VR, is a medium that is so occupied in developing its technological capabilities that its other hidden strengths have been neglected. The research presented in this paper is therefore interested in building a more holistic understanding of the "language" of VR, and aims to look beyond the technological in order to explore the creative and experiential side of VR. The goal of the paper is to cross fertilise the fields of HCI, photorealistic virtual reality and visual aesthetics. In it, the author focuses on the design of an aesthetic-interaction and in doing so, implements a comparative study to explore how the strategic patterning of the aesthetic elements (particularly colour) within the photorealistic VR environment can ensure a more engaging VR experience. In conclusion, the author claims that the next generation design of photorealistic VR experiences should consider a balanced combination of both science and art. It highlights that aesthetics can play as important a role as the development of new and more efficient technologies in getting to the heart of the "engaging" photorealistic VR experience.

Categories and Subject Descriptors (according to ACM CCS): I.3.7 [Three-Dimensional Graphics and Realism]: Virtual Reality H.1.2 [User/Machine Systems]: Human factors H.5.2 [User Interfaces]: Graphical user interfaces (GUI), Interaction styles, Screen design (e.g., text, graphics, colour).

1. Introduction

"The user-interface is the point of contact where humans and machines meet in order for exchange to take place. It can take many forms. It is at the interface... that the structures of the simulation designed for communication meet up with the human senses. Thus, the interface in virtual reality functions pervasively as the key to the digital artwork [design] and moulds both the perception and the dimensions of the interaction" [Gra03]

In virtual reality (VR) and especially in photorealistic VR, the interface is the key to the experience. It is what provides us with a visual display that is as close as possible to a real-life context and an environment that can be explored in a similar way that one would the real world. However, in order to make this interface accurate and "engaging", a huge emphasis has been placed on the technology (particularly rendering and display technologies) and in trying to come up with the newest, fastest and most efficient ways to capture, store and display the "real" visual data. In the midst of this, the author of this paper believes that the visual aesthetic and its potential for "engagement" has been underestimated. In fact, what seems to be emerging in more recent years is not so much the desire to achieve realistic representations but the desire to create believable and convincing environments [RD03]. Therefore, the goal of this paper is to illustrate how the strategic patterning of aesthetic elements (particularly colour) in a photorealistic VR environment can make for a more "engaging" VR experience. To achieve this, the author will introduce the concept of aesthetic-interaction, which refers to the use of aesthetics to sensually attract the

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user into the sharing of information and hence the creation of an "engaged interaction". An "engaged interaction" implies all that occurs between the interface and the users' feelings, past experiences, memories, and knowledge. It has the power to manipulate the perceptions of the spectator and create new enriching experiences. The following sections will compare user's experiences in a photorealistic VR environment of a sitting room in an old Victorian flat in Edinburgh, Scotland (i.e. environment A (fig. 1)) with that of their experiences in an aesthetically patterned version of the same photorealistic VR environment (i.e. environment B (fig. 2)). The aim to convince the reader that the visual aesthetic, and particularly colour, holds huge potential for the next generation design of "engaging" photorealistic VR experiences.

2. Photorealistic VR Environments

Photorealistic VR aims to provide realistic looking VR environments; it is "a computer generated three dimensional landscape in which we would experience an expansion of our physical and sensory powers" [Rya01]. This expansion has the ability to fully immerse the participant and to provide them with the illusion that the virtual environment is real [BLW*02]. One of the most important yet exciting differences between photorealistic VR and other communications media is that photorealistic VR can create artificial stimuli for the perceptual systems to interpret rather than making the interpretations for the spectators, as is the case with films and novels [Fen99a]. Marsh et al. [MWS01] describe it as a transparent or invisible style of interaction which keeps them in the flow of their activities and consequently enhances the experiences of participants. Instead of receiving fixed information like readers of a book or participants of a film, participants in a photorealistic VR environment have more flexibility to create their own experiences and narratives. It is their interactive contribution that determines the outcome [MW00]. Indeed, VR environments offer a unique medium that allows users "egocentric perspectives on three dimensional digital worlds" [Sta03]. One of its big attractions is that it can provide many opportunities for new kinds of experiences [SR01]. However, when one closely examines the design of virtual environments, one sees two distinct forms: there is the aesthetic notion of designing the desired perceptual responses; and there is the engineering notion of design which involves the creation of plans and models from which to test and build the desired effects [Fen99b]. As Fencott [Fen99b] says "both forms of design are intrinsic to the process of designing effective virtual environments (VEs)", though at times, the aesthetic tends to be pushed into second place behind the engineering. The goal of this paper is to examine the more experiential side of the visual VR content as opposed to the technical issues of how it is made and works etc. Like many artists and researchers [Gro07], [Dav04], [PJ01], [Hol98] and [Jac92] have started to do (and are still doing), this paper aims to probe the aesthetic opportunities of photorealistic VR as opposed to looking solely at the science of how it was made.

2.1. What is Aesthetic-Interaction?

"Aesthetic interaction is not about conveying meaning and direction through uniform models; it is about triggering imagination, it is thought provoking and encourages people to think differently about interactive systems, what they do and how they might be used differently to serve differentiated goal" [PIK*04].

Petersen et al. [PIK*04] propose that aesthetic interaction belongs as the fifth perspective of interaction design; they see it as the experiential aspects of the interactive systems, such as creating involvement, experience, surprise, and serendipity in interaction when using interactive systems. They feel that by focusing on intriguing and sometimes even ambiguous aspects, they aim to encourage the user to explore and playfully appropriate the system [PIK*04]. Likewise the author of this paper is of the opinion that aesthetics involves more than just supporting the user's physical interaction (in terms of pressing a button on a joystick or clicking a mouse), she also sees aesthetic interaction as putting "an emphasis on an actively engaged user with cognitive skills, emotional values and bodily capabilities" [PIK*04]. However, in terms of this research on photorealistic VR, aesthetics can be seen as more, in that it is an interaction in itself. By this it is meant that the role of aesthetics is individually active; aesthetic-interaction facilitates through the use of sensual stimuli an "engaged interaction" between the user and the VR interface which, in turn, feeds into the users overall experience.

It is not just about enhancing or even facilitating the functionality of a system but more about creating a visual interaction where users "engage" in and enjoy the VR environment before they ever touch a mouse or joystick. Aesthetic-interaction creates an appreciation within itself as well as in what it represents. The author envisions it as "the challenge of creating designs that generate a different view on things, helping perceive the novel in the familiar, discover relationships between seemingly incongruous objects, and relate the unrelatable" [WKL02]. In that sense, it takes the semiotic process to a higher level; it is about the user's "ability/ need to perceive, interpret and influence the context" [FMV01] as well as being influenced that results in the shaping of new experiences. Aesthetic-interaction aims to promote a relationship between the user and the photorealistic VR environment that encapsulates "a person's full relationship – sensory, emotional and intellectual" [MW04] and in doing so, entices an "engaged interaction" which can change the user's perceptions and interpretations of the photorealistic VR environment.

As Chang [Cha05] points out, the term interaction can represent everything from passive exchanges with content to active computer-mediated communications. It requires information flowing in both directions [Nai90] and as Shedroff

describes it involves genuine human engagement. In fact, Shedroff portrays Interaction Design as essentially story-creating and telling [She94] where a good storyteller, like a good interaction designer, captures and engages their audience. In this light, aesthetic-interaction is also very much intermingled with the concept of engagement so much so that it has an affect on the user as well as an influence on the experience created. Indeed, the aesthetic-interaction promotes the idea of an active "engagement" where participants "can engage in co-creation [with the artist/ designer], by interpreting content and constructing meaning and by modifying form and content" [Cha05]. It is the unpredictability of the user and what they bring to the aesthetic-interaction that increases the "engagement". In more detail, each artefact or design (i.e. photorealistic VR environment) is open to a number of possibilities and meanings (i.e. aesthetic-interactions) and it is this ambiguity and open-endedness which offers the greatest possibilities for the creation of new, exciting and "engaging" experiences.

In terms of HCI, this unpredictability of the aesthetic might seem like an alien concept given that HCI spent many of its early years trying to make systems predictable, efficient and reliable (i.e. the GUI interface). However, as the author of this paper believes, the unpredictability opens up many exciting doors for HCI design and particularly VR design. As Candy and Edmonds [CE02] highlight "the role of the artist [designer] is not so much to construct the artwork but rather to specify and modify the constraints and rules used to govern the relationship between the audience and artwork as it takes place in the world". In the design of aesthetic-interactions, it is the designer who plants the important seeds (i.e. sets up the frame for interaction), but it is user who brings them to flower (i.e. who transforms aesthetic qualities into thoughts and feelings by organising it into a meaningful form and then by creating relationships and patterns between it). In Applied Aesthetics, Zettl [Zet99], talks about psychological closure (i.e. proximity, similarity and continuity) and the fact that we all have a tendency to mentally "fill in" the gaps in visual information to arrive at easily manageable and complete patterns. In this paper the aesthetic-interaction process is envisioned to adopt similar techniques in a framework where the user is encouraged to fill in the gaps and build up various narrative patterns. As mentioned these patterns can feed directly into enhancing the functionality of a system but more importantly can exist on their own to provide rich and "engaging" experiences. Indeed, the aesthetic-interaction is an interaction in itself where the user is no longer a passive spectator but instead is an active and perceptually hardworking participant in that they interact with a combination of aesthetic elements that in turn lead them into specific directions and experiences (Zettl, 1999, p.105-106).

3. Building strategic Aesthetic patterns in a photorealistic VR environment

Strategic patterning is a term used by the author to describe the careful and considered organisation and arrangement of aesthetic elements in a photorealistic VR environment. To strategically pattern aesthetic elements in a photorealistic VR environment, the author has used environment A (i.e. a photorealistic VR environment of a couple's sitting room) as a baseline to implement a visual-narrative model [Car05] and hence create an aesthetically patterned version focusing on the female partner (i.e. environment B). This visual-narrative model is a three tier structure which divides the design of the environment B into three stages.

The first stage (i.e. the lowest level of the model) involves the visual units and in this case the aesthetic objects (i.e. particularly red, blue, yellow and green saturated colours). The main purpose of this level is twofold: it firstly aims to use aesthetic qualities to arouse certain thoughts and feelings, to build certain impressions about the environment and in particular its female occupant. Secondly, it also focuses on attracting participant's attention to particular objects and areas of the environment and in doing so to get them interested and looking thoroughly around the room. This feeds into level two of the model, which uses a "Through the Keyhole" scenario (i.e. a scenario which encourages the user to look around the room for clues about the occupant) to frame these impressions as well as to instil further meanings and feelings into the chosen objects and areas of the photorealistic VR environment. This stage concentrates on engagement; it looks at how a scenario can be implemented to not only nourish existing impressions created by the colours but also to involve participants in further thoughts, feelings and intuitions.

Indeed, environment B is, firstly, about the bright and saturated colours which arouse certain impressions. Secondly, it is about framing these impressions within a scenario. The saturated colours (i.e. the red shoes, the green shamrock on the teddy bear, the red bag, the white and yellow flowers, the red apples, the cat on the blue rug, the magazines on the floor, the red diary, the red ribbon on the door handle and the plants by the fireplace) have a powerful presence on their own (i.e. in terms of the feelings, thoughts and intuitions they create). They also have an important role in how they intertwine with the given scenario (i.e. how the colours – highlighting the physical presence and geographical location of the female protagonist – work with the scenario to encourage participant's sense of engagement and movement through the environment).

The last stage (i.e. level three) is where the narration takes place; this is where the saturated colours and scenario are merged together into a narrative pattern to further "engage" the participant. To achieve this, it is necessary to adopt some of the visual-narrative techniques used by artists through the centuries (i.e. particularly Duccio's use of isochromatic pat-

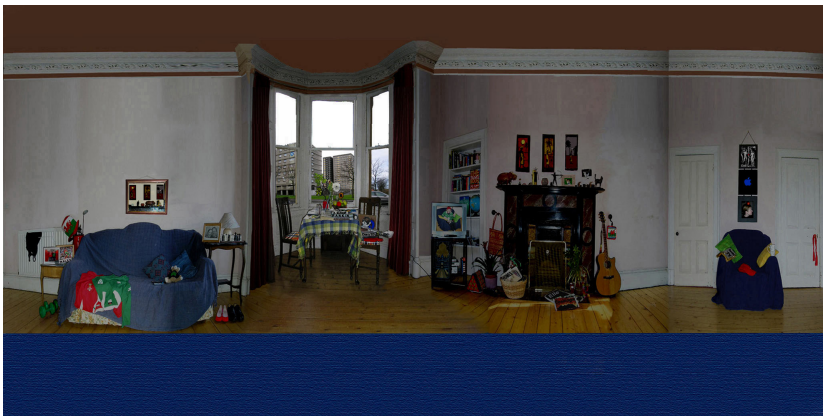

Figure 1: *Environment A of Edinburgh Flat*

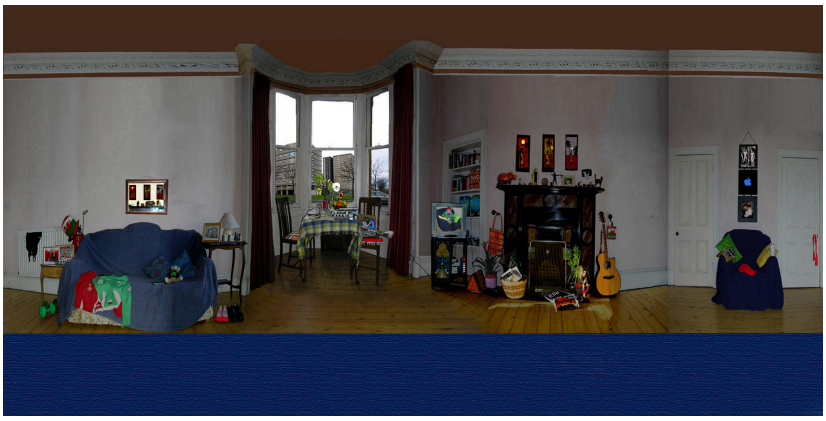

Figure 2: *Environment B of Edinburgh Flat.*

terns and symbolism and Memling's use of artificial colour and spatial narrative) [Car08]. The underlying aim is to create a photorealistic VR environment which entices participants into aesthetic-interactions with the content. The goal is to build an environment that arouses impressions, feelings and thoughts about the female occupant which in turn feed into and incite the creation of an "engaging" VR experiences.

3.1. Participants

Twenty students (i.e. thirteen male and seven female students) from a mixed academic background were asked to take part in the study.

3.2. Procedure

On arriving at the location of the test, all participants were asked to familiarise themselves with the VR experience especially the head mounted display (HMD) and the equipment, they were asked to try a sample and unrelated photorealistic VR environment for a few minutes. They were then told briefly about the nature of the test (i.e. informed that it would last at the most 30 minutes) and were asked to complete a standard Ishihara Test for Colour Blindness (http://www.toledo-bend.com/colorblind/Ishihara.html).

Again, each participant was given the Through the Keyhole scenario, they were asked to enter the room and look around for clues which might help them in identifying the type and character of person that lives there (i.e. what do you know about the person/ people? What is their profession? What are their interests? Where do they live? etc.). In random order, they were then asked to experience for 5 to 10 minutes both environment A and also environment B of the same flat. During these trials each participant was asked to talk-aloud and describe what type of person lives in the flat. After experiencing each environment, they were asked to answer in writing the following questions: Did you enjoy the experience? Why? Were you engaged in the environment? Why? (i.e. Did it catch your attention and get you involved in the experience?). They were then shown both environments

again briefly and then elaborating on the written questions, they were asked two similar questions which were recorded using a Digital Audio Tape (i.e. which one did you enjoy the most? which environment did you find more engaging?)

3.3. Results

As discussed aesthetic-interaction has been described as an "engaged interaction" between the participant and the design work which has the power to engage and guide both the senses and the thoughts of the participant into the creation of new impressions, thoughts and feelings. In that light, it can be said that the results of the study have proved interesting. The majority of participants felt their attention was captured more in the strategically patterned environment B than in environment A. They reported that they were attracted to the saturated colours; they felt that the objects stood out more; they were noticing more things and in that sense, they were involved more in their surroundings (i.e. they were participating):

- 'The first one (environment B) because I was more curious, some of the colours attract your eyes (i.e. the bag), in the first one I saw it directly and in the second one (environment A) I had to look for it, it was there but I wouldn't have seen it like that, I saw it directly, in the first, you can show what you want to show it's easier, ya I think the first one engaged you more because its much more curious...' Participant (1)
- 'The second one (environment B), I could see things more, it was clearer, there was lighter and when I was bending down it was better, seems to be better' Participant (2)
- 'Am the second one (environment B) I think because more things were jumping out and standing out more, you could have a better nose.' Participant (6)
- 'The second one (environment B) because it was clearer and more engaging it made me look for things and more details' Participant (8)

It seems that even though both environments were almost identical, participants were inclined to think that there were fewer objects in the non patterned environment A. In fact, the findings show that the saturated colours in the aesthetically patterned environment have attracted participant's attention to objects that they did not necessarily notice in the non patterned environment. The saturated colours have put an emphasis on certain areas in the room and in doing so, they have subtly persuaded participants to participate, to become involved with each object and then also to look thoroughly at each area around the environment. In addition, the saturated colours have also succeeded in getting participants to feel in certain ways; they are using their senses to create new meanings (i.e. perceptual integration) and to build their own impressions. Through the colours, some of the participants are forming happy, peaceful feelings while others are being more specific when they claim that the colours are giving them more female orientated feelings and impressions.

- 'The first one (environment B) because of the colours, it is much more colourful and I think it gives you as well as the feeling of happiness that you have more colour, more brighter colours, brightness actually thinks it makes you feel much more happy. Much more you know, peaceful feeling, I don't know if that makes sense... a peaceful and colourful environment... if its not colourful you feel much more sad...' Participant (1)
- 'The feeling of the room gives off a girls feeling...' Participant (7), environment B
- 'The first thing that occurs to me as I think it's a girl room am I think I can see female clothing lying around but then when I think the colours I immediately felt female.' Participant (13), environment B
- 'I would say a girl... the colours are shiny colours like what a girl uses' Participant (14), environment B

The data also shows that the colours are having a positive impact on the participants; their involvement with the colours is feeding into their impressions of the room (i.e. the colours are making them feel more cheered up and happy which in turn are giving them lively and warm impressions of the room).

- 'the feeling from the colours impressed me more' Participant (20), environment B
- 'it seems a little bit livelier, the room' Participant (4), environment B
- 'But the first one (environment A) felt like a dull day so the bright colours would automatically make me feel more cheered up.' Participant (5), environment B

When one probes closer, it is interesting to see how these feelings strongly differ from those felt in the non patterned environment A. The following comparisons show a distinct contrast between how participants felt in each environment:

In the aesthetically patterned environment B, participant 1 felt:

- 'I will say a lively place, there's life here... it's a very relaxed atmosphere, ya its like because it's ordered but not totally ordered it's like everything... ya it's a nice one' Participant (1), environment B

While in the non patterned environment A , participant 1 felt:

- 'It's exactly the same but it looks sad... I still feel comfortable but in the other one I would still have a smile on my face while looking at the bed room but in this one I will just look at it I don't know how to express it, it's a global feeling... its much more sad...' Participant (1), environment A

In the patterned environment B, Participant 11 felt:

- 'I think I feel warm about this room (environment B) ah why... the colours of the room, there are many warm colours in the room... the room is small, not many things in the room and warm in my mind, it feels comfortable maybe there is a beautiful girl' Participant (11), environment B

In the non patterned environment A, they felt:

- 'It's very similar but I feel some lonely... am am it's a simple and lonely room' Participant (11), environment A

In the patterned environment B, participant 18 felt:

- 'its a lot warmer its seems to have come to life a lot more am... certainly younger ah don't know if I would still go with student am the flat seems warmer I don't know if I would still say that it is rented certainly younger probably 20's am' Participant (18), environment B

While, in the non patterned environment A, participant 18 felt:

- 'I cant tell but am it strikes me as being slightly cold I think it may be the lack of light elsewhere in the room' Participant (18), environment A

In fact, when further investigated, quite a few participants pondered over the contrasting feelings they were receiving from both environments (i.e. why they were feeling these). In many ways Berleant's [Ber91] idea of "continuity" is beginning to emerge (i.e. 'continuity' between environment B and the user's individual and cultural experiences).

- 'got slightly different feelings. it feels am... the first one (environment B), I keep going back to colours but they were things that stood out first and foremost for me, am they would give me a different impression to the person who lived there, the second one (environment A) I almost felt the person who lived there was in a, you know, longer relationship, don't really know why, could be to do with things like flamboyance for example the shoes... ya that's it' Participant (5)
- 'The second one (environment B) it seemed warmer, it seemed more inviting am there was less. I don't know if it was the limitation of the equipment am but details seemed to be clearer. The whole place seemed to be am... almost more living than just a temporary place to stay... the whole sense that I got was there was someone living there' Participant (18)

In terms of the visual-narrative, it is interesting to see how the feelings, thoughts, and intuitions etc. created by the colours are starting to fuse with the scenario to encourage participants to piece together a story. As Participant (1) demonstrates the saturated colours and the consequent feelings created are being framed within the scenario to feed the narrative (i.e. the happy routine of the person living in environment B versus the more 'mundane' routine of the person living in the non patterned environment A.)

- 'The second one (environment A) shows you a kind of routine, the first one shows you a happy routine but a more lively, the second one is much more a routine because the colours are always the same' Participant(1)

It is true, the aesthetically patterned environment B more so than non patterned environment A has promoted the sharing of information between the photorealistic VR environment and the participants. The saturated colours have not only triggered the participant's attention but also they have started to influence their thoughts, feelings and intuitions and hence the narratives that they are creating.

- 'I think the two rooms were two times of the day, the first one maybe noon or afternoon; the second one is more like morning' Participant (11)
- 'very strange because I feel two atmosphere... think I feel a normal atmosphere... and the dark atmosphere' Participant (16)

Indeed, the participants are sensually, intuitively, reminiscently and intellectually interacting with the colours within the room, so much so, the happy, warm female feelings that are emerging are seen to feed directly into the building of a narrative. From the impressions the colours have aroused, the participants have started to tease out a female presence. The colours have influenced the participant's judgement on some of the finer details concerning this female character (i.e. the colours have made participants feel that the character is quite young):

- 'younger people probably 20's to 30's this time ok' Participant (4), environment B
- 'I would say the person is probably mid 20's early 30's' Participant (5), environment B
- 'certainly younger ah... don't know if I would still say that it is rented certainly younger probably 20's am... ya' Participant (18)
- 'I would say that she is in her late to mid twenties that am...' Participant (7)

However, in the non patterned environment A participants are building different impressions, they feel that the character living in the flat is that bit older:

- 'it kind of an old ladies flat... oh no perhaps not middle aged slightly younger, kinda 30's to 40's maybe' Participant (4), environment A
- 'I would probably say they were a little bit more reserved... in terms of what they were, maybe reserved is not the right word maybe a little bit... they are not as flamboyant' Participant (5), environment A

In both environments, participants are seen to engage with the content and to create some form of a narrative. Indeed, it is a quite a natural phenomenon for humans to build a narrative of their experiences and surroundings. As Pradl [Pra00] says "without stories our experiences would merely be unevaluated sensations from an undifferentiated stream of events. Stories are the repository of our collective wisdom about the world of social/cultural behaviour; they are the key mediating structures for our encounters with reality [virtual reality]." However, what is interesting about this research is the impact of aesthetics on the narratives that are being created, particularly how the use of colour is pulling participants into a specific narrative experience, how it is influencing their impressions of the environment and then the stories they are building. As the findings show, participants are beginning to form female orientated narratives in the pat-

terned environment B, they are creating narratives about a young and even "beautiful" female, a lively person, who is in a happy routine and living in a comfortable, relaxed flat. In the non patterned environment A, participants are reading the opposite; they feel it is about an older and less flamboyant couple who are in a long term relationship and in a routine, who perhaps live simple, lonely and sad lives. The use of saturated colour and even lack of saturated colour are having an obvious effect on the narratives being created. What is important for this and future research is developing methods that possess similar amounts of control (and lack of control) over the narratives and experiences created. As Carlson [Car02] says it's "this kind of bringing together and balancing of feeling and knowing which is at the heart of any aesthetic experience" and as the study verifies, this is quite powerful when it comes to the creation of "engaging" VR environments.

From this research, it was established that a statistically significant fifteen out of nineteen participants (one participant was unsure) found the aesthetically patterned environment B more "engaging". Reflecting on this, it is feasible to suggest that the aesthetic qualities of environment B have been successful in getting participants to participate, perceptually integrate and create a "continuity" (when compared to the non patterned environment A). In conclusion, it can be said that the aesthetic-interactions articulated through the visual-narrative model [Car05] have successfully generated more "engaged interactions" where specific thoughts, feelings and narratives about the female occupant have emerged. Indeed, as the findings show, it has successfully influenced the participant's thoughts and feelings within the environment to create new and "engaging" experiences.

3.4. Discussion

This study has focused on the role of aesthetics (and in particular the aesthetic-interaction) in the creation of "engaging" photorealistic VR experiences. It shows how saturated colours embedded in a scenario and then patterned with visual-narrative techniques have started to prompt participants to participate, perceptually integrate and create a "continuity" within the photorealistic VR environment. In doing so, the study demonstrates how the participants start to aesthetically interact with the content in order to "engage" further in the creation of deeper thoughts and narratives. It is this power to "engage" participants that emphasises the importance of the aesthetic-interaction process within the photorealistic VR environment. In fact, it is this very "power" that exposes the need to rethink the current drive within photorealistic VR development and to start considering how these environments actually influence what participants feel (i.e. how the aesthetics can influence the mood of the experience) as opposed to solely looking at what they enable us to do. In this particular study, Environment B was described as the "happier" and more "engaging" of the VR experiences, however it is important to note that neither is inseparable and the approach used here can be modified to explore the relationship between other moods and the "engagement" they might create. In terms of HCI, this idea takes the general understanding of interaction to a new level, to the "engaged interaction" and an invisible style of interaction [MWS01]. It takes interaction beyond usability and more towards the experiential which as seen, introduces many possibilities for new and exciting experiences.

4. Conclusion

The findings reported in this paper confirm that the aesthetic process of interaction has the power to create "engaging" photorealistic VR environments. Overall, these findings highlight the potential of aesthetics in influencing how participants feel in a photorealistic VR environment and then what type of experiences they might adhere to. In demonstrating this, the work presented in this paper can be seen as moving towards the building of a more holistic understanding of the "language" of VR and in doing so, how we might design photorealistic VR environments more effectively. As discussed, the technical possibilities have, in the past, tended to take precedence over the visual aesthetics in that more time and energy has been spent in trying to improve the technical capability of photorealistic VR than has been spent on exploring its aesthetic potential. To counteract this, the author of this paper has put an emphasis on the visual aesthetic, and in doing so, has shown that it has the potential to create "engaging" photorealistic VR experiences. As Mitchell et al. [MIB03] point out "the arts and design worlds open the possibility of discovering new methodologies for and solutions to problems that, until now, have been beyond the reach of the computer science field to solve or perhaps even articulate". By revealing the potential of the "aesthetic" in photorealistic VR, the author of this paper has opened the door for further experimentation and exploration of the aesthetic within the HCI and other computing fields. In particular, the research has contributed to lessening the divide between art and science and in doing so, promoted the design of more complete and convincing photorealistic VR experiences.

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