Pragmatic and hedonic aspects of user experience in Virtual Reality: analysis of novice users' information mediation during their first interaction with a Metaverse platform

Aspectos pragmáticos e hedônicos da experiência do usuário em Realidade Virtual: análise da mediação da informação de usuários novatos durante sua primeira interação com uma plataforma de Metaverso

Lucas Baptista Oliveira Souza, Aura Celeste Santana Cunha, Mariana Monteiro Xavier de Lima, Diego Enéas Peres Ricca

virtual reality, user experience, metaverse, VRchat

The topic of virtual and extended reality has increasingly captured the interest of developers who aim to widely adopt it among the general population. Over the last five years, significant investments in this field have brought the term "Metaverse" back into discussions as a potential ideal for social interaction within virtual environments. This paper aims to contextualize the Metaverse and its potentialities by investigating its relation to new users from a UX (user experience) design perspective. This work aims to understand the pragmatic and hedonic aspects of user experience and information mediation of novice users during their first interaction with a Metaverse application. To achieve this, we selected six users and analyzed their first interactions within the popular digital platform called "VRchat". For data analysis, we used a method inspired by Marc Hassenzahl's AttrakDiff tool and investigated the interactions based on three main aspects: interactivity, immersion, and self-identification. As a result, we noticed a positive impression of virtual reality (VR) on user experience after immersion. We also observed some UI (user interface) solutions that are functional, and others that are not, in an immersive interface. Based on these findings, we propose some hypotheses for solution paths to enhance these three aspects of the Metaverse experience.

realidade virtual, experiência do usuário, metaverso, VRChat

A realidade virtual e estendida têm atraído cada vez mais o interesse de desenvolvedores que pretendem torná-la disponível para a população em geral. Nos últimos cinco anos, investimentos significativos neste campo trouxeram o termo "Metaverso" de volta às discussões como um potencial ideal para interação social em ambientes virtuais. O presente artigo visa contextualizar o Metaverso e suas potencialidades, investigando sua relação com novos usuários sob a perspectiva do design de experiência do usuário. O principal objetivo deste trabalho é compreender os aspectos pragmáticos e hedônicos da experiência do usuário e a mediação da informação de usuários novatos durante sua primeira interação com uma plataforma de Metaverso. Para isso, selecionamos seis

usuários e analisamos suas primeiras interações dentro da popular plataforma digital chamada "VRChat". Para a análise dos dados, utilizamos um método inspirado na ferramenta AttrakDiff de Marc Hassenzahl e investigamos as interações com base em três aspectos principais: interatividade, imersão e auto-identificação. Como resultado, notamos uma impressão positiva da realidade virtual na experiência do usuário após a imersão. Além disso, também observamos algumas soluções de interface do usuário) que são funcionais, bem como outras que não são, em uma interface imersiva. Com base nessas descobertas, propomos algumas hipóteses de solução para aprimorar esses três aspectos da experiência do Metaverso.

1 Introduction

In 1992, Neal Stephenson's science fiction book 'Snow Crash' described a virtual reality (VR) online that simulates the real world. In this reality, the characters are immersed in a virtual world called the Metaverse and, through immersive devices, the avatars, the digital representation bodies, can interact with displayed information and each other in a cybernetic simulation (Stephenson, 1992). Since then, reproducing the Metaverse out of the book has become an obsession among developers of immersive virtual realities, but there was a long journey of technological improvement before becoming what we know. The attempts to reproduce the Snow Crash's Metaverse began with textual environments on Web 1.0, around the 90s, and only reached relatively similar levels years later, on Web 2.0, in the 2000s (Pereira, 2009).

Today, the available technology allows the possibility of performing a similar cybernetic simulation to Stephenson's fiction, however, like any other technological innovation, it still requires a transition period to make it possible in all its features and be accepted by the general public. In this transition emerges the platforms that present a three-dimensional world in VR, with customized avatars and free movement, but without unified servers, that we decided to call on this paper with the term "proto-metaverses".[1] These platforms, besides providing an experience similar to the metaverse, also present the first solutions in user experience design in charge of adapting information design conventions previously established in two-dimensional platforms for immersive three-dimensional worlds, ensuring the understanding of the information and the satisfaction of its users.

The main objective of this work is to understand the perception of a user in their first contact with a Metaverse application by pragmatic and hedonic aspects of the experience and information mediation (Hassenzahl, 2003). This was approached by analyzing their perceptions and interpretation of the information displayed on a selected VR platform on three main topics: interactivity, immersion, and self-identification (Pereira, 2009). "VRchat'' was the application selected for the study, which best fit into the category of proto-metaverse, due to its

1 In this paper we consider that there is no publicly available platform that has all the requirements to be called a Metaverse. For this reason, we have decided to use the term "proto-metaverse" to designate platforms that share similar characteristics to this main concept, but not all of them.

characteristics (a term that will be better explained in the course of the work). While the interest in metaverse is down, by 71% in global search interest (StockApp, 2023), the VR technology is still making progress with new devices and apps, therefore designers have to keep improving the solutions applied in VR interfaces.

To achieve the proposed objective, we start with a contextualization of the metaverse and its potential value while briefly describing its history within the studies of cyberculture, web 3.0 and VR to understand the technological innovations involved. Finally, the research will carry out the study to understand how VRChat converts the information displayed usually in a bidimensional screen to a virtual reality immersive view and how it impacts the user experience in the first contact with proto-metaverses. We will use the AttrakDiff-R model (Margolis & Providência, 2021), a reduced version translated into Portuguese of AttrakDiff 2 (Hassenzahl, 2003), a evaluation model of a information system, measuring scores of hedonic and pragmatic aspects of an interface. The reduced model consists of a self-report scaled form of 18 pairs of semantically opposite adjectives that must be answered after an experience with an interface. This experience was created as three administrative tasks related to aspects of the metaverse like: 1) free movement (immersion); 2) virtual presence through an avatar (self-identification); 3) and contact with other users (interactivity) as explained in Figure 1.[2] Within 20 minutes, these tasks were performed: the first one was to move to a different room, the second to change the avatar's appearance, and the third to interact with another avatar.

2 Still according to Pereira (2009), there are another three characteristics of the Metaverse: monetary flow (financial transactions and mini transactions inside the platform), content creation by users (provide tools for users to create or customize items) and users' activities property and persistence (mechanism to allow users keep their own items every time it log in the platform). For the limited duration of the evaluation, these three characteristics were not considered because it's not possible to notice and assess these mechanics in 20 minutes.

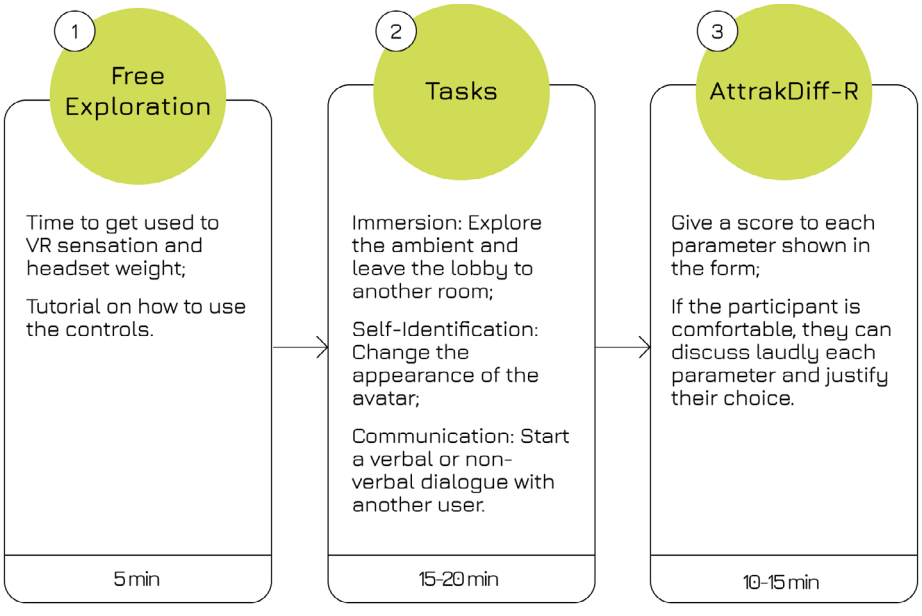

Figure 1 Evaluation phases. Source: Authors.

2 Theoretical reference

2.1 Web 3.0

Briefly, the history of the www (World Wide Web), the systemic software developed by Tim Berners Lee to support computer-to-computer interaction over the Internet, is divided into three major phases: Web 1.0, 2.0, and 3.0. Web 1.0 is, essentially, defined by pages made of text information, and graphics in flash that allows millions of users to find information (Nath et al., 2014). Back then, interfaces were limited from a visual information point of view. So the "communicative efficiency", defined as one of the objectives of information design by The Brazilian Society of Information Design (SBDI, 2020), allowed by the layout, was not fully possible yet. In Web 2.0, users were able to connect in virtual communities through text, voice, images, and videos that helped them to contribute to the knowledge shared online and interact with each other (O'Reilly, 2005) and the technology allowed web designers to create different forms to display information. Lastly, Web 3.0 has more ambitious intentions: build a more immersive and interactive internet, with the Metaverse being one of the immersive navigation solutions (Gomes, 2017) but designing useful interfaces in a VR platform is still a poorly explored territory. Figure 2 shows a diagram that summarizes the main characteristics of the three phases of the www.

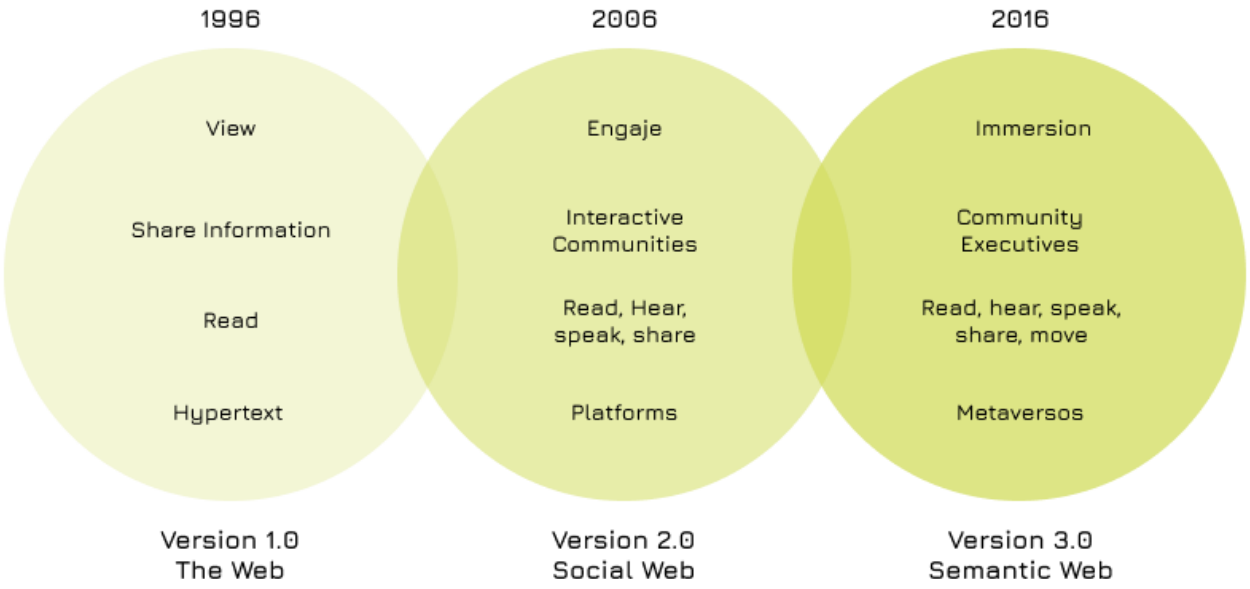

Figure 2 World Wide Web's phases. Source: Prepared by the authors based on O'Reilly (2005); Nath et al. (2014); Gomes (2017).

2.2 Origins of Metaverse

In web 2.0, the first virtual worlds are developed close to Snow Crash. One of them, which gained relevance due to technological relevance and the number of users, was Second Life. The platform is committed to its name: it simulates real life in a physical, communicative, and monetary way (Pereira, 2009). Although the resources provided were diverse and there were countless possibilities, Second Life still a virtual world on Web 2.0, so its graphics were not very smooth and the input devices, hardware that produces commands for the processor that allow navigation and interaction with the world, are not optimized to navigate in a virtual world, like mice and keyboards (Tori & Kirner, 2006). Figure 3 shows a diagram to understand the relationship between the input and output devices.

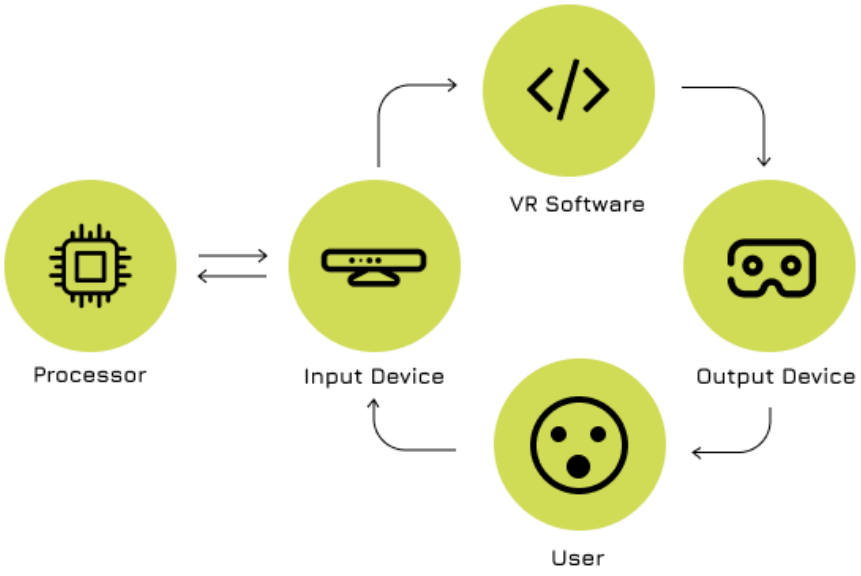

Figure 3 Operation of a VR platform. Source: Cardoso & Machado (2006). Adapted by authors.

The hypotheses for immersion and navigation in the Metaverse access platforms on Web 3.0 are more ambitious, the visual output devices associated with this phase are VR headsets that try to increase the degree of immersion in these online environments. This creates a new study field led by the question "how to create a layout in a virtual reality?". Are the statements overstudied by human-computer interaction professionals of how to display information on a screen still valid in virtual reality?

In the past two years, the Metaverse became a trend topic because of a commercial proposal made by Meta (also known as Facebook) in 2021, as a possibility for professional and social meetings at social isolation periods required by the COVID-19 pandemic. The proposal couldn't go

further because of the downfall caused by a lot of questions about the project's viability, including user access to required devices and user experience inside the platform. Associated technologies like NFT's and Blockchain also helped to create a negative public impression about the project because of the expensive values of commercial transactions. Otherwise, the recently announced Apple Vision Pro, a VR headset with a built-in processor, brings back the discussions of how to design a RV experience with a more solid vision of how to build and use immersive virtual ambients.

3 Hedonic and pragmatic qualities

Understood as "an expanded concept of usability that incorporates key factors to develop attractive and pleasant interfaces and systems" (Hassenzahl et al., 2000, p. 202), hedonic qualities are assigned to products that wish to delight the user. It happens either by providing characteristics that stimulate their attention, motivating them to complete the tasks (hedonic qualities of stimulation); or that generate identification, by the perception that one's identity, or traces of it, are represented in the product (identifying hedonic qualities) (Hassenzahl et al., 2003). Hassenzahl (2001) attributes some features like color, graphics, interactive components, sound effects, and revolutionary maneuvers as hedonic resources (Hassenzahl, 2001). These effects may or may not be related to pragmatic aspects like spacing, collaborations, and all those related to efficiency, effectiveness, and accessibility.

Still, it's important to emphasize that both Hedonic and Pragmatic Qualities are connected. Solutions that allow users to perceive the information and open possibilities to learn and take actions (Da Costa & Valoso, 2021), improve the ergonomics of a digital interface and guarantee the user essential human conditions such as security and process control, as are foreseen in Nielsen's heuristics (1995). Sensations like these will attest to the good performance of resources focused on user satisfaction and these, in turn, will ensure that interface tasks will be met without dispersion or user disinterest.

As it follows, Hassenzahl (2003) develops a model that aims to understand how a product can captivate and encourage its use by the target audience. Through a scale form, the AttrakDiff 2 model proposes to evaluate the quality of a system from the perspective of the experience of use of potential users from the **pragmatic qualities** (QP), **hedonic qualities of stimulation and identification** (HQS and HQI) (Hassenzahl, 2003). It also evaluates the **attractiveness** (ATT) of the product with an aspect of global synthesis about the user's opinion and how attractive the product is (Brennand, 2018; Ramos, 2016). In the present research, we used this model to obtain hedonic and pragmatic data to understand how a novice user interprets and perceives the information displayed on a social platform in VR. In the next item, the methodology applied in this work will be detailed.

4 Methodology

4.1 The AttrakDiff-R model

In order to understand the user experience on first use, it is necessary to understand not only the pragmatic aspects of the platform and how the user understands it, but also the hedonic resources to deliver a satisfactory experience. Therefore, the choice of method for this research prioritized, among other criteria, evaluations that can simultaneously analyze these two qualities.

Following this priority, the AttrakDiff model, proposed by Hassenzahl (2003), was chosen as the main method for the research. It consists of a self-report form that presents adjectives divided into 28 pairs that are semantically opposed. Through a numerical scale, participants can record their perceptions of the experience. In this work, we gonna use the Margolis & Providência (2021) proposed AttrakDiff-R, a reduced version translated into Portuguese of the original, which suggests the use of 18 pairs and a scale of 7 scores, with 4 being the neutral score between the words (Margolis & Providência, 2021). The use of AttrakDiff-R is reinforced by the considerations of the original model made by Marques (2019), in which confusion with the meanings of many terms in Hassenzahl's complete model form was reported by participants in his research (Marques, 2019). Board 1 presents the adjectives adopted and translated by Margolis & Providência (2021) organized by area.

Board 1 Bipolar adjectives of AttrakDiff-R separates by type of quality: QP (Pragmatic Qualities); HQS (Hedonic Qualities of Stimulation); HQI (Hedonic Qualities of Identity); ATT (Attractiveness). Source: Margolis & Providência (2021).

QPR	HQS	HQI	ATT
Technical–Human	Uncreative–Creative	Professional–Unprofessional	Unpleasant–Pleasant
Complicated–Simple	Cautious–Bold	Unpresentable–Presentable	Ugly–Attractive
Unpredictable–Predictable	Dull–Captivating	Cheap–Premium	Bad–Good
Confused–Clearly structured	Undemanding–Challenging	Alienating–Integrating	Discouraging–Motivating
Unruly–Manageable		Separates me–Brings me closer	

The model, according to Margolis e Providência (2021), is a preliminary study and needs further analysis and applications for validation; however, the results presented in the proposed study were satisfactory. The choice of applying the AttrakDiff-R in this work also contributes to validating the model for comparable applications. In addition, scales of differences, such as AttrakDiff-R, are simple and quick to apply and give solid results (Marques, 2019).

4.2 Evaluation preparation

4.2.1 Participant profile

Six participants which share one common characteristic were invited to the research: having few, or none, experience with VR immersion or with "VRchat". They answered a short questionnaire about their experiences and knowledge about the Metaverse, VR, avatars, 3D games and online virtual worlds, to be sure if their profile fit the one needed on the investigation.

4.2.2 Platform choice

The criteria to select a platform was "allow interactivity between different users, customizing avatars and free movement". Considering these criteria and limitations, the platform "VRchat" was chosen due the closest fit to the main objective of this paper.

"VRchat" presents itself as a virtual world MMO (Massive Multiplayer Online) platform. There, users can interact with other users through voice dialogues and body expressions of their avatars. Despite not considering itself a Metaverse platform, "VRchat" has enough characteristics to be categorized as a proto-metaverse, the existing form closest to the concept of a Metaverse platform currently, since the platform in VR presents persistence of content, monetary flow, multimodal communication processes, enables interaction and communication between users, creation of its own content and is not categorized as a game (Pereira, 2009).

4.2.3 Evaluation conduct

This work aims to explore the perception and interpretation of information displayed on the "VRchat" platform for new users. To achieve this, evaluations were conducted individually and only once, as suggested by Nzongo (2018). It started with the verbal presentation of the work, contextualizing the user about the Metaverse, and requesting the necessary authorizations for the audio and video recording of the recording through the Free and Informed Consent Form. All interactions in VR were recorded, also with the participants' consent.

The evaluations took place in a classroom of the Architecture, Urbanism, and Design Department of the University Federal of Ceará, in Brazil. There was a concern about the discomfort of the participant in an unknown and controlled environment (Catecati et al., 2018). However, due to immersion provided by the input and output devices, evaluations in VR are less susceptible to issues of this type. Still, the technical team managed the temperature and noise to create an undisturbed environment.

The evaluation was divided in three main phases, as explained previously in Figure 1.

First phase: In the first one, the "free exploration" phase, the six participants were equipped with Oculus Rift S, and VR headsets, and instructed on the use of input devices. For 5 minutes, they were able to explore the vision and movement controls. As the intention was to evaluate perception and interpretation, we decided to make this initial phase a free exploration moment.

Second phase: Following the initial interaction with the equipment, the "task" phase began. At that moment, the "VRchat'' application was launched, immersing participants in the welcome lobby—a space adorned with portals and notices. As mentioned before, we intended to investigate the interaction based on three main aspects of the metaverse by Pereira (2009): **immersion**, **self-identification** and **interactivity**. These were the aspects that guided the creation of the tasks proposed in the second phase of the experiment. These tasks are important to guide the experience and to evaluate the performance of the user and the interface (Da Costa & Valoso, 2021). After the setting, 20 minutes were determined to perform the three tasks, described below.

1. Transport yourself to a different room using the mechanism available in the welcome hall – to accomplish a good **immersion**;
2. Choose another appearance for your avatar, according to the participant's personal preference – to stimulate the **self-identification** with the avatar;
3. Establish communication with another active individual in the game, this communication can be verbal (listening and/or being heard) or non-verbal (nodding, helping, etc.) – propose an **interaction** and create a good sense of presence.

Third phase: After the experience, the AttrakDiff-R evaluation form was applied. The title "Interface Evaluation" is accompanied by the instructions for filling in: "The next pairs of words represent strong contrasts. Select the description you consider most appropriate concerning your experience with "VRchat"". The form, as already mentioned, presents 18 pairs of semantically opposite words and to avoid trends, they were shuffled and arranged following Margolis; Providência (2021) order.

5 Results

After the evaluations, the results were treated by the recommendations of Nzongo (2018) and Margolis & Providência (2021), with the first step being to make an average values diagram, Figure 4. In this one, it is possible to see the positive analysis of "VRchat" in all four evaluated dimensions by the participants, which means a good reaction to the platform, even though it's an unprecedentedly odd experience.

According to Nzongo (2018), values close to the neutral zone (between 1 and 0 or −1 and 0) are standard, that is to say, are perceived

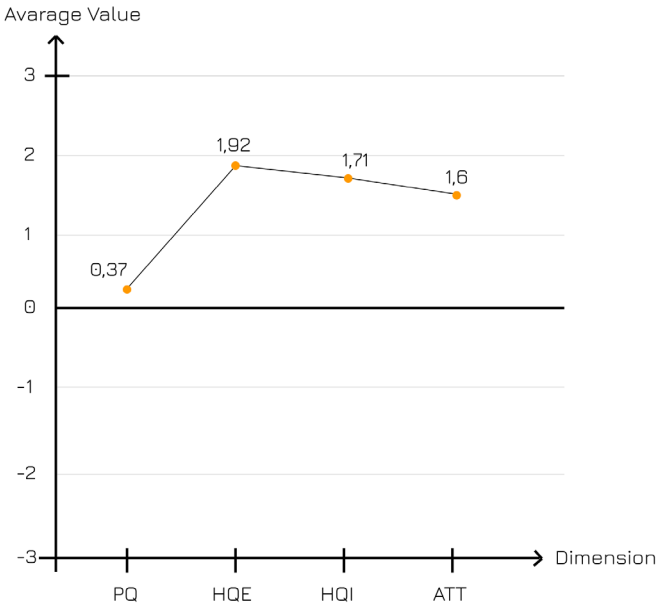

Figure 4 Average values diagram. Source: Authors.

neither positive or negative, only reaching their objective. The pragmatic quality (QP) was the only in the neutral zone, meanwhile the other dimensions (HQS, HQI and ATT) received values larger than 1. Then, the pragmatic quality neutral score may have been caused by an issue noticed in almost every participant: the understanding of essential information to use "VRchat" like metaphors, mostly the portal (Figure 5) as an indication of avatar transport between the rooms. Below, we present some results from the perspective of Information Design regarding how the content is arranged and organized within the interaction. From this analysis, we identified several areas that could benefit from improvement.

In the transport task, there was a certain confusion of the users on how to complete it; with two of them it was necessary to explain exactly what to do. Even after understanding how to use the portal, they felt confused by the connection delay between getting into the portal and actually being transported to the next room; it shows the lack of feedback provided by the interface. Similar to the participants in this evaluation, many individuals lack experience with virtual reality, and the design of VRChat's portals — an ellipse shape against an animated purple or blue background (Figure 5) — deviates from anything found in the real world.

The same portal issue happens with the other tasks, for example, when the participant tries to interact with another avatar to complete the communication task. The lack of visual, audio or haptic feedback makes it hard to check if the participant was heard by another avatar. Many participants ask the evaluators questions like "I got it?" or "It's done?" It happens when they try to change the avatar's appearance too. In the avatar personalization room (Figure 6), specifically, the participants had to approach an avatar statue and click it to get the same appearance, but the interface didn't have any visual instructions to teach how to

Figure 5 "VRchat" portals. Source: The authors.

Figure 6 Avatar personalization room. Source: The authors.

do it and no visual or sound sign to give positive or negative feedback after the click. The participants had to go to a virtual mirror, placed far from the statues, to see if their appearance had changed or not. Despite this issue, all participants complete all the tasks but at different times and with different adversities.

Back to the communication task, some participants found some difficulties to complete it. Besides the feedback challenge, participants, who are native Portuguese speakers, encountered difficulties in communicating with other avatars. This was primarily attributed to language disparities, as a significant number of "VRchat" users communicate in English. Additionally, technical issues such as headset malfunctions, slow internet connections, or a lack of interest in conversation by other users further contributed to these communication challenges.For those participants who couldn't speak to another user due to shame or absence of English skills, they interacted by waving or using body language.

Another pragmatic issue noticed, from an information design perspective, was the resemblance between buttons in pop-up interfaces. This difficulty in selecting the right button also disturbs the immersion and sense of present of the user, so it's a relevant problem to solve. There are some adjustments that make the interface, shown in Figure 7, work and look better. It's necessary a new arrangement to begin with. The "Join" button, with the most relevant action in this window, should be bigger and preferably in the bottom-right to create a sense of "next page".

Figure 7 Rooms browser interface. Source: The authors.

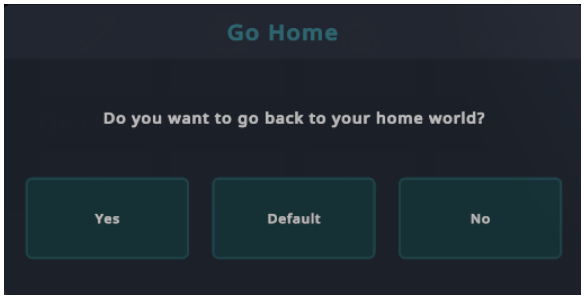

Figure 8 Confirmation pop-up. Source: Authors.

After selecting "Join", Figure 8 the confirmation pop-up shows up with buttons with a very similar appearance and the "default" button in the middle doesn't have a clear action. The button "Yes" shifts places with the "No" button placed in right, where the confirmation button should stay as a pattern established by many other digital interfaces. Because of that, many participants would select "No" instead of clicking "Yes" to go to the selected room. These details increase the time to complete a task because they had to do the whole flow again. In this screen, a new color

palette for the pop-ups and menus in the platform should help the user select the right button. Also, the buttons can perform better by putting icons along with the label to help non-english readers, just like it does in Figure 7.

For the hedonic qualities, the results from the two types – identification and stimulation – were similar, both close to score 2. In Figure 9, the word pair diagram shows every parameter in a detailed analysis of the dimension.

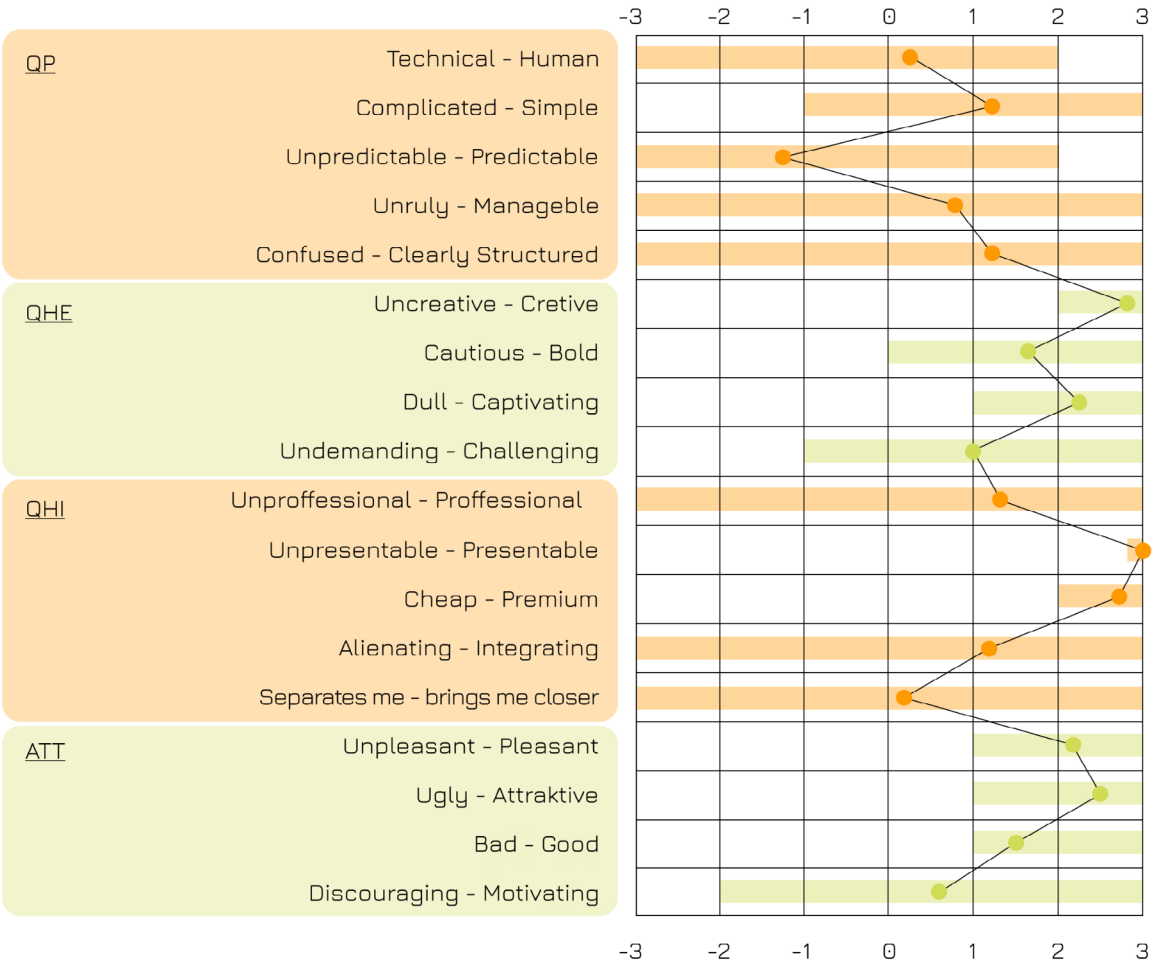

Figure 9 Word pair diagram. Fonte: Authors.

Looking at the HQS and HQI dimensions, it's possible to see more uniform results and tend to keep between 1 and 3, which means that the experience in "VRchat" was exciting for the participants. The participant's positive perception is made, mainly, by the interface. Parameters like "uncreative – creative", "dull – captivating", "unpleasant – pleasant", "cheap – premium" and "ugly – attractive", all of them with a score greater than 2, show the good reaction of the participants.

The performance of the AttrakDiff-R method in this context had some issues too. Some participants couldn't figure out how some of

the parameters fitted the experience. As shown in Graphic 2, many parameters of QP and QHI had a big difference between the answers and the participants made questions to the technical team while answering the form. Those doubts came from the lack of specification of the parameters and the inexperience of the participants with VR. With the parameter "separates me – bring me closer", for example, some participants related to the people they're around (separates me) and some others related to the people they meet in Metaverse (bring me closer).

In general, all the participants got surprised and excited by the immersion in the "VRchat" rooms, but some conditions of the research could impact this perception. First, it's important to remember the profile chosen for this study; the lack of experience of the participants could cause exciting emotions in the first minutes that can impact the final results. Despite the evaluation with "VRchat", its evident the enthusiasm was caused by the VR technology and, perhaps, another proto-metaverse could be the same performance in the hedonics characteristics.

6 Conclusion

Therefore, the work took advantage of user experience design concepts to understand what these virtual worlds can make their users feel, in a practical way. To achieve this, the "VRchat" proto-metaverse platform was chosen as the Metaverse representative because of its accessibility and compatibility with almost all characteristics of a Metaverse by Pereira (2009).

Due to the recent decline in the metaverse popularity, it's not interesting to reduce the efforts of this work to a classic usability evaluation as suggested by Nielsen (1995). Thus, we prepared a user experience evaluation of VRChat with six participants using the AttrakDiff-R model (Margolis & Providência, 2021), an inspired version of the original model by Hassenzahl (2003) that is still in validation. The choice of evaluating both hedonic and pragmatic aspects are relevant to understand what makes the user comfortable or uncomfortable inside an immersion experience, to avoid public rejection in other projects with social immersive spaces.

The results showed a first positive impression of the participants about the "VRchat" because all of them expressed joy in the experience as a consequence of the hedonic characteristics present in the platform, established by the score of attractiveness, a dimension evaluated by the model. However, it is important to point out that among the six participants, just one had a previous experience with VR. So relating the exciting experience only to "VRchat" experience resources is a hasty conclusion, it is necessary to look at the VR technology influence in this evaluation.

Overall, "VRchat" delivers a positive user experience across all evaluated aspects, including communication, immersion, and self-identification. However, participants encountered challenges in each of

these areas while attempting to complete the designated tasks. These difficulties were essentially in information design, caused by developer's information arrangement and visual design choices in the designing of the interface, which significantly hampers the experience of new users, making it harder to notice the displayed content and to learn how the platform works. The lack of feedback issue present in the portals teleportations to another room and in changing the avatar appearance could be solved using a classic progress bar, incoming screen notifications or, and more fit to the context, using haptics like controller vibrations or sounds.

It is relevant to consider that the use of VR to navigate the Internet allows the creation of new interfaces, compositions and types of interactions, so it is important to review the user experience's guidelines and standards of how to display and interact with information on screen. It is not useful to use the same recipe for how to design a two-dimensional interface in the designing of a VR one. By using the potentiality of sensors as input devices, it is possible to create different alternatives of how to interact with the system. For example, in an ambient with a pop-up window with buttons to choose, the system choice method can be through body positions that the user has to stand to choose between the options, or make a specific move to select a button, always with clear instructions to teach the user how to use. Another example of useful alternatives in VR experiences is how incoming notifications can be displayed outside the front view. Unlike 2D interfaces, VR's developers can explore the 360° field of vision provided by the VR headset and display a notification center above or beside the user's view, and also deliver sound notifications to the user to check the notification center and improve the user experience making the interface clearest and minimalist making the virtual space widest and comfortable, improving the sense of present by not interrupting the experience with virtual protocols.

All of this solution can help to create a more natural and recognizable environment. As said before and demonstrated by the results of AttrackDiff-R, many people have little or no experience in virtual reality immersion, so the confusion and disorientation it's a natural thing to feel. The designers of this virtual reality worlds are responsible to adapt the statements of user experience, such as the classics Nilsen's Usability Heuristics (Nielsen, 1993), to a VR interface and taking advantage of the possibilities provided by the system's devices.

The low experience is also relevant to rethink the interaction with the settings menus, for example, required as any other software, can set the level of immersion, just like the user-object interaction or user-user interaction. Confusing menus or with no instructions of how to use them are breaking the main principle of information design by Sless (1992): to make every kind of information accessible and useful to users in a proper form.

Besides the issues in some immersion and self-identification features provided by the platform, the VRChat highlights are in the communication features. Despite the feedback problem present in many moments of the experience, including talking to someone, all

the participants felt very excited to see and interact with other avatars in the room. VRChat provides many ways of interaction between users like by voice, pre animated movements (wave hand, dance) or movements made with input devices.

For future research we plan to follow the investigations about the pragmatic and hedonic aspects of user experiences in VR, specifically in how to perceive and interact with alerts, notifications or confirmation interfaces without reproducing the same design applied in bidimensional interfaces with a cursor. By using VR headsets and its control devices, the possibilities with gestures can be more explored with solutions that allow a better user flow and experience.

Acknowledgment

We thank to Laboratory of Digital Experience (LED) of Department of Architecture, Urbanism and Design (DAUD) of Federal University of Ceará.[3]

3 http://led.ufc.br/

References

Brennand, C. V. L. T. (2018). *Um estudo sobre a avaliação da experiência do usuário em cenários pervasivos, ubíquos e sócio-enativos*. Dissertação (Mestrado). São Paulo, Brasil: Universidade Estadual de Campinas.

Catecati, T. et al. (2018). Métodos para a avaliação da usabilidade no design de produtos. *DAPesquisa*, 564–581.

Cirino, N. N. (2018). *Entre o imersivo e o pervasivo: conceitos e aplicações na relação com o virtual*. Tese (Doutorado). Recife, Brasil: Universidade Federal de Pernambuco.

Gomes, R. (2017). *Experiência do usuário no paradigma da internet das coisas: estudo exploratório em um sistema de gestão empresarial integrado*. Dissertação (Mestrado). São Paulo, Brasil: Instituto de Pesquisas Tecnológicas do Estado de São Paulo.

da Costa, A. C. R., & Velloso, L. M. R. (2021). Interfaces digitais de serviços de entrega de alimentos – Análise semiótica dos aplicativos da plataforma iFood. *InfoDesign – Revista Brasileira De Design Da Informação*, *18*(1). https://doi.org/10.51358/id.v18i1.838

Hassenzahl, M. (2001). The Effect of Perceived Hedonic Quality on Product Appealingness. *International Journal Of Human-Computer Interaction*, *13*(4), 481–49.

Hassenzahl, M. (2005). The thing and I: understanding the relationship between user and product In M. Blythe & A. Monk, *Funology 2* (pp. 301–313). Cham: Springer.

Hassenzahl, M., Platz, A., Burmester, M. & Lehner, K. (2000). Hedonic and ergonomic quality aspects determine a software's appeal. In *Proceedings of the SIGCHI conference on Human Factors in Computing Systems* (pp. 201–208).

Hassenzahl, M., Burmester, M., & Koller, F. (2003). AttrakDiff: Ein Fragebogen zur Messung wahrgenommener hedonischer und pragmatischer Qualität.

In G. Szwillus & J. Ziegler, *Computer 2003: Interaktion in Bewegung* (pp. 187–196). Stuttgart: B. G.

Machado, L. S., & Cardoso, A. (2006). Dispositivos de Entrada e Saída para Dispositivos de Realidade Virtual. In R. Tori, C. Kirner, & R. Sistercouto, *Fundamentos e Tecnologia de Realidade Virtual e Aumentada* (pp. 39–50).

Margolis, I., & Providência, B. (2021). O Attrakdiff-R para o design: uma redução do Attrakdiff para a análise holística das experiências do usuário. In I. Margolis & B. Providência, *Design Centrado no Usuário: concepções, práticas e soluções* (pp. 171–182). Braga: Editora Científica Digital.

Marques, L. C. (2018). *UX-Tips: uma técnica de avaliação de user experience para aplicações de software*. Dissertação (Mestrado). Manaus, Brasil: Universidade Federal do Amazonas.

Nielsen, J. (1993). *Usability Engineering*. Boston: Academic Press.

Nielsen, J. (1995). Usability Testing. In *Usability Engineering*. Oxford: Morgan Kaufmann.

Nzongo, F. L. (2018). Avaliando a atratividade de um produto interativo, além da usabilidade. In *Interaction Latin America*.

O'Reily, T. (2005). *What is Web 2.0: Design Patterns and Business models for the Next Generation of Software*. Oreilly.com.

Pereira, I. C. (2009). *Metaverso: interação e comunicação em mundos virtuais*. Dissertação (Mestrado). Brasília, Brasil: Universidade de Brasília.

Nath, K., Dhar, S., & Basishtha, S. (2014). Web 1.0 to Web 3.0 – Evolution of the Web and its various challenges. In *International Conference on Reliability, Optimization and Information Technology* (ICROIT) (pp. 86–89).

Ramos, J. L. C. (2016). *Uma abordagem preditiva da evasão na educação a distância a partir dos construtos da distância transacional*. Tese (Doutorado) Recife, Brasil: Universidade Federal de Pernambuco.

Smart, J. M., Cascio, J., & Paffendorf, J. (2007). *Metaverse Roadmap Overview*. metaverseroadmap.org

Sociedade Brasileira de Design da Informação [SBDI]. (2020). http://www.sbdi.org.br/definicoes

Stephenson, N. (2015). *Snow Crash*. São Paulo: Aleph.

Tori, R., & Kirner, C. (2006). Fundamentos da Realidade Virtual. In R. Tori, C. Kirner, & Sistercouto, R. *Fundamentos e Tecnologia de Realidade Virtual e Aumentada* (pp. 2–21).

StockApp. (2023). *Global Search Interest in the Term Metaverse Slumped by 71% Over the Past 12 months*. https://stockapps.com/blog/global-search-interest-in-the-term-metaverse-had-slumped-by-71-over-the-past-12-months/

About the authors

Lucas Baptista Oliveira Souza
lucasbaptista@me.com
Universidade Federal do Ceará
Fortaleza, CE

Aura Celeste Santana Cunha
aura@daud.ufc.br
Universidade Federal do Ceará
Fortaleza, CE

Mariana Monteiro Xavier de Lima
mariana@daud.ufc.br
Universidade Federal do Ceará
Fortaleza, CE

Diego Enéas Peres Ricca
diego.ricca.p@gmail.com
Universidade Federal do Ceará
Fortaleza, CE

Submission date/*Artigo recebido em*: 28/3/2023
Approvement date/*Artigo aprovado em*: 20/11/2023