An Investigation of the Advantages and Disadvantages of University Students as Avatars in Virtual Learning Spaces

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Abstract

Authors have noted the increasing importance of avatars in Higher Education, as more teaching is conducted virtually, drawing upon gaming conventions. However, it is also recognised that little is known about how students make use of avatars (especially over an extended period) and the subsequent impact on learning experiences. For the last three years, a university module has been conducted within a persistent virtual world – where students (49 in 2020; 95 in 2021; 122 in 2022) predominantly interact with each other and teaching staff in avatar form. Observation data constitutes 60 hours of video recordings of virtual world seminars. Students have also been surveyed (average 40% response rate) and interviewed. The experience of learning on this module while in avatar form has been extremely positive, with students expressing many advantages to being an avatar – including the ability to express oneself in original/engaging ways, the ability to move freely in the environment (less restricted by social norms), increased confidence to speak up in class, reduced concern over actual physical appearance, and being praised for their avatar. Nevertheless, disadvantages were also apparent, including the distracting nature of certain avatars, inappropriate behaviours, usability challenges in designing an avatar, and lack of sense of self. An initial design framework for the use of avatars in Higher Education is proposed.

Keywords*: Avatars, Persistent Virtual World, Learning Experiences, Higher Education*

Introduction

Many empirical studies have investigated whether learning benefits exist when immersing students in Virtual Reality (VR)-based experiences for their education. Indeed, in the last few years there have been several meta-reviews (e.g., Di Natale et al., 2020; Hamilton et al., 2021; Coban et al., 2022) comparing multiple experiments (up to 48 studies) where the focus has been on VR in K-12 and Higher Education (HE) educational contexts. All such reviews have concluded that the majority of research to-date (66-72% studies) have demonstrated statistically significant positive learning effects for the use of VR when compared with traditional on-line/in-person teaching methods. The minority of experiments have found no differences, or reduced learning for students using VR technologies – usually because of either a) distraction due to novelty, or b) cognitive overload effects (Hamilton et al., 2021). As noted by Di Natale et al (2020), "The general picture of the studies included in the present research shows that [immersive virtual reality] can support a number of activities and experiences that in turn improve learning and motivate students to fulfil educational goals" (p. 2024).

Many arguments are put forward for why VR affords learning benefits over more traditional modes of engagement. These can essentially be grouped into viewpoints related to educational paradigms or to characteristics of the technology itself (Radianti et al., 2020). For instance, VR clearly satisfies the paradigm of experientialism (a form of constructivism) – as students can learn by doing, but also experience entities from unique, memorable perspectives – especially due to the inherently 3D/magical nature of virtual worlds.

Moreover, VR provides many more opportunities for contextualization - whereby students are immersed in environments consistent with the topic under consideration (Geng et al., 2019). From a technological angle, Makransky and Peterson (2021) highlight two affordances of VR which ultimately will impact on measures of learning, namely: presence - the immersive nature of VR technology can lead users to truly believe (and behave) as if they are somewhere different to where they actually are (Witmer and Singer, 1998) and agency - VR allows students considerable control over their movements, as well as interactions with others and the environment, and so on.

From additional observations of the multitude of studies contained within meta-reviews, it is apparent that previous work in this area has largely focused on one-off/short-term experiences with VR, that is, use over minutes/a few hours rather than a whole term/semester/year, as well as individual (rather than group) experiences. Both points are significant in the context of the present paper. For the former issue, it is highly likely that attitudes towards, and behavior with, VR will evolve over time, as students (and potentially teachers) adapt to this highly novel media. Two recent studies reported by Han et al. (2022) demonstrate such a phenomenon. In their work, university students (n=81 and n=137) experienced seminars in VR across a semester and provided various responses to survey data on a week-by-week basis. Sessions were also recorded and analyzed to understand avatar communication behaviors. Han et al found that ratings for presence and realism increased over time whereas factors such as pleasure and enjoyment gradually decreased. The authors speculate that, as the novelty of the experience declined and familiarity/ confidence increased, students were better placed to "focus more on being present and pay attention to their surroundings, rather than focus on learning how to use the medium" (p.22). In essence, for research in this area to be ecologically valid, it must consider the effects of VR on the student experience over a typical module/course timeframe.

With respect to the second limitation of previous work, it is important to emphasize the potential importance of social VR platforms, in which students and teachers engage within virtual worlds – that is, "Shared, simulated spaces which are inhabited and shaped by their inhabitants who are represented as avatars. These avatars mediate our experience of this space as we move, interact with objects and interact with others, with whom we construct a shared understanding of the world at that time" (Girvan et al., 2018, p. 1099). In essence, a virtual world is synonymous with social interaction, as people (personified in avatar form) are free to move, communicate, and collaborate in both seemingly natural, but potentially magical ways (Burnett, Harvey, and Kay, 2022).

Regarding education, several authors have noted the significance of social context in the overall learning process and the subsequent benefit of students present within virtual worlds being able to engage with one another, regardless of their location in the real-world (Han et al., 2022; Yalcinap et al., 2012; Petrakou, 2010). Mystakidis, Berki and Valtanen (2021) summarise many of the socially oriented benefits that VR affords for students in HE, primarily in relation to traditional distance-learning approaches - including enhanced ability to co-create, collaborate on tasks, heightened mutual trust, and importantly, a greater sense of community. Moreover, they note the significance of the student's avatar itself because studies have shown this can assist in the capture and maintenance of students' attention whilst also providing a sense of togetherness within a virtual world (Downey et al., 2012; Ozonur, Yelken and Tokmak, 2018).

In terms of formal definitions of an "avatar", Nowak and Fox (2018) assess in their review that numerous definitions exist, with widely different perspectives on the concept – varying as to whether an avatar is considered to be a) purely visual (or is multi-modal), b) controlled predominately by a human (as opposed to AI), or c) requires specific levels of fidelity (2D vs 3D, level of detail, anthropomorphism, etc.). In their conclusion, Nowak and Fox argue that researchers should adopt their broad view of an avatar as "a digital representation of a human user that facilitates interaction with other users, entities, or the environment" (p. 34), encapsulating their opinion that avatars can take many different forms but ultimately must characterise a specific human.

Nowak and Fox's definition raises questions as to what forms an avatar could potentially take, as well as the myriad of motivational factors affecting the individual choice or design of an avatar. In this respect, most of the avatar research has been conducted focused on gaming/ entertainment environments (see for example, Loewen, Burris and Nacke, 2021). Nevertheless, there are interesting observations of potential relevance to the HE sector. For instance, Triberti et al. (2017) categorise avatars according to three specific variables, the representation of body (shape, hair, eyes, skin etc.), clothing, and accessories (e.g., jewellery). Other authors have noted that avatars will vary according to depictions of body movements (head, eyes, legs, etc.) and the degree of caricature employed (Jerald, 2015). Indeed, in gaming contexts, it is apparent that users will often adopt non-humanoid avatars (potentially with no physical body at all) (Dugodo and Ritter, 2022). As a final point, it is important to distinguish between first-person and third-person portrayals of avatars (Pan and Steed, 2017). Avatars that are closely aligned with the human's viewpoint (especially in vision) are typically described to be embodied (Kilteni et al., 2012), providing greater sense of self-location, body-ownership and agency (Eubanks et al., 2021) – but may be less obviously perceived by an individual (Lim and Reeves, 2006).

In addition to these largely objective characteristics of an avatar, it is critical to understand the subjective user response, that is, how the avatar is perceived by the user. On this point, there is considerable research (again, predominately in gaming contexts) concerning the relationship between avatar choice/design and an individual's sense of identity – usually drawing upon self-discrepancy theory (Higgins, 1987). Deploying this theory, a user's choice/design of an avatar can be classified according to three types of self: true/actual-self (does the avatar objectively look/appear like the user does in the real-world?); ideal-self (does the avatar represent an aspirational view of the user?); ought-self (does the avatar possess attributes the user believes should be included?) (Loewen et al., 2021). Other researchers have outlined a fourth aspect of self (termed here value-self) not included within self-discrepancy theory but considered significant in this context to signify the importance of a users' values or ideals (like/dislikes) in shaping the preferred avatar characteristics (Nowak and Fox, 2018).

When researchers have then used these components of self to investigate an individual's motivation for designing an avatar, they have typically done this in a controlled fashion with participants initially creating an avatar with specific software or perceiving their preferred avatar, which is subsequently related to their answers within various surveys, e.g., considering why they conceived that avatar (e.g., Loewen et al., 2021; Fokides, 2021). Such a methodological approach has enabled some understanding of why users of avatars in gaming might initially design a particular avatar, but neglects to consider avatar choice/ design in the social context in which they would be used, that is, how avatars can change over time.

In addition to this background work on avatars and identity, recent work (mentioned above) from Han et al. (2022) highlights the wider range of factors involved with avatars. Han et al.'s study one is of most relevance here, as students were forced to embody either a true-self avatar (based on a photo of them in the real-world) or a humanoid uniform avatar (i.e., where everyone looked the same) for the teaching activities. Analysis indicated that students enjoyed learning more as a uniform avatar (presumably because of the enhanced community/team mentality), compared to when they were represented more realistically. Nevertheless, true-self avatars were associated with higher levels of personal presence (embodiment) and were observed to communicate more efficiently (i.e., non-verbal cues were more synchronized between avatars).

Whilst Han et al.'s work is not specifically about motivation factors for avatar choice, it raises interesting questions about students potentially utilizing avatars that do not reflect a desire to represent some aspect of self – in this case, deploying avatars that look the same or resemble those used by their classmates. Indeed, there is considerable literature within the area of social VR outlining the phenomenon of identity tourism, whereby people deliberately take on the persona of someone else (different ages, genders, races, etc.) as a means of easily exploring alternative identities in a relatively safe environment (see, for example, Dugodo and Ritter, 2022; McVeigh-Schultz et al., 2018; Nakamura, 1995).

In summary, we can highlight various learning from the existing research in this area. In particular, there is now clear evidence that VR can significantly improve learning outcomes for students, both in school and HE contexts. Moreover, virtual worlds have considerable potential for use in educational contexts, providing numerous benefits associated with social learning, mediated by the use of avatars by students and teachers. In this respect, several different motivational factors can influence an individual's choice or design of a specific avatar, related to both a desire to represent some aspects of self, but also potentially a deliberate decision not to represent self.

With respect to gaps in the literature, it is apparent that further longitudinal studies are required to understand students' choice and use of avatars within virtual worlds over an extended period. In addition, it is noteworthy that prior work on avatars has been very focused on gaming contexts, arguably very different to a university setting. Consequently, this research aimed to identify the major advantages and disadvantages apparent when university students are represented as avatars for most of their learning experiences across a semester. More specifically, the following research questions were addressed:

- What avatars are naturally chosen/designed by university students?
- How do students behave (especially socially) when in avatar form for an extended time period (across whole semester)?
- What impact does being an avatar have on the student learning experience?

2. Methodology

2.1 Overview

At the authors' university, a module is taken by final year Engineering undergraduate students (Mechanical Engineering; and Product Design and Manufacture) and postgraduate students in Human Factors/Ergonomics and Human-Computer Interaction. This largely optional module concerns the Human Factors Engineering design issues for simulation and virtual reality – and is extremely novel in that almost all learning experiences across a semester occur within a fantastical virtual world. This paper reports data from across three

academic years: 2020/21 (49 registered students); 2021/22 (95 registered students); 2022/2023 (122 registered students).

The virtual teaching world developed for the module utilises the Mozilla Hubs social VR platform which runs on the browser. As can be seen in Figure 1, for the 2020 running of the module, the virtual world was a single building on a Mediterranean-style island surrounded by a lake. In 2021, the world took the form of a more expansive medieval campus on a floating island in the sky, whereas in 2023 the virtual world represented a more futuristic sci-fi building floating above a volcano. More information about some of the considerations behind the evolving design of the virtual world itself can be found in Burnett (2021).

Figure 1 – Virtual Worlds Used in Teaching (left-2020; middle-2021; right-2022)

Most students across the three years accessed the virtual world on their desktop computers/ laptops (i.e., non-immersive VR). Increasingly though, students have utilised VR headsets for more immersive experiences, typically either Meta Quest 2 or Pico 2/3 devices.

- In 2020, two students who owned a headset routinely used them in class.
- In 2021 all students were given the option to borrow a headset for a one-week period during the semester of which 38 (40%) took up the offer. In addition, three students regularly used their own personal VR headset.
- In 2022, all students were given the opportunity to try out a VR headset at the beginning of semester. Those students (22 in total – 18% of cohort) most responsive to immersive VR (based on a survey) were then lent out headsets to use to access the virtual world for all sessions throughout the semester. In addition, five students frequently used their own personal VR headset.

The overall teaching approach of the module in 2020 and 2021 was a 'flipped classroom', whereby core content was delivered via pre-recorded lectures watched by all students asynchronously – which were then consolidated in synchronous seminars (with students in smaller groups – approximately 10-15/group). Specifically, the lectures were recorded by the module convenor from within the virtual world; this was because the virtual world enabled easier explanation on a number of different human factors issues associated with VR which were being taught. Here is a sample lecture: https://www.youtube.com/watch?v=zn2NVkK6IQI For example, perception of 3D in VR; role of immersion and presence; factors influencing sickness, and so on. An example lecture is available on-line. In 2022, a different approach was adopted in which live lectures (approximately 45 mins in duration) were given from within the virtual world by the module convenor, followed by seminars related to that topic with smaller groups of students (also within the virtual world).

With respect to the seminars, numerous different socially oriented activities were conducted with the students each week, aiming to exploit the magical/fantastical capabilities of VR, for example, treasure hunts, show and tells, 'meet the expert' fireside chats, design/empathy

workshops, etc. An example seminar is available on-line: https://www.youtube.com/watch?v=puktO2g-Wpc Finally, a 2 hour 'open-office' time was provided for students to meet with the module convenor if they had any questions. This occurred within the virtual world and was a popular additional activity for the students (typically 20-30 students would attend each week).

An advantage of the Mozilla Hubs platform is that there is considerable creative freedom for avatars, in contrast with some other available platforms which force a particular type of avatar. Consequently, students could choose/design an avatar through several different mechanisms which were explained to them at the outset of the module (either on-line in 2020/2021 or in-person for 2022). The mechanisms were as follows:

- They could choose an avatar from several pages of options directly from the Mozilla Hubs preferences (these are mainly cartoon animals/robots).
- They could use the Ready Player Me 3rd party web-based software to create and then upload a realistic humanoid half-body avatar based initially on a photo.
- They could use the Hubs Hackweek avatar creator to design and then upload a cartoon humanoid avatar.
- They could create their own avatar using the Blender software which could then be imported to Hubs.

Methodology

A range of objective/subjective data have been collected across the three years of running the module, and ethics approval has been provided by the Faculty of Engineering Ethics committee for all of these. Specifically, the following data collection activities have taken place:

- Videos from all seminars have been recorded, representing approximately 60 hours of video data across the three years. A focus here is on the behaviours exhibited by certain students as avatars within the virtual worlds.
- Surveys of students about their broad experiences of the module (2020 – completed by 28/49 students in cohort = 57% response rate), and specifically about their use of avatars (2021 – completed by 26/95 students = 27% response rate).
- One-to-one Interviews with students about their use of avatars, completed by nine students from the 2021 cohort.
- Avatar creation/reflection exercises conducted in 2022. Specifically, two exercises were conducted:
    - Initially, in an in-person session at the beginning of the semester, students were asked to create an avatar they believed would be appropriate for use in HE and to write 2-3 sentences on why they believed it would be suitable. This was completed by 115/122 students in the cohort (94% response rate)
    - Subsequently, at the end of the semester, students were asked to reflect on their experiences of being an avatar in the module, to indicate if they had changed their initial avatar and then to write 2-3 sentences as to why they had either kept or changed their preferred avatar. This was completed by 52/122 students (43% response rate).

Quantitative Results

In the 2020 running of the module (the first year in which students were exposed to a virtual world on this scale), students were asked a broad range of questions related to their experiences. Much of this work is reported already in Burnett, Kay and Harvey (2021) and Burnett, Harvey and Kay (2022), both of which highlighted the overwhelmingly positive

experience this group of students had to being immersed in a virtual world for their education.

Figure 2 highlights responses to two specific questions asked relating to being an avatar. They highlight how students felt that being an avatar allowed them to express themselves (86%-24/28 students at least somewhat agreed with statement), and that their avatar itself reflected aspects of their identity/personality (71%-20/28 students at least somewhat agreed with statement).

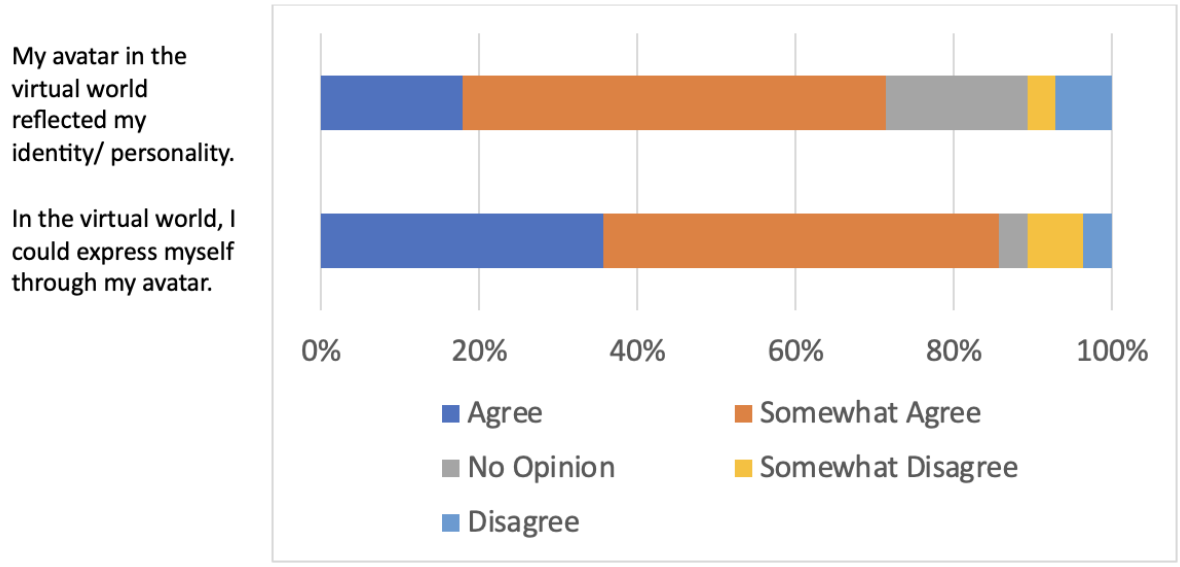

Figure 2 – Students Experiences with Avatars (2020 cohort)

Based on the 2021 survey data, Figure 3 shows the percentage of students who believed that a particular avatar category was their most used avatar throughout the semester, together with representative images for that avatar type. In a specific question for 2021, students were asked if they ever changed their avatar during the year. Eighteen of the 26 students who completed the survey indicated that they did (69%). Of these, the majority highlighted that they changed their avatar early in the semester, before then keeping the same representation. Moreover, students were also asked about how attached they felt to their preferred avatar. The great majority (22/26 students – 85% of sample) stated that they felt at least some degree of attachment to their avatar, with a significant number (12/26 students – 46% of sample) expressing fair/high levels of attachment.

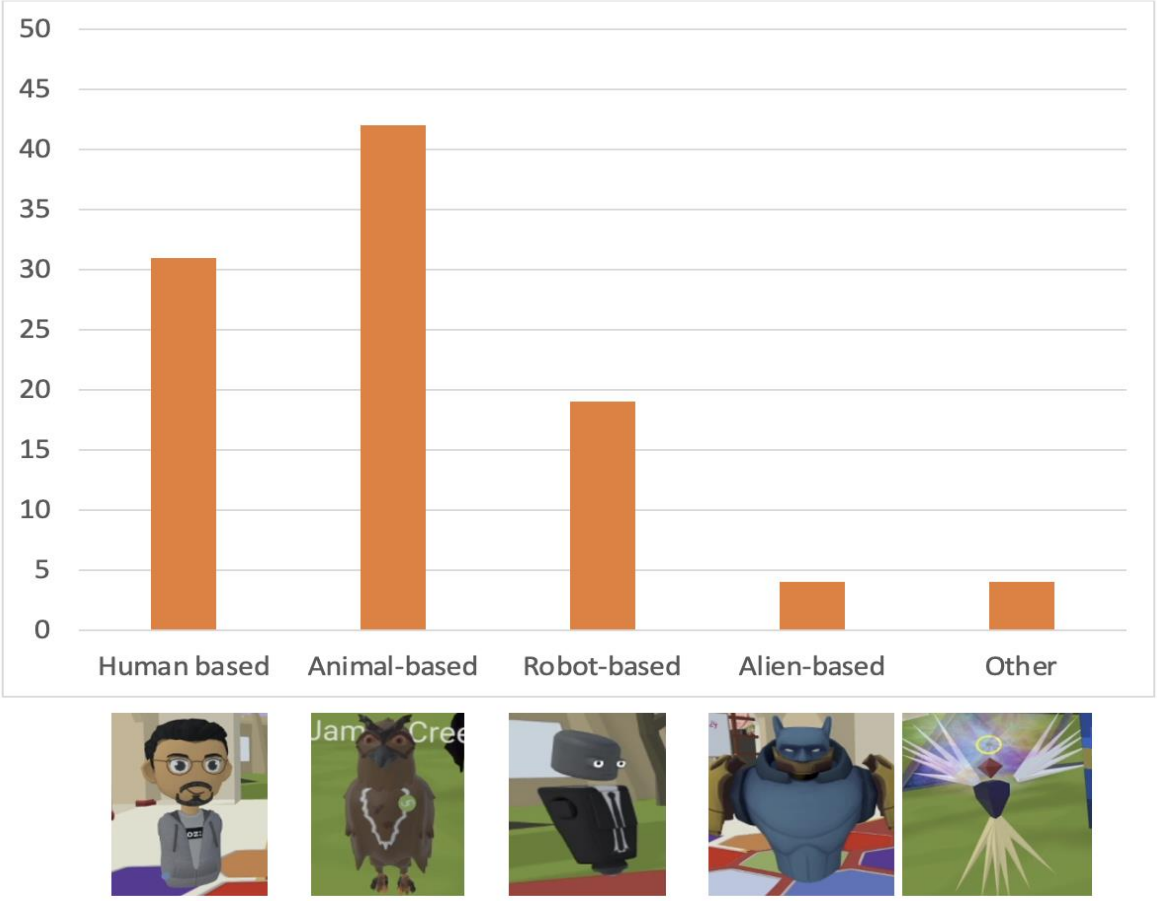

Figure 3 – 2021 Cohort of Students Reporting Categories of Avatar Use

Figure 4 shows the percentage of students who initially designed an avatar of a particular type according to the analysis of the 2022 avatar creation exercise. The graph also shows the percentage of students who, at the end of the semester, believed that a specific avatar category was their most used avatar throughout the teaching sessions. Examples of typical avatars for each category are also shown. Further analysis of this data indicated that 54% of those who completed the end of semester exercise reported a change in avatar from the original one.

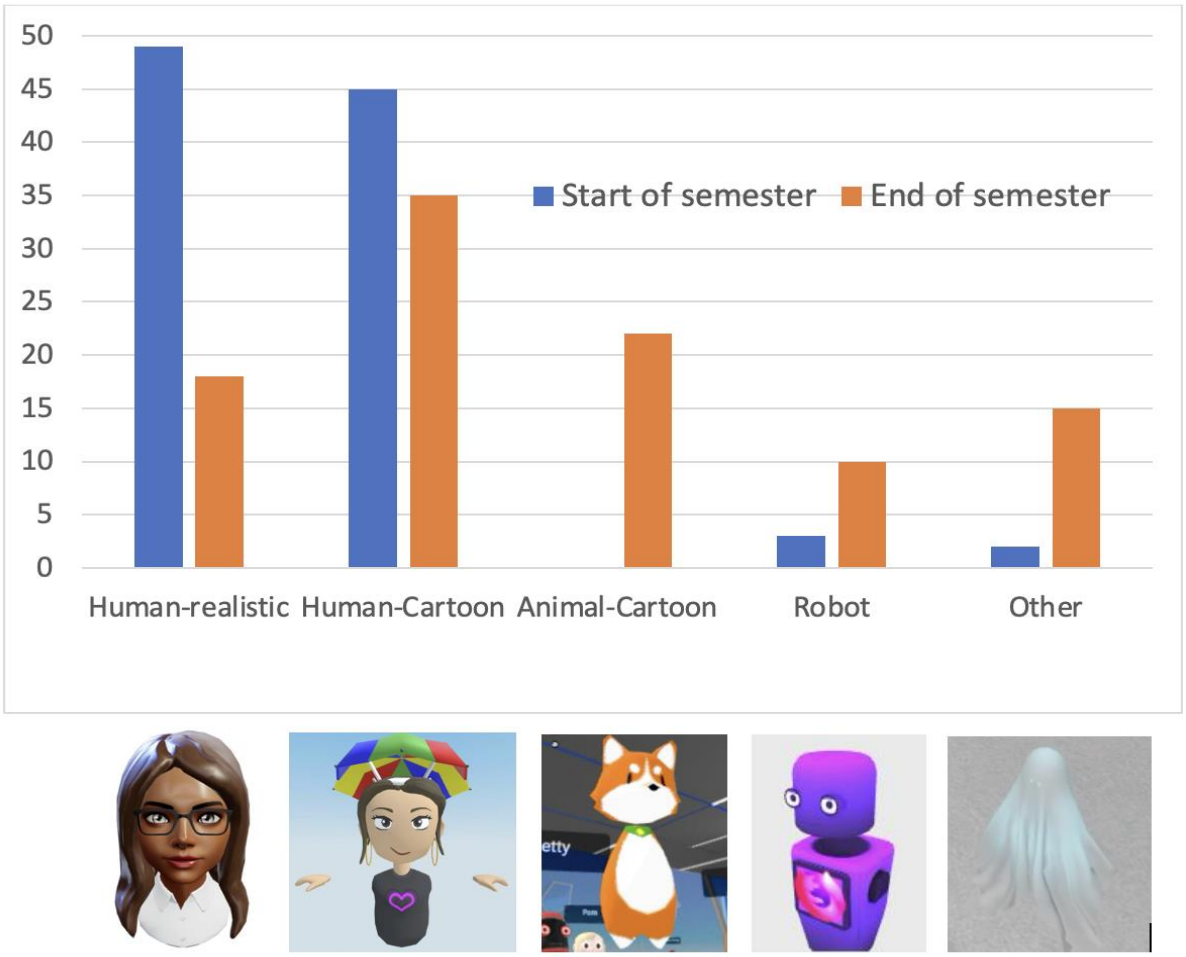

Figure 4 – 2022 Cohort of Students Reporting Use of Preference for Avatars at Beginning/End of Semester

In the 2021 survey, students were asked why they chose/designed their preferred avatar. Figure 4 shows the percentage of students responding on a 5-point Likert (strongly agree to strongly disagree) scale to specific statements –drawing upon previously used questions from Loewen et al. (2021), as well as sentiments from Nowak and Fox (2018) and Han et al. (2022). The graph shows that the two most common reasons why students chose/designed an avatar in a particular way were: to relate to their own values (likes/dislikes) – where 81% (21/26 students) at least agreed with the statement; or to be purposely different to other people's avatars - where 62% (16/26 students) at least agreed with the statement. For the other statements, there was a considerable mix of opinion, highlighting the diversity of avatars utilised and, accordingly, variations in the reasoning behind their choice/design.

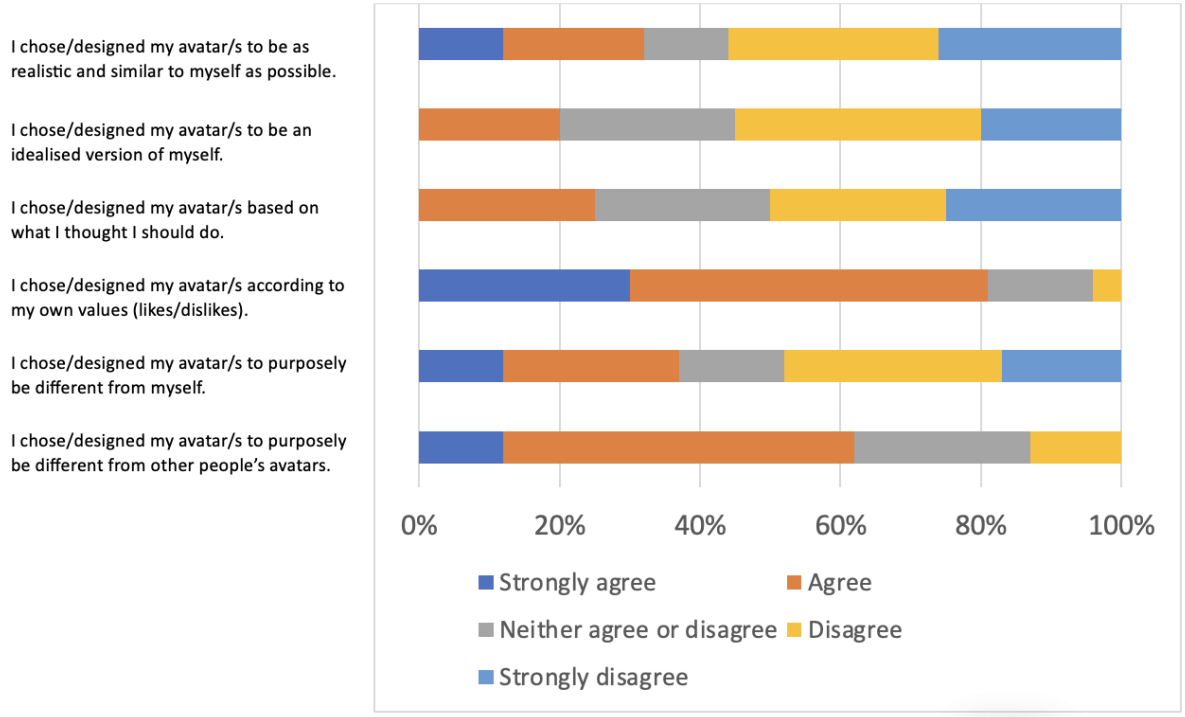

Figure 5 – Percentage responses to specific statements related to reasons for choosing/ designing an avatar (2021 cohort)

Qualitative Data Results

A thematic analysis (Braun and Clarke, 2006) was conducted by the authors utilizing the various qualitative data generated by the open-ended questionnaire responses (including the avatar design reflective exercise), the interviews and the behavioural observations. Specifically, raw data was initially transcribed and then coded, linking back to the original research questions – utilising the NVivo software. Following an iterative process of review and reflection conducted by both authors, four themes were apparent from this analysis: Design; Identity; Interaction; and Anonymity – as represented in Figure 6. These themes are discussed below, linking to the literature and supported by quotes from students (either from the surveys, responses to the reflective design exercise or interview transcripts). In addition, results from the quantitative data analysis are drawn upon to enhance understanding of the student experience. Figure 6 also highlights some potential interventions that could maximise the advantages and minimise disadvantages of students represented as avatars within their education. As such, it serves as an initial design framework for practitioners to consider the implications of an avatar-oriented approach to learning in this context.

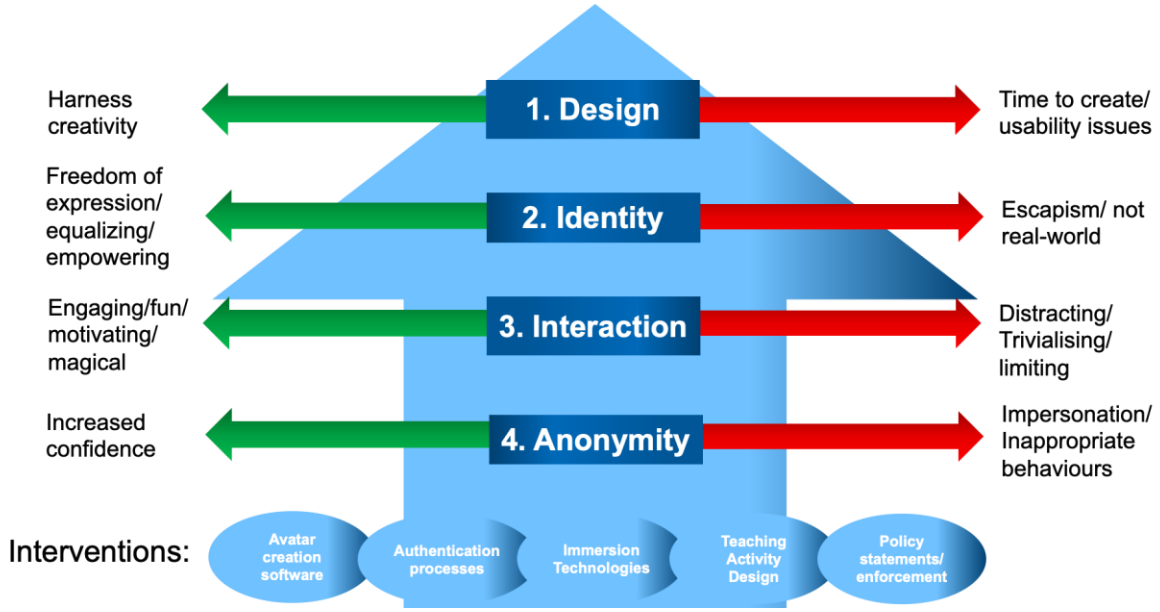

Figure 6 – Initial Design Framework for Interventions to Maximize Advantages of Avatars in Higher Education

Prior to joining a virtual world, users usually must design an avatar to represent themselves, or at least select one from available options. It was clear from the interviews conducted in 2021, as well as the reflective exercise from 2022, that some degree of creativity was involved for all students in this process. Students typically did not make a random choice for their avatar, and carefully considered a range of different factors when deciding which avatar to use in their class activities (see later discussion). Indeed, some students experienced a degree of anxiety during this act of creativity, as demonstrated by this quote from the 2021 survey, "[I was] worried that my choice of avatar would be offensive to others and create a bad impression".

During the design process, it was apparent that a range of usability challenges were encountered with current avatar creation software (also noted in prior work by Triberti et al., 2017), including the limitations in features available, as well as the difficulties in choosing and selecting specific elements for an avatar. In Mozilla Hubs, several students noted technical problems with uploading and storage of their preferred avatars, e.g., "logging into lectures on other devices logs me out of my account, and it can be challenging to recover the old custom avatar if I switched to a different one". Also, for some students, the basic time required to select a preferred avatar could be a barrier, ultimately influencing some of the avatars they used, "because time is usually very urgent before class, I usually choose one of the default Avatars when I log in the VR room".

In terms of the types of avatars utilised by students in the teaching sessions, it is apparent from the quantitative analysis that students varied considerably in their preferences in this context – i.e., there is considerable diversity on show with avatars, indeed, much more so than would be possible in the real-world. In the 2021 data based on a survey conducted at the end of the semester, the most common preference was for non-humanoid avatars (nearly 70% of all avatars were of this kind). In 2022 at the end of all the teaching sessions this figure was lower (47% of avatars were non-humanoid), most likely because students were more formally introduced to humanoid-focused avatar creation software at the beginning of semester.

Nevertheless, in 2022, the most common humanoid form of avatar was cartoon-based, providing significant caricature options (also noted as important by Jerald, 2015).

An interesting aspect of the data from both 2021 and 2022 was the changes made in avatars used in class. In both years, significant numbers (54-69%) of students adapted their avatar (apparent in the surveys but also clearly observable by the teachers and from the video-recordings). This highlights two key advantages of avatars: a) the ability to experiment with representation, and b) to do so in a highly fluid fashion according to context (also mentioned several times in the literature, e.g., Nowak and Fox, 2018). Indeed, from the video observations across the three years, there were many occasions when students temporarily changed their avatar, usually to relate to a variety of changes in context for: the virtual world (e.g., being a Jedi when taking part in a seminar within the Jedi Temple on Coruscant; the time of year (e.g., being a robot with a Christmas jumper for seminars conducted in December); or in social influence (e.g. several students spontaneously adopting the same avatar) - as shown in Figure 7.

Figure 7. Examples of Teaching Sessions with Students Temporarily Changing Avatars to Suit Aspects of Context in Virtual World (left), Time of Year (middle) and Social Influence (right).

Nevertheless, the in-depth interviews from 2021 highlighted the importance for some students in maintaining some element of consistency in their avatar throughout the teaching sessions. For instance, one interviewee remarked how they were very attached to their avatar because it was how they were recognised, citing one instance where the usual group of students they interacted with did not recognise them when they changed avatars one week. This thought was echoed by another interviewee from 2021, who said that “eventually people identified me by my avatar, and I did not want to confuse people”.

In the survey responses, the theme of identity representation was probably the most apparent when questioning students as to why they chose/designed a particular avatar for use in class. For the quantitative data from the 2021 survey, it was clear the primary motivation for a specific avatar was to reflect value-self (i.e., specific likes/dislikes), demonstrated by this quote from a student in the 2022 reflective exercise, e.g., “Since cats are one of my favourite pets and I love the animal-eared characters in Japanese anime, I chose a cat-eared headpiece and clothes with cat prints on them. Besides, I used to dye my hair pink, which I really like. The pink-blue colour scheme is one of my favourite colour combinations, so I gave her blue eyes”.

A further key aspect of self which was commonly mentioned as a reason for an avatar choice in the initial 2022 reflective exercise, was true-self, that is, the desire to replicate oneself in the virtual world (Loewen, Burris and Nacke, 2021). At the beginning of the semester, many students reported this as a primary motivator and linked this concept to its potential impact on how others might perceive them, e.g., “I designed my avatar in this way to try and represent

what I look like in real life. I wanted to make sure I looked approachable and professional so I can be taken seriously in the virtual classroom".

Nevertheless, an interesting outcome from repeating the avatar reflective exercise at the end of the semester was to consider how opinions changed – and in this respect, it was clear that whilst value-self continued to often be mentioned as important, students frequently discounted their original realistic avatar for several reasons, e.g., "my previous avatar was a little too much like a real person, kind of the uncanny Valley effect", "it was.. boring to use a human-like avatar in a simulated world".

Moreover, by the end of semester, a much broader range of reasons were given for their preferred avatar, demonstrating from a methodological perspective the importance of students using avatars over an extended period to fully understand/reflect on their personal significance (as considered by Han et al., 2022). For instance, several students noted the practical importance of being unique/different in the world (also rated as a significant motivator in the 2021 survey), for example, "… when many started using the astronaut avatar within the class, it was confusing. So, I preferred to change my avatar and decided to use lego batman". In addition, other students noted how positive reinforcement from fellow students and/or friends influenced their continued use of an avatar (e.g., "I kept this avatar because I loved the feedback all my friends gave on her").

Three other novel aspects of identity were apparent in the subjective data – which appear to have been somewhat neglected in prior research but are clearly important for some university students. Firstly, a few students expressed a deliberate desire to look unlike themselves, sometimes due to prior extreme negative experiences, e.g., "I have been harassed and made uncomfortable because of my appearance, especially my gender and race. If I can choose my appearance, I want it to be as unreflective of my real-world characteristics as possible". Secondly, some students stated that their preferred avatar represented an aspirational personality and not just an idealised appearance, e.g., "The reason I designed this avatar is that she is what I am working towards. She has her own ideas and is cool". Thirdly, on occasion students noted how the perceived identity of their chosen avatar itself affected their own prospective behaviours and/or emotions, e.g., "I think the animal shape of this fox makes me very lively, and secondly, his orange skin can make me feel happy".

Although the students themselves did not raise any problems relating to the freedom of identity expression afforded by using avatars in an educational context, some authors have voiced concerns. For instance, Oravec (2020) argues that the use of avatars in HE is potentially a form of escapism from societal injustices, where students might manipulate their on-line appearance in such a manner as to subsequently "increase the real-world invisibility of many disenfranchised individuals and decrease awareness of their life circumstances" (p.1). Oravec hypothesizes various motivations for such behaviours, such as to gain acceptance in a group, shield from bullying or to conform to stereotypes. Nevertheless, it is important to note that Oravec is predominately talking about the appearance of humanoid avatars and is not considering a broader range of possible representations.

As a final point related to identity, some students mentioned that they often were unsure what avatar they were currently inhabiting and were more aware of others' avatars, especially those used by the module convenor, e.g., "I could not see myself and my image of the avatar, but other people's avatar influenced me. I found [the teacher] easier to engage with when his avatar looked and resembled him, instead of his desktop robot avatar". From the videos, we

observed that this lack of awareness occasionally caused problems for an individual when they joined class with an inappropriate or unintended avatar, such as an overly large avatar. Others have noted this limited sense of self for first-person perspective avatars in virtual worlds (e.g., Lim and Reeves, 2006) – which can potentially be improved using third-person views, better avatar feedback provided in the software, or more naturally through the presence of mirrors within a virtual world (e.g., a 'dressing-up' area).

Students noted several times in interviews and open-ended questions across the three years that being an avatar empowered them to interact more freely with others and the space, and, on occasion, seemingly to have magical/super-human abilities (e.g., flying, moving through walls/objects, teleporting, re-sizing objects), that is, to have the agency noted in the literature as a key affordance of VR (Makransky and Peterson, 2021). The sense of fun in the world was apparent in the videos and is highly likely to have improved students' motivation and attention/engagement (as found in many previous studies, and noted in meta-reviews such as Hamilton et al., 2021).

Nevertheless, a negative potential implication of heightened engagement can be distraction from learning outcomes – and this was most evident in some of the observational data, where the choice of avatar occasionally led to distraction, either for the students or the teachers in the virtual world, as shown by the extremely large avatar adopted by a student in one session (see Figure 8). Distraction has been noted as a broader problem with VR in educational contexts (e.g., Soliman et al., 2021), although usually related to VR-induced sickness, rather than specifically avatar design.

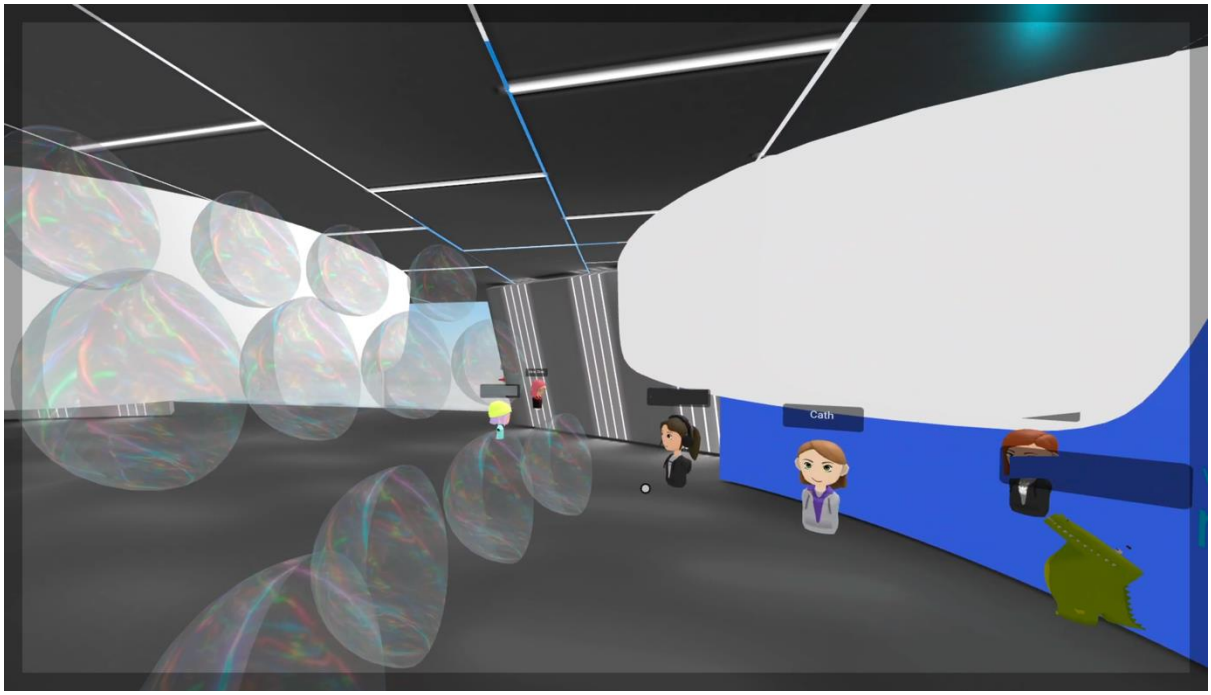

Figure 8 – Example of Distracting Avatar Used in Class

Some students in the 2021 interviews noted the lack of interaction cues evident within avatars (especially for those people using desktop/laptop computers) that impacted on communication, such as eye movements, hand/arm/body gestures, etc. Nevertheless, it was also apparent that an avatar in a virtual world afforded fundamentally new cues that, in some contexts could significantly enhance overall awareness, e.g., "it was easy to spot where

conversations were happening in the world with avatars from a distance by their bobbing heads".

A final theme that was evident in the interview, survey and observational data was anonymity. For some students, this was a familiar benefit related to on-line learning, e.g., "I didn't have to prepare myself to look presentable for class (i.e. in bed)". More noteworthy was the fact that many students openly remarked that being an avatar significantly changed their attitude to social learning – equipping them with greater confidence to engage with others. For example, from the 2020 survey, "Joining in as an avatar gives you a veil of anonymity that has made everyone less awkward about speaking up and sharing views in class", and the 2022 reflective exercise, "…having [this] avatar actually made me feel more comfortable and engaged in the sessions as I didn't feel as if I was going to be identified if I was caught not concentrating etc..".

Prior work has demonstrated similar confidence-related benefits of anonymity for on-line learners, especially for those with introvert personalities (e.g., Amichai-Hamburger, Wainapel and Fox, 2002), and/or special educational needs, such as autism (e.g., Putnam and Chong, 2008). More recently, some work has also demonstrated the importance of avatar-based representations for a broader range of neuro-diverse learners (e.g., McLauchlan and Farley, 2019). The current paper has extended this work highlighting how perceived anonymity in a virtual world can enhance the student experience across a whole cohort.

Nevertheless, it is important to note that anonymity was a complex, multi-faceted phenomenon in this HE context. Students clearly perceived they had anonymity, in appearance at least, as they were free to adopt avatars that bore no resemblance to themselves in the real-world (as many clearly did – see Figures 3 and 4). Yet, students' names were easily viewable (large labels floating above their heads) which significantly diminished objective anonymity, whilst incidentally enhancing student/teacher communication with the virtual world providing cues impossible (or at least impractical) in the real-world (Han et al., 2022).

As part of the initial process for creating an avatar, students were informed of the importance of using their real name during class, rather than a random name or a pseudonym. From observations of the videos, it was apparent that most students followed this guidance and only adopted different names, on occasion, due to technical problems. Moreover, there was no evidence that students used any form of voice modulation software.

Nevertheless, there was some evidence of students 'playfully' pushing the boundaries of what could be acceptable in this context, for example by impersonating teaching staff, as evident in this quote from the 2022 reflective exercise, "[teaching assistant] happened to drop his avatar in the world during one of the lessons and I thoroughly enjoyed pretending to be him for the week. Though, it was clear that I was not as good at answering questions and it was quite amusing when my classmates realised I was not [teaching assistant]".

In addition, there were numerous observed behaviours, most likely prompted by the sense of anonymity, that were arguably socially inappropriate. These varied from those which presumably were undertaken for educationally related goals (e.g., 'standing' very close to lecturer's slides) to those with potentially more sinister motives (e.g., pretending to grab the tail of a fox avatar). That said, we have no evidence (either in videos or the survey/interview data) that students negatively responded to these actions. More broadly, such observations

highlight an issue also raised by Han et al (2022) concerning emerging social norms in behaviour within virtual worlds - and the fundamental need to better understand (and develop guidelines for) where the limits in social behaviours of avatars should be for different contexts.

Conclusion

This research conducted over a three-year period for a semester-long module has revealed many issues concerning university students as avatars. Notably, we have found that students naturally desire a wide range of avatar options for use in their learning experiences, including a diversity of non-human avatars. Such avatars largely reflect highly individual needs for identity expression (particularly related to personal values) and strong motivations amongst some for anonymity when learning. Taken as a whole, such findings highlight the importance of not forcing an avatar type on university students. Students in HE clearly value the opportunity to express themselves in a wide range of ways through the medium of an avatar.

Similar to the conclusions of several meta-reviews (based on many individual studies) concerning VR in HE, we have also established that the student experience from being an avatar can be extremely positive – providing greater confidence for learners and engagement in teaching activities, through freedom of movement, harnessing of creativity, magical capabilities, and so on. Nevertheless, there are numerous disadvantages evident in our observations and survey/interview data, such as distraction from specific avatars and potentially inappropriate behaviors. The initial framework (Figure 6) outlines four key themes in this area and is intended to aid educators, as they consider how to maximise the advantages to their students being avatars in virtual worlds, whilst minimizing disadvantages. Specifically, the framework includes a range of interventions that different stakeholders (including social VR platform developers, as well as teachers and policy makers) could consider when planning to use and/or develop VR for use as an integral part of the university student experience.

Limitations of our work include the fact that we have only investigated issues for students within two disciplines (Engineering and Computing) in a UK university setting. Future work should consider the attitudes and behaviours of a wider range of students, examining specific individual differences (such as study discipline, as well as the impact of a students' cultural background or special educational needs). In addition, although our students varied in their use of devices for accessing the virtual world, we have not directly investigated the role of immersion on avatar use. Finally, it is worth noting that our research was limited by the range/style of avatars possible within Mozilla Hubs. Although many avatars could be chosen/designed for use in the teaching sessions, full-bodied avatars were not supported. Related to this, it will be valuable to investigate the potential for enhanced interactivity cues within future avatars, either natural (e.g., to facilitate eye contact) or magical (e.g., an avatar that reflects a user's current emotional state) to enhance communication and student experience.

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