Anticipating the Manipulative Risks of Advertising in Virtual Reality

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Information)
in The University of Michigan
2023

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ACKNOWLEDGEMENTS

This work would not have been possible without the help of many people. There are literally too many people to thank and list out individually, and that (combined with a fear of accidentally leaving someone out) prevents me from writing everyone down. But I shall do my best.

First, I would like to thank the Graduate Employees Organization (GEO) and all those who have volunteered their time for the organization. Their work and advocacy for graduate students created the necessary employment conditions for me to pursue a PhD. Without their work fighting to obtain benefits for graduate students, it is likely I would not have been able to complete this thesis.

I would like to thank those who have mentored me on the way. First and foremost, my advisor, Florian Schaub, for taking a chance on me and providing valuable mentorship. The wonderful members of my committee: Naz Andalibi, Michael Nebeling, Shobita Parthasarathy, and Franzi Roesner, whose valuable feedback and advice greatly strengthened and improved the thesis. I thank all my teachers for their mentorship and guidance, who are too many to name here and for whom not enough words could be said to express my gratitude. But I want to give a shoutout for Charlie Curtsinger, who first introduced me to research; Jen Paulhus, whose confidence in me taught me to believe in myself and pursue a career in research; and Silvia Lindtner, who taught me about the relationship between technology, capitalism, and neoliberalism, and who has heavily influenced my political outlook on life.

My collaborators who helped me in this thesis (Selin Fidan, Gina Herakovic, and

Shwetha Rajaram), and all other collaborators I have had for both research and non-research related projects—you all helped projects succeed and soar beyond what I could have done alone.

A big thanks goes to UMSI staff, whose work has been invaluable in allowing me to carry out my research.

I would also not have been able to survive the PhD program without the support and friendship of a huge number of peers. I would like to thank the members of SPILab, the 2017 UMSI cohort, friends from UMSI, Ann Arbor, Grinnell, Bochum, and Gran Canaria for your friendship, solidarity, and banters. Keep on being amazing!

I would also like to thank my family for their invaluable support, encouragement, and advice throughout this journey.

And a final thank you goes to Yixin Zou, my partner in crime without whom I would not have made it through the PhD. Your love and support got me through some of the most difficult times in the PhD program, and your spirit, kindness, and fun provided some of the best moments in the PhD program. For this I will be eternally grateful.

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ABSTRACT

As Virtual Reality (VR) technologies become increasingly popular, so too will VR advertising—advertising that takes place in a VR medium. The defining features of VR devices, such as the immersiveness of VR and the ability of VR devices to recreate and replace reality, could be exploited to create manipulative VR advertisements that trick and deceive VR users. Even though VR advertisements are not yet mainstream, to understand and mitigate these risks it is imperative to study them now, rather than wait until VR advertising (and harms within them) are established and mainstream, and so difficult to address.

In this thesis, I studied the risks that VR advertising poses. I focus on one specific risk, that of manipulation, and answer two research questions: (1) *What are the manipulative risks that VR advertisements pose?* and (2) *What are VR users' attitudes and concerns regarding VR advertisements?* This thesis presents three studies that address these questions. In the first study, I used scenario construction to understand what are the key features of VR advertising and uncover key ways through which VR advertising can be manipulative. I highlight that VR advertisements will have increased immersiveness and increased realism; they will allow VR users to interact and preview products before buying them; and they will likely be hyperpersonalized and customized towards individual VR users. I subsequently discuss how these techniques can be used to manipulate VR users through the usage of misleading experience marketing, appeals to emotion, and targeting consumer vulnerabilities through hyperpersonalization. In the second study, I examined existing VR advertisements through walkthroughs to understand manipulative risks present in existing VR adver-

tisements. I confirm the use of gamification and product previews in VR, and uncover three additional manipulative risks: the use of distressing events to advertise product (shockvertising); how VR advertising can allow users to embody of characters with certain traits; and a lack of appropriate exit options for VR. I also discover new risks, such as the risk for physical and emotional harms, and inconsistencies regarding how VR advertisements disclose their data practices.

In the final study, I interviewed VR users (n=22) to understand VR user concerns regarding VR advertising. I find that the largest concern is with forced, unskippable VR advertisements and how in-app VR advertisements can interrupt the user experience and ruin the immersiveness of VR experiences. With regard to manipulation, participants were worried about how VR advertising might manipulate vulnerable populations (such as children or compulsive shoppers). However, many of our participants did not consider manipulation a concern or a serious risk. This was mediated by resignation towards manipulative advertising and an illusion of invulnerability.

Through this work, I contribute a list of manipulative risks that VR advertisements present and contextualize these risks with how VR users perceive them. This in turn provides key insights to improve the VR advertising space and create VR ads that are non-manipulative and best align with VR users' needs and wants.

CHAPTER I

Introduction

Virtual Reality (VR) technologies, and in particular VR headsets (such as the Vive Pro or the Meta Quest 2) are becoming increasingly mainstream. It has been predicted that VR devices will one day become ubiquitous and widely used [192]. For context about the growth of VR, the global VR market size was valued at $10.3 billion in 2019, and is predicted to reach $62.1 billion in 2027 [105].

With the proliferation of VR technologies comes the expectation that there will also be a proliferation of VR advertisements—advertisements that take place in a VR medium. Currently, the VR advertising market is small compared to more traditional advertising markets, such as TV or online advertising [33, 234]. There are signs, however, that this market will grow, with many companies exploring and developing VR advertisements and respective technology [116, 139, 256]. Promised features of VR technologies, such as increased immersiveness, the ability to render virtual worlds and virtual graphics in front of users, and the sensing capabilities of VR devices, could create new and exciting ways to market products to VR users [227, 269].

However, these same characteristics could result in VR advertising posing unprecedented risks to VR users. New forms of VR advertising could pave the way for new types of *manipulative advertising* — tricking VR users into buying products they do not want or need, potentially convincing VR users to buy products that are

detrimental to their health and well-being. There is a history of advertisers employing manipulative techniques in advertisements to promote their products. Marketers have been known to alter images to make products seem better than they are [63]; modify an advertisement's language to leverage consumer's emotional sensibilities [254]; and even make exaggerated or outright false claims [171]. Manipulative advertising is a concern given that marketers may give misleading impressions about their products, leading to VR users purchasing products that they do not intend or want to buy. The harms from this range from financial losses to physical and mental harms, and possibly even deadly harms—for example, deceptive marketing by pharmaceutical companies has been linked to the US opioid epidemic, which has killed countless lives [7].

The risks that manipulative advertising brings, alongside the imminent arrival of VR technologies, beg the question: what will manipulation look like in a VR world? The increased immersiveness and interactivity of VR environments could be used to make dangerous products seem playful and fun. Realistic three-dimensional experiences in VR could mislead VR users as to what a product is actually like. The numerous sensors and data collection capabilities of VR devices present new and dangerous privacy risks for VR users, which may be leveraged for advertising; advertisers could know sensitive information about VR users that renders them susceptible to certain advertisements, such as inferring consumer's emotional state to gauge when they are emotionally vulnerable. All of these could pose great risks to users.

Studying how VR advertising can be manipulative is necessary for mitigating the risks and influence the design of VR technologies to create non-manipulative advertisements. However, studying VR advertising is complicated by the future oriented nature of the technology. Whilst VR technologies and VR advertisements do exist, they are not yet mainstream. This presents two unique challenges. The first is how to evaluate risks that are to come and not yet present. While this is a challenging problem, researchers have developed creative solutions for studying the harms of emerging

technologies, including the use of speculative design [17], design fiction [23], and various types of impact assessments [102, 277]. There is a rich history of researchers applying these methods to studying the potential risks and impacts of emerging technologies [70, 250], showing that it is possible to study emerging technologies and the harms they bring. The second challenge is a top-level concern, and that is to ask: should VR advertising even be studied? Since VR advertising is not yet mainstream, some may argue it is a phenomenon not worth studying, since the technology is not harming anyone right now. However, I argue it is *because* these technologies are not yet mainstream that it is the perfect time to study them. Now is the ideal time to address the harms of VR manipulative advertising, before VR technologies and VR advertising become entrenched and unchangeable. Now there is a window of time within which we can effect change and influence VR advertising development for the better [57]. As such, it is not only possible, but important, to study the harms that advertising VR poses, in spite of the futuristic nature of the technology.

To that end, I conducted a thesis that explored the manipulative risks and harms of VR advertisements. Specifically, I make the following **thesis statement:** VR advertisements can pose severe risks to VR users; despite the future-oriented nature of these technologies, it is still possible (through a variety of methods) to study these harms, and make meaningful insights into what these harms are likely to be, in order to ideate solutions to influence VR advertising design for the better.

More concretely, my thesis answers the following research question:

RQ1: What are the manipulative risks that VR advertisements pose?

To answer RQ1, I carried out two studies examining VR advertisements and the risks they pose. Chapter III, titled "Identifying Manipulative Advertising Techniques in Extended Reality (XR) Through Scenario Construction" presents a study anticipating the risks of manipulative advertising in extended reality (XR) contexts. Using scenario construction, I created scenarios depicting how XR technologies (of which

VR are a subset) can be leveraged to create manipulative advertisements; from here, I synthesize key mechanisms through which VR advertisements can be manipulative. Chapter IV, titled "Manipulation in VR Marketing: An Analysis of Virtual Reality Marketing Experiences" presents a study that examined existing examples of VR advertisements to better understand the current VR advertising landscape and manipulative techniques that are used within them through a walkthrough of 87 VR advertisements. These contrasting approaches (a speculative approach that is future oriented and an examination of existing VR ads grounded in the present) complement each other well to provide deep insights as to the anticipated and current risks of VR advertisements. Overall, the chapters demonstrate that there are numerous manipulative techniques that VR ads can employ, including the use of immersiveness, interactivity, and gamification; how companies could leverage user data to hyperpersonalize VR advertisements towards users; the use of emotions, most concerning of which is the use of distress; and the potential for misleading experience marketing that deceives users as to the quality and nature of products being sold.

Alongside understanding the risks and harms of VR advertisements, I seek to understand user concerns with regards to VR advertising. Part of the motivation behind this thesis is an acknowledgement that manipulative VR advertising can pose risks to VR users, and consequently, we must advance knowledge to mitigate these risks. Since VR users will be the ones most impacted by manipulative advertising, their voices are essential to mitigating the harms of VR advertising; the aspects that are most concerning to them are the ones that warrant the most attention and priority. To that end, my thesis also answers the following research question:

RQ2: What are VR users' attitudes and concerns regarding VR advertisements?

Chapter V, titled "Understanding VR Users' Attitudes Towards VR Advertisements", presents an interview study with VR users to answer this question. I inter-

viewed 22 VR users using semi-structured, in-depth interviews to understand how VR users view VR advertising, what their main concerns are regarding VR advertising, and get their thoughts on the manipulative risks identified in the prior studies. Overall, I find that participants are most concerned about VR advertisements interrupting the user experience and ruining the immersion VR has to offer, and VR ads collecting sensitive data about users. With regards to manipulation, I find that participants were often resigned to the presence of manipulative advertisements, and tended to believe they would not be affected by manipulative advertising practices.

In summary, my thesis makes the following contributions. First, I provide an overview of anticipated and current VR advertising risks and challenges. Second, I contextualize these risks by discussing how users perceive them. By identifying these risks, I chart a pathway for researchers, VR designers, and legislators who want to create VR ads that are non-manipulative and best align with VR user's needs and wants, since I highlight risks that are likely to occur and what areas should be prioritized in terms of study and intervention.

CHAPTER II

Background

In this section, I first provide background information on advertising, defining what advertising is, its history, and the interplay between manipulation and advertising. I then delve into VR advertising to discuss the current state of the field, and what is known about the harms of VR advertising. From here I discuss the key takeaways and how my thesis contributes to the literature. Lastly, I conclude the background section by discussing methods that are used to analyze the harms of emerging technologies, such as design fiction and technology impact assessments.[1]

2.1 Advertising

2.1.1 What is advertising?

Advertising is a concept that is difficult to pin down to an exact definition. In its most basic form it means to inform and/or make known [186]. Oftentimes the term is used in a commercial context, describing practices through which businesses make their products known to consumers with the purpose of increasing sales of that product, good, or service (e.g., see Nicosia [186], Defleur and Dennis [69])—a meaning

[1]Parts of this background chapter are extended versions of sections that appear in the following published paper: Abraham Hani Mhaidli and Florian Schaub. Identifying Manipulative Advertising Techniques in XR Through Scenario Construction. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems, CHI '21, pages 1–18, New York, NY, USA, May 2021. Association for Computing Machinery.

that has remained relatively consistent over time (e.g., see Richards [207]). For example, Defleur and Dennis define advertising as "*a form of controlled communication that attempts to persuade consumers, through the use of a variety of strategies and appeals, to buy or use a particular product or service*" [69]. Other views of advertising focus more on the spreading of information, such as as political messaging to propagate a desired version of reality [285, 288] or public service announcements that try to inform about a health issue or encourage an action (e.g., preventing drunk driving).

Borrowing heavily from the definitions these scholars have used, I define advertising in the following way: "*Advertising is any message aimed at spreading information to consumers, usually with the purpose of increasing the sale of their product, good, or service (such as by improving the brands image and reputation), persuading consumers to purchase their product, encouraging a certain action or behavior by the consumer, or promoting a certain world view.*"

Some scholars try to differentiate advertising from other related terms including marketing, public relations, or promotional content [207]. I purposefully leave my definition broad, since these terms refer to the same overarching concept—using messaging to increase sale of a good, product, or service. I do not wish to argue the nuances of where the boundary is between advertising and public relations, and would rather talk about them all together under the definition of advertising. Particularly for this thesis, where the focus is on what advertising may look like in the future, it is important to leave this definition broad to encompass all possible ways advertising can look like in VR.

2.1.2 A brief history of advertising

The definition I am using for advertising is purposefully broad. Depending on how broad one wants to interpret this definition, one can trace the history of advertising several hundred or even thousands of years back, encompassing activities such as

kings who would inscribe their name into the bricks of the buildings they had built or Babylonian merchants who employed people to shout wares to passersby [201]. Most scholars agree that what we might recognize as 'modern' advertising originates to the middle of the 19th century, a period of increasing industrialization, availability of consumer goods, and the rise of newspapers as a form of mass communication [253]. This led to rapid developments in advertising techniques that closely resemble modern-day advertising practices. Examples of such techniques included businesses offering prizes for consumers if they had purchased a product a specified number of times (similar to modern-day rewards points) [188]; the inclusion of collectible cards in cigarette packets and encouraging consumers to collect them all [188]; the proliferation of billboard advertisements [188]; the creation of slogans [188]; the rise of branding (before branding, consumers bought generic products as opposed to a certain brand; e.g., rice instead of 'Uncle Bens' rice) [188]; celebrity endorsement of products [135]; and increasingly sophisticated print advertising techniques (for examples, newspapers initiating classified ads sections) [188].

Once advertising was fully established, it quickly appropriated new communication technologies as they developed in order to reach wider audiences. The reason for this is simple; mass communication technologies allow for the "*simultaneous delivery of identical messages through mechanisms of high speed reproduction and distribution to relatively large [...] numbers of people*" [117]. This makes it ideal for advertising, since businesses desired to reach large numbers of people and for their message to be delivered reliably and with high fidelity—all of which mass communication technologies offer [230]. Additionally, there are incentives for owners of mass communication technologies to allow advertising on their platforms. Owners of mass communication technologies can charge fees to advertisers that subsidize the cost of their operations, allowing them to lower the price of entry and make their communication technology more widely accessible and more widely adopted [215, 230]. Thus, radio was

populated with advertising soon after it meet these requirements (circa 1928) [230], followed by television, the internet, and smartphones [147]. It is interesting to note the ways they affected each other; as advertising populated a communication medium, it changed the content on that communication medium [147]. And in turn, these communication mediums influenced advertising techniques and practices [147]. For example, ads influenced television by having sway over what content was shown on TV and controlling the time slots and segments for different programs to allow for advertisements [147]; in turn, television allowed ads to be in video format. In short, advertising and mainstream communication technologies form a symbiotic relationship that mutually benefit each other and which influence each other in interesting ways.

2.1.3 Manipulation in advertising

Before studying manipulation in VR advertising, one first has to ask: what constitutes manipulation, especially in the context of advertising? If a business uses an ad to convince you to buy a product, were you manipulated into buying it, or were you persuaded into doing so? Is there anything wrong with a company convincing a consumer to purchase a product?

Scholars have answered this question by separating persuasion from manipulation [24], with the former being considered an acceptable practice and the latter a morally objectionable one [226]. Persuasion occurs when an advertiser presents their message (i.e., an advertisement) to the consumer, and the consumer rationally debates and evaluates the message, coming to a conclusion on whether to purchase the product or not. Manipulation occurs when advertisers use techniques and methods to make consumers do something involuntarily or something that goes against their best interests by deliberately sabotaging a consumer's ability to evaluate an advertisement's message and make an informed decision on whether to purchase a product

or not [226].

Elaborating on the question of manipulation and persuasion, Danciu notes that a single advertisement can have some features that are informative, some features that are persuasive, and some features that are manipulative [63]. Informative features are any factual features of the product (e.g., the name of the product or its price). Persuasive features are rational, logical arguments as to why the consumer should buy the product (e.g., this medicine will alleviate headaches, and so by buying this medicine you will have fewer headaches and a greater quality of life) [63].

By contrast, manipulative features are those that encourage consumers to buy a product in ways that sabotage a consumer's ability to make an informed choice [63]. There are many types of manipulative advertising features [199]. These include: lying and obfuscating the truth (which sabotages the possibility of an informed choice) [63]; fallacious arguments (arguments that have erroneous reasoning and logic) [63]; the use of emotive persuasion (appealing to a consumers' emotions, such as by falsely promising extremely high levels of satisfaction or evoking high levels of fear, in ways that bias consumers' thought processes and override informed decision-making) [63]; and associative advertising (falsely associating desirable traits with products, such as claiming that by smoking tobacco one will be 'cool') [199]. These manipulative features can be accomplished through the use of language, the message content, or by carefully altering visual images that are shown to consumers (e.g., by enhancing images) [63].

Scholars have created taxonomies of manipulative techniques advertisers employ [14, 63]. Armstrong [14] describes general persuasive techniques in advertising in his book; however, some techniques he describes could be classified as manipulation, such as associating products with things that are favorable, inducing emotions such as guilt or fear in consumers, or the use of distraction [14]. In a similar vein, other work has examined the use of dark patterns, i.e, techniques companies use to encourage

behaviors users otherwise might not engage in [39, 107, 162], and nudging, i.e., the alteration of small details, such as the order in which products are displayed or determining which option is the 'default' choice, that significantly impact consumers' behavior [242, 272]. Other work has surveyed and analyzed ads in order to identify the prevalent manipulative advertising techniques [4, 180, 213, 285, 288], finding that manipulative techniques are prevalent in various advertisements and websites.

Manipulative advertising is particularly concerning given the dangers that may stem from it; namely, that consumers buy products that they do not intend or want to buy. This can mean consumers waste money purchasing products they do not need or want. More worryingly, consumers may buy products that cause them physical or mental harm, such as by purchasing dangerous substances (alcohol, tobacco, fast foods), or engaging in behaviors that may disrupt their lives (e.g., cheating on their spouses by taking part in services that promote infidelity, such as dating service Ashley Madison [16]).

This harm could be particularly problematic when the individuals being manipulated are part of vulnerable populations [37]. An advertisement that may not be manipulative to most people may be manipulative to a certain subset of the population; these vulnerable populations may be more susceptible to the manipulative effects of these sorts of ads and the harms of manipulative advertising on these populations may be magnified. One such vulnerable population are children. Children are a population that often is deemed unable to give legal consent (e.g., in the US, children under the age of thirteen cannot legally consent to online websites collecting their information, and must have an adult guardian give consent for them [257])—thus, although an ad may not deliberately have manipulative features, is it fair to assume that children can engage in the deliberation and careful consideration of messages that distinguishes persuasion from manipulation [18]? Other populations that could be vulnerable to certain types of advertising are consumers who are addicted to a cer-

tain product and who then see ads for that product (e.g., compulsive gamblers seeing ads for gambling), compulsive shoppers, and people of low socioeconomic status (for whom the financial waste of buying unneeded products has greater impact).

One final note regarding manipulative advertising is that the development of modern advertising was closely followed by the developments of consumer movements and backlash against advertising. For example, in 1905 a series of articles titled *"The Great American Fraud"* was published lamenting advertising fraud and echoing consumer discontent. The Federal Trade Commission was established in 1914 to protect consumers from unfair business practices (including deceptive advertising) [188]. This shows the extent to which deception and advertising have been, and are, dangerously intertwined.

2.2 Advertising in VR technologies

I first provide a brief overview of VR technologies, followed by a discussion on what we know about advertising in VR. I then pivot towards talking about the risks and harms of VR advertising, and finish by focusing on what we know about manipulation in VR advertising.

2.2.1 VR technologies

Virtual Reality (VR) refers to technologies that attempt to block out or hide reality and replace it with a virtually generated world, such as through digital graphics [164]. The most widely-used consumer VR device is the VR headset; a head-worn apparatus that immerses the user in a three-dimensional experience by covering the user's eyes and displaying a 3D environment instead [244]. Although VR technologies have been theorized and talked about since the 1960s [36], it is only recently that VR technologies have become commercially available, mostly through consumer-available head mounted displays like the Meta Quest or the HTC Vive. Common use cases

for VR include gaming [239], social networking [151], fitness and exercise [114], and entertainment such as movies and documentaries [51, 114].

The level of immersion and interactivity can differ among different headsets and 3D environment shown [274]. Some VR applications allow the user to interact with the virtual environment: for example, by rotating their head, users can change what they see (similar to turning ones head in the real world), given that the headsets offer 360-degree vision [274]. Some VR headsets come with sensors that can track the position of the user, and so if the user walks around a room, this movement is replicated in the VR world—this gives the illusion that the user is walking in the virtual environment [75]. Many VR headsets allow user input through hand-held controllers; some advanced models even allow for precise hand and finger tracking [258].

As VR devices evolve, it is likely that they will be able to create virtual worlds that are increasingly realistic and indistinguishable from reality. Ways of achieving this include having greater graphical fidelity that show realistic graphics [280]; more accurate body tracking of users that allow a greater degree of inputs and that allow the world to respond realistically to what the user is doing [169]; and greater emulation of senses—current VR devices are often limited to rendering virtual audio and graphics, but as VR devices evolve they could virtually create other senses such as haptic or olfactory senses [29]. More than technical innovations, the way we use VR is expected to change. Whereas current VR technologies are often niche devices, it is expected that one day VR devices will be used in a variety of different contexts, becoming mainstream, ubiquitous, and a crucial part of everyday life [138, 192, 274].

2.2.2 Advertising in VR

VR advertising is advertising that takes place in a VR medium (not to be confused with advertisements that promote VR technologies). VR advertising is still in very early stages, but it is soon expected to grow [156]. There are two reasons behind this

predicted growth. First, it will come as a consequence of VR technologies becoming mainstream: as discussed above, mainstream technologies often adopt advertising given the mutual benefits each one gives the other (greater reach for advertisers; subsidized costs for technology creators). Second, there is an excitement among marketers about the affordances that VR can offer. Scholarly work that has examined VR advertising has highlighted numerous benefits that distinguishes VR advertising from non-VR advertising, such as increased immersion and interactivity [202], as well as the ability to digitally recreate products with relatively high fidelity [227].

One key question that has concerned scholars is whether VR advertising is more effective than non-VR advertising in promoting products. Here the results are mixed, with some papers suggesting VR ads are more effective [228, 269] and others that they are not. For example, Leung at al., [149] find that VR ads were more effective in the short term than traditional video ads, but suffered significant decreases in purchase intention over time. Berki [26] found that two-dimensional banner ads performed better when placed in a virtual, 3D world compared to being displayed on a traditional computer screen. Wedel et al. [269] highlight that whether VR ads are more effective than non-VR ads remains an open question that needs to be tackled by the research community.

2.2.3 Risks and harms of VR advertising

To understand the risks and harms of VR advertising, we must first understand the harms of VR technologies more broadly. Scholars have identified a range of user harms in VR technologies. One is that of physical harms, such as nausea or motion sickness caused by headsets [1, 133, 219] or epileptic seizures caused by VR graphics [1]. Another is that of mental harms, such as addiction to alternative realities that are 'better' than actual reality [189, 232]; distress caused by VR experiences that are upsetting and that users may think are real [31]; how VR experiences allows users

to recreate anti-social behaviors (such as violence or murder) in a realistic, immersive virtual environment and the psychological harms this may cause; as well as how the enactment of these behaviors could change how users perceive these behaviors and how likely they are to engage in them (e.g., could committing murder in an VR experience affect one's likelihood of committing murder in real life?) [1, 38].

One risk that has received particular attention are the privacy risks that VR technologies pose [66]. VR devices have vast data collection capabilities, since they can capture information about a user's surroundings such as the layout of the room the user is in [66]; gestures, movements, and activities by the user wearing the VR device [66]; physiological data such as a user's gaze, facial expressions [19], or eyeball movement [66]; and even the data of bystanders [68]. Scholars have investigated not only what the data collection capabilities of these devices are, but also what can be inferred from this data and potential consequences. Miller et al. find that five minutes of body motion data is enough to identify individual VR users [177]. Vivek et al. find that adversarial VR experiences can trick users into revealing sensitive data—for example, by standing in certain poses to get more accurate physiological data [185]. VR activity could be used to identify medical conditions such as autism [129] or dementia [240]. O'Brolchain et al., in studying social networking sites in virtual reality, hypothesized that the collection of sensitive information could be used to discriminate against certain users [189].

Risks of VR advertising understudied: Although VR advertising has sometimes been mentioned in the literature, the risks and harms of VR advertising have so far not been explored in depth. If scholars mention the harms of VR advertising, it is often described as an extension of another harm. For example, O'Brolchain et al. [189] briefly mention VR advertising, but only as one of the harms within the context of VR social networking sites. Similarly, Adams et al. [1] talk about adver-

tising, but only in one subsection in their broader consideration of VR privacy risks. Specifically, Adams et al. note that one of the privacy risks of VR is that data could be leaked to, among other entities, advertisers, which may in turn affect VR advertising. In papers focused on VR advertising techniques, harms are rarely mentioned; and when they are mentioned, it has often come as a subpoint in a discussion section or a concluding thought to the paper without properly engaging with those harms. For example, Barnes et al., in studying the consumer experiences of VR advertising, briefly discuss problems and consumer harms of VR, but only discuss motion sickness [22]. Similarly, Lombard and Snyder-Duch, in studying interactive advertising, mention the ethical dilemmas of immersive advertising and how it *"gives new meaning to the term 'deceptive advertising'"* but do not unpack it further [159].

2.2.4 Manipulation in VR advertising

With regard to manipulation in VR, there has been very little work studying how VR advertising can be manipulative. The closest work that directly studies manipulation in VR advertising is that of Brittan Heller, who coined the term biometric psychography to describe how, through the collection of behavioral and physiological data, a VR advertisement can learn about VR users' psychological states (e.g., likes and dislikes) [118]; advertisers could use this information to make manipulative advertisements, e.g., by learning about and targeting emotional vulnerabilities of VR users [119]. Another technique that has been hypothesized about is the implantation of false memories through VR, whereby marketers create VR experiences that implant false memories in VR users, possibly changing their attitudes towards a product [5, 35]. For example, a VR service that allows users to relive memories by digitally reconstructing them in VR, but in those digitally recreated memories, brands are reinserted into the recreation (e.g., placing a particular brand of wine put in a digital recreation of a wedding, making the VR users think that they actually

drank that particular wine at their wedding) [35]. Manipulation can occur via embodiment. Through VR, users can embody avatars with certain traits or avatars who engage in certain behaviors, such as embodying avatars who are older than the user, or embody avatars who engage in exercise and are physically fit. Numerous studies have shown that such embodiment can impact a user's behavior, e.g., by recreating in real life traits that the avatar displayed [5, 94]. This could be used by marketers to cause certain behaviors in VR users. I note that this work is theoretical in nature, discussing what could occur in VR advertising (as opposed to directly observing it occurring in existing VR applications).

Thus, although there has been research on ethical issues and harms of VR technologies and a few mentions of the harms of VR advertising, the issues of manipulation with VR advertising have not been explored more deeply.

2.3 Takeaways and thesis contribution

From this background chapter, we have a few key takeaways. First, VR advertising is still in its infancy; and while there is a lot of excitement and speculation over the features it can bring, there are still a lot of unanswered questions, including how exactly will VR advertising evolve and what is its impact on consumers. Second, there is ample work documenting how advertising can be manipulative; as such, it is probable that once VR advertisements become mainstream, there will be some VR advertisements that utilize manipulative techniques. Lastly, VR technologies can pose various risks, including risks of physical and psychological harms, as well as numerous privacy risks. However, there has been relatively little work studying the risks and harms of VR advertising specifically, and even less as it relates to manipulation in VR advertising.

From these takeaways, it is clear there is a need for a comprehensive look at the risks that VR advertising poses, particularly the manipulative risks. This thesis will

fill this need by providing a comprehensive and in-depth look at manipulation in VR advertisements. Currently there is work examining manipulation in advertising, and work studying VR advertisements in general, but there is a substantive lack of work in the overlap of these two. The little work that does examine manipulation in VR advertising focuses on either a singular technique (e.g., looking only at embodiment), or looks at VR harms more broadly. There is a lack of direct analysis of the ways VR advertising can be manipulative.

My thesis will fill this gap by providing an overview of the various ways VR advertising can be manipulative. I bridge the fields of VR advertising and manipulative advertising to answer how can VR advertising be manipulative. Together with an understanding of VR user concerns and attitudes towards VR advertising, my thesis highlights the challenges and risks that VR advertising poses, setting the stage for future work that can address these risks and design VR advertisements that are not manipulative and better align with VR users' needs and wants.

2.4 Anticipating the impacts of emerging technologies

Researchers looking to anticipate and mitigate the harms of technology inevitably run into the Collingridge dilemma [57]. This dilemma points to how, on the one hand, it is difficult to accurately gauge what the harms of a technology are going to be until the technology is firmly established. On the other hand, waiting until a technology is established means that changing technology and mitigating its harms becomes a lot more challenging.

While studying emerging technologies is challenging, it is not an impossible or pointless task. There is a rich history of researchers developing creative ways to study the impacts of future and emerging technologies.

One area that has been interested in examining how technologies can be like in the future is the field of design. Specifically, design fiction and speculative design

are approaches that use design methods to imagine what technologies can be in the future, or imagine alternative presents with different technologies. Design fiction uses fictional probes (such as stories, prompts, or fictional artifacts) to imagine and understand what future technologies can be [23]. Speculative design tries to design futuristic technologies or reimagine alternatives to existing technologies [17]. While there are nuanced differences between these approaches, they share in common that "*all remove the constraints from the commercial sector that define normative design processes; use models and prototypes at the heart of the enquiry; and use fiction to present alternative products, systems or worlds.*" [17]. The goal of these approaches can vary. At times, these methods are used to design what technologies can or should be like; at other times, the goal is not to accurately predict what future technologies are like, but instead, it is to surface potential ethical issues and shed light on concerns users have regarding a current or futuristic technology. These approaches have even been used to influence stakeholders of these technologies, such as using design fiction to encourage responsible innovation among developers [28] or encourage children to be more engaged with bullying-prevention initiatives [263]. These design methods have been used in a variety of technologies, including medical technologies [184], robots [249], virtual assistants [209], the future of food [145], and brain computer interfaces [276].

Another field that has tried is that of impact assessments. As the name suggests, impact assessments are tools that help organizations identify (or assess) the likely impact a certain project or endeavour will have. More formally: "*Impact assessment, simply defined, is the process of identifying the future consequences of a current or proposed action*" [92]. There are many types of impact assessments that exist, each one measuring a different type of impact. For example, environmental impact assessments are used to assess the impact of a project on the local environment [25]. Privacy impact assessments are tools that help organizations identify privacy risks in their

organizations and minimize them [102].

In the context of measuring the impacts a new and emerging technology may have on society, there are both technology impact assessments (also known as technology assessments) and ethical impact assessments. Technology Impact Assessments (TIAs) are "*A class of policy studies which systematically examine the effects on society that may occur when a technology is introduced, extended, or modified. It emphasizes those consequences that are unintended, indirect, or delayed*" [92]. Ethical Impact Assessments (EIAs) are frameworks that help "*ensure ethical implications are adequately examined by stakeholders before deployment [of technologies] and so that mitigating measures can be taken as necessary*" [277]. These methods are slightly different in scope; whereas EIAs emphasize the ethical issues technologies can raise, TIAs are broader, seeking to understand the broader societal impacts these technologies will pose.

Within both TIAs and EIAs there are different approaches and frameworks specifying how to carry out an impact assessment. However, there are usually broad steps these assessments follow. Most impact assessments involve some form of literature review (to understand the current state of the field) and detailed examination of the technology in question. Then there is an anticipation of what are likely impacts and risks. There are several methods that can be used to accomplish this. Sometimes there are a systematic series of questions (also known as the checklist method) that are asked of a technology that aim to tease out what specific impacts will be [277]. Envisioning cards are a series of flashcards that use images, text and prompts to help think through what are impacts that technologies can have [96]. Futures wheel is a technique that helps structure brainstorming to understand the impacts of a novel technology; starting from one change, futures wheel structure thinking about the consequences these changes will cause and what consequences these consequences will have, mapping out the impacts of the technology [103, 187]. Analogical case stud-

ies involve looking at other, similar technologies, understanding what their impact has been, and seeing whether similar impacts would apply to the technology being studied [55]. Throughout this process, there may also be engagement with stakeholders, such as through stakeholder interviews, focus groups, surveys, workshops or citizen conferences [277].

In my dissertation, I take inspiration from these methods to guide my analysis of VR advertisements. I borrow elements of design fiction and analogical case studies to inform the scenario construction method for Chapter III. In Chapter IV I carefully analyze existing VR artifacts using a walkthrough approach as a way to ground predictions. I engage with stakeholders in Chapter V through semi-structured interviews to understand VR users' perspectives and attitudes regarding VR advertising. Lastly, in Chapter VI, I combine insights in the prior chapters to form conclusions on the likely harms of VR advertising and what issues warrant further attention and study from the wider community.

CHAPTER III

Identifying Manipulative Advertising Techniques in Extended Reality (XR) Through Scenario Construction

3.1 Introduction

In this chapter of my thesis, I present a study that used scenario construction to anticipate the manipulative risks that VR advertisements pose. One of the challenges of studying the risks of VR advertising is the future-oriented nature of the technology, meaning that studying existing VR technologies may be a poor proxy of near-future capabilities and harms. As such, we cannot just rely on existing VR technologies to give a complete picture of the harms that are to come.

To overcome this problem, I utilized *scenario construction*—analyzing current technologies and trends to construct informed narratives, or scenarios, regarding how a technology could be used in the future [73, 166, 205, 270, 278]. This method is often used in predicting and imagining the future [28, 166], as well as for surfacing ethical tensions and impacts of various technologies [190, 270]. Scenario construction is, therefore, well suited for exploring potential future incarnations of manipulative VR advertising and their harms.

Astute readers may notice that the title of this chapter references scenario con-

struction in Extended Reality (XR) rather than VR. XR is a term encompassing a broad range of closely related technologies, which includes VR, but also mixed reality (MR) and augmented reality (AR) [12, 194, 244]. The reason I focus on XR technologies (rather than VR technologies alone) is because of the expected blending of technologies and blurriness between technologies that are strictly VR and technologies that are strictly not VR. It is possible that in the future, there will be no devices that are *just* VR, but rather, are more flexible devices that allow for various forms of interactions with reality. In fact, some devices already exhibit these traits (such as the Meta Quest Pro, which allows Virtual and Mixed reality views).[1] Thus, there may not be strictly VR advertising since there is no medium that is strictly VR, but rather, a more fluid type of XR advertising. Broadening the scope to XR advertising allowed me to capture all possible incarnations of how VR technologies can evolve in the future, rather than being limited to current VR technologies (i.e., headmounted VR displays).

As such, in this study, I used scenario construction to create scenarios that project out from current XR capabilities, XR research, and documented harms of other advertising techniques, to illustrate ways in which future XR advertising is likely to be manipulative. Through this work, I make the following contributions. First, I provide an overview of the main characteristics of VR marketing. I highlight how VR ads will be more immersive than traditional ads: they will be extremely realistic; they will allow VR users to interact and preview products before buying them; and they will be hyper-personalized and customized towards individual VR users. Second, I identify five key manipulative risks of XR technologies: misleading experience marketing, inducing artificial emotions in consumers, targeting consumers when they are vulnerable, emotional manipulation through hyperpersonalization, and distorting reality. Through these findings, I highlight future challenges and risks of VR adver-

[1] https://www.meta.com/quest/quest-pro/

tising, paving way for future work to examine these harms in detail as well as to pre-emptively address these risks (e.,g., through research or legislation).

This study was conducted in 2020, and published at the Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems.[2] This work was done in collaboration with Florian Schaub; as such, throughout this chapter I write using first person plural terms (e.g., 'we', 'our') to reflect the collaborative nature of this study.

3.2 Background

In this section, we introduce XR technologies and XR advertising. We first discuss definitions of Extended Reality and associated terms. We then talk about XR advertising by walking through examples of current XR advertising techniques.

3.2.1 What is Extended Reality (XR)?

Extended Reality (XR) has emerged as a catch-all term encompassing technologies that augment or create realities [12, 194, 244], predominantly: Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR). The XR Safety Initiative defines XR in the following way:

> *"Extended Reality (XR) is a fusion of all the realities—including Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR)—which consists of technology mediated experiences enabled via a wide spectrum of hardware and software, including sensory interfaces, applications, and infrastructures. XR is often referred to as immersive video content, enhanced media experiences, as well as interactive and multi-dimensional human experiences."* [196]

[2] Abraham Hani Mhaidli and Florian Schaub. Identifying Manipulative Advertising Techniques in XR Through Scenario Construction. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems, CHI '21, pages 1–18, New York, NY, USA, May 2021. Association for Computing Machinery.

Virtual Reality (VR) refers to technologies that attempt to block out or hide reality and replace it with a virtually generated world, such as through digital graphics [164]. The most widely-used consumer VR device is the VR headset; a head-worn apparatus that immerses the user in a three-dimensional experience, by covering the user's eyes and displaying a 3D environment instead [244].

Augmented Reality (AR) refers to technologies that aim to enhance, or augment, a real environment through digital displays and computer graphics [176], often by superimposing these graphics as overlays onto the physical world. One common AR technology is AR smartphone apps [53]. These apps overlay digital images onto a live video feed from the smartphone's camera. Thus, if one is looking at the smartphone screen, it seems that the digital elements that are created by the app are part of, or attached to, real-world objects. Another type of AR device is the AR headset, such as the Microsoft Hololens [172] or the Magic Leap One [163]. Similar to VR headsets, a user wears an AR headset over their eyes. The user can still view the world around them, with the headset overlaying digital graphics onto real-world objects the user is seeing. Though popular in fiction, AR headsets have not yet found mainstream adoption.

Mixed Reality (MR) is more difficult to define [231]. Milgram and Kishino popularized the idea of MR being a virtuality continuum with the two extremes being completely real environments and completely virtual environments [176]—mixed reality is anything that lies along this continuum.

Thus, XR technologies encompass any VR, AR, or MR technology. VR headsets, AR smartphone apps, AR headsets, all are part of XR. For the purposes of studying XR advertising, our focus will be on XR technologies that are aimed at consumers. Though there are numerous XR devices with industrial applications (e.g., heads-up displays for pilots [76], or VR experiences that simulate work environments in order to train employees [244]), these are not likely to include advertisements due to their

context of use, and are therefore of low relevance to our investigation.

3.2.2 What is XR Advertising?

XR advertising is any form of advertising that takes place in an XR context or is shown on an XR device. There are a variety of ways in which XR has already been used for advertising and marketing [88, 221, 269, 284]. Currently, common XR ad formats include: 360° videos and photos [284]; apps that allow users to project products into their real-world environment to preview them (e.g., projecting furniture onto their living room floor) [284]; product placement within XR experiences [284]; location-based AR advertisements, also known as geo-layer (AR applications that require consumers to go to a specific physical location to access content) [221, 284]; projection mapping (projecting images or videos onto already existing surfaces) [88]; magic mirror (using AR mirrors or TV screens where a user sees themselves or their surroundings, but with digital graphics that augment the scene) [221]; active print packaging (AR applications that scan a pattern or item in the real world to unlock digital content on a phone screen) [221]; and AR lenses (using a smartphone's camera to place images and brand logos onto the user's surroundings) [284].

So far, XR advertising is still in its infancy compared to other advertising markets [33, 234] but there are signs that XR advertising is growing. 75% of Forbes' "World's Most Valuable Brands" have already developed some form of XR advertising [139], including companies such as Pepsi [246], Glenlivet [273], and Audi [74]. A recent survey showed that over 30% of XR apps are monetized through advertising [158]. As XR devices become more ubiquitous, it stands to reason that XR advertising will become ubiquitous as well.

3.3 Method

Our approach for understanding what manipulative XR advertising will look like in the future was inspired by methods such as design fiction [166] and value sensitive design [97] that critically examine future technologies and their ethical implications. After careful consideration, we chose *scenario construction* as our method.

Scenario construction is a process by which, through analyzing current technologies and broader societal and historical trends, narratives (i.e., scenarios) are created describing how a technology could be used in the future [73, 166, 205, 270, 278]. It is a common tool used to both prototype the future [166] as well as analyze the ethical impacts of technologies. Scenario construction is effective at surfacing ethical tensions, impacted stakeholders, and abusive usage of technologies [155, 205, 270].

In our case, scenarios are used to highlight potential instantiations of manipulative XR advertising. For the purpose of identifying what manipulative advertising will look like in XR, we consider scenario construction an ideal method given the future-oriented objective of our work. We conjecture that while XR manipulative advertising may not be a pronounced issue currently, it will be an issue in the near future. Through the developed scenarios, we can explore what different manipulative techniques are likely to emerge in XR advertising.

In constructing scenarios, we aimed to construct narratives that were meaningful, informed, and reflective of future manipulation risks in XR scenarios; moving beyond simple prediction or guesswork into something more accurate and useful [278]. To this end, we ground our research in current XR advertising techniques. However, existing techniques alone are not sufficient to identify future manipulative XR advertising scenarios. Given the relative novelty of XR advertising and the speed at which XR technologies are evolving and changing, new XR advertising techniques are likely to appear and existing ones may become antiquated.

Therefore, we first analyzed what features, enabled by XR technology and re-

search, constitute opportunities for XR advertising by carefully studying the literature, current XR devices, advertising techniques, and advertising trends. The identified defining characteristics help ground our scenario construction in development trajectories that manipulative XR advertising techniques are likely to follow.

Second, we constructed the manipulative XR advertising scenarios. Despite scenario construction being used by many different researchers and practitioners, there is no universally agreed upon process on how to create scenarios, with many different approaches being used. Our scenario construction process took inspiration from several approaches, namely the SATORI Project [270], Wright et al., [278], and Betten et al. [28], and proceeded as follows. We first searched the literature and popular media to gain an understanding of manipulation in current advertising mediums, consumer-available XR technologies, and current XR advertising examples. With this knowledge, and the previously identified XR advertising features, we asked a series of questions such as:

- Could this existing manipulative advertising technique be replicated in XR?
- How could each of the features of XR advertising exacerbate this manipulative technique?
- How could an already existing XR advertising technique be used by bad actors to manipulate XR users?
- A given XR advertising feature is enabled by a certain XR technology characteristic. How could this be leveraged to manipulate XR users?

Using these prompts, we developed an initial set of scenarios of users interacting with XR ads that were manipulative. We revised and iterated on these scenarios, ensuring that the scenarios were properly grounded and consistent with prior knowledge about advertising, manipulation, and XR, as well as the identified XR advertising fea-

tures. Once the scenarios were finalized, we chose the subset of distinct scenarios by removing redundant or overlapping scenarios.

As a way of summarizing and synthesizing the scenarios, we condensed them into the specific ways in which the scenarios were manipulative. We identified five key ways that XR advertising can be manipulative: misleading experience marketing; inducing artificial emotions in users; targeting users while they are vulnerable; emotional manipulation through hyperpersonalization; and distorting reality. Based on these techniques, we describe research challenges for mitigating associated risks.

3.4 Defining features of XR advertising

We identified the defining characteristics of XR advertising by examining the current and proposed capabilities of XR technologies; current examples of XR advertising; relevant literature; and studying trends in how advertising techniques have developed over time. We identify five traits that we anticipate will define future XR advertising and differentiate it from previous forms of advertising. These traits are: (1) greater immersivity (2) extreme realism, (3) previewing products, (4) hyperpersonalization, and (5) pervasive advertising.

3.4.1 Greater Immersivity—feeling as though you are in the ad

Immersivity, or immersiveness, is the feeling of presence and of 'being there' [22]. In the context of XR technologies, this means feeling that one is part of the virtual world being presented, and that the graphics being displayed shape reality. The digital world or enhancements are said to be immersive if the generated sensory stimuli are compelling enough to make the user believe the displays are real and seem to be physically present alongside the user [216].

The immersiveness of an experience is not a binary construct; instead, it can be imagined as a point on a spectrum, with some experiences being more or less

immersive depending on various traits, such as the level of interactivity, or how well the experience can obscure and make the user ignore the 'real world,' thus presenting the experience as the only reality [159]. XR technologies enable the expansion of this spectrum, allowing unprecedented forms of immersiveness that go far beyond what can be achieved in traditional computer screens by maximizing these traits [159]. For example, XR devices allow greater forms of interactivity; most MR and VR headsets track a user's pose and gaze direction and change what the user is seeing accordingly, which is vastly more interactive than using a mouse to manually move the viewport on a computer screen [159]. Similarly, VR headsets often completely cover a user's eyes, hiding the real world from them; unlike a traditional 2D screen, where a user can simply look away, it is much harder to do so with a VR headset, thus making the experience more immersive [159].

Since XR is more immersive than non-XR mediums, it stands to reason that XR advertising will be more immersive than advertising in other mediums. For example, instead of seeing a product on a TV or computer screen, with XR technologies a user could interact with a digital version of that product by picking it up, rotating it, using it, throwing it, or examining it in detail. An ad shown in a VR headset could potentially surround the user, making it difficult for them to ignore or look away and making the world presented in the ad appear to be real and make the consumer feel they are really there.

This increased immersiveness and interactivity is important in the context of advertising, given that these traits make advertising more effective [159]. Scholars have hypothesized that interactivity and immersiveness make ads more effective by two key mechanisms. The first is that increased immersiveness and interactivity generate positive feelings in the user which may inhibit the user's resistance strategies to the advertisement's arguments [110, 159] — this is especially true if the ad is interactive in a playful manner [130]. The second is that the increased cognitive load of being in

an immersive and interactive environment (having to respond to and interact with an ad, perhaps engage in tasks as part of the ad) means that fewer cognitive resources can be spent critically evaluating the ad's message and enacting resistance strategies to counter the ad's message [110].

3.4.2 Extreme Realism—hard to tell advert from reality

Related to immersiveness is the idea of extremely realistic ads — ads that are so photorealistic and subtle that they are potentially mistaken for reality. This differs slightly from immersiveness. An immersive ad is one where the user feels they are in the ad and that they are present in the world the ad is presenting. A *realistic* ad, though, would have consumers believe the ad they are seeing is the real world, and may not notice that it has been artificially created. For example, if consumers are using AR to enhance or augment reality, they might have difficulty discerning if something they see is an ad or if it is part of reality. Though current AR and VR graphics are not photorealistic, we anticipate that over time the sophistication of devices will lead to photorealistic graphics.

There are many ad techniques that attempt to be subtle, such as product placement (when a business pays a media company to insert a branded product into their media content [226]) or native advertising (when an ad appearing in an online or print publication *looks* like an article in that publication medium, but is actually an ad [229]). In the context of XR advertising, if an advertiser wants to make their ad subtle and the graphics used to display an ad are photorealistic, the consumer may think the ad exists in reality. Using the example of product placement in XR, if an AR application overlays a digital soft drink can on a user's field of vision, if that digital overlay is realistic enough, the consumer may not know if that can is real or not.

3.4.3 Previewing Products—try products before buying them

A new opportunity XR advertising presents is the chance to show and let consumers experience the goods they want to buy prior to a purchase [34]—a phenomenon known as experience marketing [22]. XR technologies can recreate digital three-dimensional representations of products, and consumers can then see if they are interested in purchasing that product.

While consumers can already preview goods and services before buying them (e.g., going to a physical store to see the product before buying it, or looking at pictures and customer reviews of a product online), XR enables people to preview more complete and higher quality representations of items (3D-digital recreation instead of a photograph) from the convenience of their own homes. Additionally, XR technologies allow users to preview products in real contexts. For example, let us assume a consumer wants to buy a new table for their house; without XR technologies, they can visit the store, look at the table, perhaps take pictures and measure its dimensions, but they wouldn't truly know what the table looks like in their living room until they buy the table. But through XR technologies this problem could be easily overcome: an AR app could project a digital recreation of the table onto the consumer's living room, allowing the consumer to see what the table looks like.

Beyond products, XR advertising could allow for previewing experiences. For example, a hotel resort could offer a VR tour of its premises [112, 149, 165]. The National Hockey League (NHL) created an experience that allowed fans to experience watching a hockey game at a crowded stadium through the use of a VR headset [144]. Potentially, as XR devices evolve, senses such as smell, touch, and taste could be incorporated, changing how consumers can preview a product or experience.

3.4.4 Hyperpersonalization—an ad made just for you

Personalized advertising, sometimes referred to as targeted advertising or online behavioral advertising, is an advertising technique whereby ads are selectively delivered and targeted to those consumers who are more likely to engage with that ad [80]. This is accomplished by advertisers gathering data about individuals, such as their age, gender, location and search queries [79], and then matching ads to users who are most likely to engage with the ad based on their characteristics (e.g., only showing ads for restaurants in Paris to individuals who live in Paris) [80]. Companies such as Facebook and Google thrive on selling targeted advertisements and allowing advertisers to target consumers based on demographics, location, and inferred interests.

Hyperpersonalized advertising would be personalized advertising but on a much larger scope and granularity, where ads are not targeted to groups of consumers who share a characteristic (e.g., adult women aged 25–34 who live in Madrid); instead, ads are tailor-made and customized for individuals so that no two people see the same ad. For example, a person who really likes dogs might be shown an ad for a product with a fictional dog as a spokesperson for the product. A different person who dislikes dogs and prefers cats would be shown the same advertisement, but with a fictional cat as a spokesperson for that product.

There are two reasons why XR is likely to enable and feature hyperpersonalized ads. First, there has been an advertising trend towards more and more personalized advertising [266], which inevitably leads to hyperpersonalized advertising. Netflix has already premiered a primitive type of hyperpersonalized ads, algorithmically selecting what thumbnail image for a movie gets shown for individual users; thus, different users see different thumbnails for the same movie [128]. As algorithms become more and more sophisticated, it is possible that they will able to generate custom advertisements for each individual.

The second reason that hyperpersonalization will likely be present in XR adver-

tising is the vast data collection and sensing capabilities of XR technologies. Current XR devices can capture consumer's biometric and physiological data. For example, VR headsets are worn on a user's head, and controllers are held by the user: the positioning of these devices and their orientation can be used to track a user's gait, height, body posture, and gaze-direction [19]. Cameras that are integrated into XR devices can capture a user's facial expressions [19]. These expressions, coupled with biometric and physiological data, may give insights into a user's emotional state at that time [19] and may disclose sensitive user information, such as how gaze-direction can be used to infer a user's sexuality [206].

XR devices may also collect data about the user's surroundings — for example, smartphone AR apps require the user to use the smartphone's camera to film the real world before digital images can be superimposed on the real world. Not only does this allow data collection of the user, but it can capture data about bystanders standing next to the user (e.g., if a smartphone camera films another person in the frame). Similarly, some VR headsets have accessories that track a user's location and their movements — these movements may be used to predict the layout of a room [66].

As XR devices develop further, it is not hard to imagine additional sensors being integrated into these devices to aid in device functionality. For example, the VR horror game "Bring to Light" [100] comes with a heart rate sensor, to detect when a user's heart rate is elevated (and therefore when they are most scared) to change the course of gameplay. Thus, there exists the possibility that future XR devices will incorporate a wide range of sensors to measure and react in realtime to physiological information about the user.

Additionally, XR technologies capture the consumer's behavior within an XR experience. For example, if a consumer is using a VR headset to use a social media application to talk to friends, who that consumer is talking to and what they are saying can be collected.

3.4.5 Pervasive Advertising—ads are everywhere

Pervasive advertising refers to advertising that is ubiquitous, frequent, and embedded within an individual's daily life and environment, to the point where an individual would be surrounded by advertising [182]. Some XR technologies, by their design, enable pervasive advertising. For example, some AR glasses and AR contact lenses are designed to be worn by users constantly throughout their daily life, as evidenced by the ways they are marketed. Mojo Lens is a company that designs AR contact lenses, and advertises its product by saying "Mojo Lens uses unique, purpose-built microelectronics and the world's densest microdisplay to layer digital images and information seamlessly into your life. By providing critical information through smart software that understands your context, Mojo Lens empowers you to be your best self in any situation." [127]. We see from this text how the goal of this technology is to be used constantly, throughout everyday life. While current AR lenses and glasses may not yet be fit for continuous use, it is conceivable that this technology will mature to the point where they are comfortable and desirable to be worn throughout the day.

By being worn constantly at all times, and being the lens through which users see the world, AR glasses and lenses could display advertisements constantly, and design the ads to blend seamlessly into the user's view of their environment. Since the user is looking through the AR glasses to see the world, they would essentially be surrounded by these advertisements.

3.5 Manipulation in XR Scenarios

Following our scenario construction approach, we developed seven scenarios of manipulative XR advertising. Our scenarios vary in severity and negative impact or harm on XR users; what XR devices or experiences they are likely to appear in (e.g., VR versus AR versus MR); and the actors behind the manipulation in the scenario.

Some of these scenarios are unique to XR, in that the scenario would be difficult to exist outside the XR context. Other scenarios are not exclusive to XR, but the manipulative features are exacerbated by XR technology. All our scenarios have in common that they are instances of a consumer being tricked, deceived, or otherwise sabotaged through XR advertising in their ability to evaluate the claims of an ad, and make an informed decision of whether to purchase a product.

For each scenario, we first present the scenario, and then elaborate on how the scenario was constructed and on its manipulative characteristics. After listing the constructed scenarios, we synthesize them into five mechanisms through which manipulative XR advertising can occur: misleading experience marketing; inducing artificial emotions in consumers; targeting consumers while they are vulnerable; emotional manipulation through hyperpersonalization; and distorting reality. Figure 3.1 shows the links between the XR advertising features identified in the previous section, our scenarios, and the manipulative XR advertising mechanisms.

Note that we do not consider our set of constructed scenarios to be a comprehensive representation of any or all possible types of manipulation in XR advertising. Scenario construction is about providing reasonable estimates of scenarios that are likely to play out in the future, but they are not meant to be exclusive. We anticipate that novel manipulation risks and techniques beyond our set of scenarios will emerge as XR capabilities and other technologies continue to develop. The contribution of our work lies in identifying and describing a first set of potential risk and consumer harm scenarios and in articulating associated research challenges. By doing so we create opportunities to consider and mitigate identified issues already in the design of XR technologies and experiences and facilitate reflection on ethical issues in XR design and XR advertising by developers, XR users, as well as policymakers.

3.5.1 Scenario 1: Military Games

The U.S. army creates a VR experience that allows people to "live a day in the life of a soldier." The experience itself is highly gamified and punctuated with achievements, fun, excitement, and a play-like atmosphere. The U.S. military uses this as a recruitment tool and markets it heavily to teenagers. John, a sixteen-year-old teen, sees the experience and decides to try it out. Although apprehensive at first, John finds he is having fun. He likes running around, fulfilling missions around base camp, and outshooting other players in the shooting range makes him feel pretty good about himself. John slowly becomes enamored with the military, and now convinced, applies to become a member of the armed forces.

3.5.1.1 Construction Process

To construct this scenario, we first identified a current advertising practice — that of the military advertising job positions through videogames. The U.S. military has a history of using videogames to recruit participants, having released a series of videogames titled "America's Army", a collection of first-person shooters used as a recruitment tool [15, 174]. In a recent scandal, it was revealed that the U.S. military maintains a presence on Amazon's online gaming platform Twitch and has allegedly used the platform to target teenagers (some as young as 13) for recruitment [20, 154].

Given how the U.S. military uses video games as recruitment tools, it is reasonable to imagine that they would create similar experiences in VR; several military-style VR games exist already (e.g., Pavlov VR [101]).

We then asked ourselves: if these games existed in XR, could the XR features identified in Section 5 make this experience manipulative? If so, how? We imagined the experience leveraging the greater immersivity of XR and the extreme realism of XR, leading to an experience that is highly immersive and realistic — much more so

than traditional games.

This could lead to manipulative advertising in two key ways. First, given the realism and immersiveness of the experience, teenagers would not be playing the game, they would be *living* the experience. The experience may seem more convincing and realistic, and teenagers may think that what is presented is a realistic depiction of what life in the armed forces is like — almost like a preview of what military life would be like.

Second, the emotions felt in the VR experience could be more intense than those felt in a traditional marketing experience, which could impact the ad's effectiveness. Ads that generate positive emotions in consumers are generally more effective than ads that do not [21, 52]. The excitement, adrenaline, engagement and fun that an immersive, realistic experience generates in the user could be more intense than when viewed through a 2D screen. If powerful enough, teenagers may associate these feelings of positivity with the military — an association that might be so powerful that it biases the decision of whether or not to apply to the armed forces.

These two features combined create a situation where a user is being misled and swayed on an emotional level to react positively to the ad — which constitutes manipulation. This led to the creation of a scenario where a teenager plays the game, succumbs to the realism and immersiveness of the medium, and joins the armed forces as a result.

3.5.2 Scenario 2: Ugly Furniture

> *A furniture company releases a new AR app that allows customers to place 3D renderings of furniture into their home, to see how the furniture would look like in their home. Unbeknownst to the consumer, the preview is altered in ways that make the photorealistic rendering of the furniture seem brighter and more colorful than real life, whilst still seeming realistic.*

An unsuspecting customer uses the app to "try out" a new sofa in their living room; satisfied with how it looks, they buy the sofa, only to find that the actual sofa is much duller, uglier, and of vastly lower quality than the preview had suggested.

3.5.2.1 Construction Process

We first identified a common XR advertising practice (and a feature of XR advertising); that of Previewing Products. Many furniture companies (e.g., IKEA) have already developed AR apps that allow users to place 3D models of furniture in their home [132]. As discussed in Section 3.4.3, this form of experience marketing is a big draw for advertisers, since it allows users to preview and interact with products before purchasing them.

We asked, how could this advertising practice be used by bad actors? We imagined that it could be possible for these previews to be fake and misleading. It is well known that advertisers often doctor images of their products to make them seem better than they actually are [60]. Techniques used include using image and video editing to hide imperfections in products, to make models appear thinner and more conventionally beautiful, or using props and subtle photography tricks, such as using eyeliner to create artificial grill marks on food [93]. It can be reasonably deduced that advertisers will similarly attempt to alter and enhance XR previews of their products.

Combining these two ideas led us to imagine a scenario in which a furniture company misleads a consumer about the product they are selling through a doctored preview. At first it may seem like this scenario is not that revelatory; advertisers have been doctoring images of their products for a long time, how could it be different in XR? However, these manipulations could be *more convincing*, and thus more manipulative, in XR advertising. Consumers would see the furniture right in front of them and be able to interact with it, instead of seeing a 2D image on a screen or

in a print ad. Consumers may think that the sofa they are interacting with is real, and not be aware (or not take into account) that they are fictional representations. Research shows that XR ads can lead to high feelings of presence [289]. In the cases of previewing experiences, users will not just see an experience through a photo or video: users will actually live through that experience. While currently rendered objects are often still recognizable as such in XR experiences, if a preview takes advantage of the Extreme Realism feature of XR, the sofa could be rendered photorealistically in realtime, and incorporate an environment's actual lighting and shadows; making the deception difficult to notice.

3.5.3 Scenario 3: Fake Relatives

> *Carolina gets a video call from her brother, which she picks up in her VR chat app. The call is not unexpected — they chat regularly, and him calling out of the blue is no big deal. The conversation starts the usual way with their jokes, asking about each other's lives. Eventually, the call turns to her financial situation; with her new job, Carolina is looking for ways to invest her money. Her brother convinces her to invest in a profitable stock portfolio, which she readily agrees to — she trusts her brother. Too late, it transpires that Carolina was tricked: the person she thought was her brother was actually a holographic recreation of him in the form of an ad. The profitable stock portfolio was actually a very high risk investment that does not pan out, and Carolina loses thousands of dollars on the deal.*

3.5.3.1 Construction Process

One manipulative technique used with current technologies is bad actors pretending to be family members, relatives, or other trusted parties, to convince people to transfer money to unknown accounts. Although this is a form of scamming, and not

a legitimate form of advertising, we felt it was appropriate to include here for two reasons. First, because it shares many of the same traits with manipulative advertising (convincing a user to carry out an action against their better interests). And second, because despite its illegality, this type of scam is prevalent right now, with particular danger when older adults are targeted. Millions of adults fall victim to this form of scam every year [82]: the FBI even has a special page dedicated to detecting and preventing financial fraud of the elderly [82].

Then we asked, what could this look like in XR? First, it could leverage the Extreme Realism of XR to create photorealistic avatars of trusted loved ones. Through the rise of deepfake technologies [217], it will be possible to create realistic XR avatars of anyone from a small amount of video footage or photos. The data collection capabilities of XR devices mean that it could be relatively easy for would-be scammers to scrape data such as the identity of their victim and pictures of relatives, and perhaps have them act in realistic ways (e.g., having the avatar use the same idiosyncratic phrases that the person they are replicating will use). We already know that such recreations are possible in XR; researchers in South Korea managed to reunite a mother with her dead child, by recreating an avatar of the child in VR [6]. Recreating a living relative is therefore conceivable. Thus, we imagined a scenario in which a person is reunited with a realistic avatar of a loved one (who they believe to be real); and are then scammed.

This form of scam is dangerous, and millions fall victim every year; how would the scale increase in a world where this is happening in XR? How will users differentiate between a genuine call and an avatar created by a scammer if the avatar looks exactly like the person the consumer is attempting to reach?

3.5.4 Scenario 4: Political Alternate Reality

A politician, struggling to win their re-election bid, hires an obscure political ad firm that specializes in XR advertising. The firm releases a series of ads meant to display on consumer's head-worn AR glasses. These ads are fairly sophisticated and subtle; the ad simply analyses a building and overlays graphics to leave a slightly modified version of the building. The ad is conveniently geolocated in places of extreme poverty. The targeting is so specific, and the ad so sophisticated, that if a consumer with AR glasses turns to look at evidence of poverty, such as a closed down store or a homeless encampment, the ad kicks in; the modifications it makes aim to erase any evidence of poverty. A closed down store is edited to seem simply closed for the day. Graffiti is "erased," broken windows are "fixed." An alleyway with a homeless person in it is redrawn, but without the homeless person. This erasure of poverty creates the impression that the economy is booming.

3.5.4.1 Construction Process

To construct this scenario, we first imagined manipulative ads in the context of politics. Politicians will sometimes create deceptive ads in order to get re-elected; for instance, in the 2020 U.S. presidential campaign, the two main candidates released ads that outwardly lied and contained deceiving statements [58, 136]. There have even been cases of explicit image tampering in campaign images, such as one ad released by the Trump campaign to make it seem like his opponent Joe Biden is in a basement [136]. Thus, it is not only possible, but plausible, that politicians would lie to get elected and take advantage of the capabilities of XR advertising to do so.

This begs the question: how could politicians use XR advertising techniques to create deceptive ads? What if a politician wanted to claim the economy was going

great when it was not? We imagined a situation where strategically placed AR ads would distract the user from evidence of poverty and economic downturn, such as by overlaying a banner ad to hide evidence of poverty. This evidence could be inferred based on a user's location (e.g., when in zip codes that have low median income), as well as image processing to detect evidence of poverty (e.g., shuttered businesses).

We further imagined this ad leveraging the Pervasive Advertising and Extreme Realism features of XR advertising. This would mean that the ad is on at all times and always able to hide evidence of poverty. Moreover, instead of displaying a banner ad to hide the image of poverty, the image could be replaced with a digital recreation of the same scene but without indications of poverty.

3.5.5 Scenario 5: Pervasive T-Shirts

> *A sports brand company wants to increase sales. It plans a new marketing campaign aimed at increasing the frequency at which users see the brand logo, with the hope that the more often users see the brand, the more familiar they are with it and the higher the chances they will purchase their product. The company develops AR ads that place a photorealistic digital image of its brand logo onto other people's T-Shirts. The ad is sophisticated enough to detect competing brands' logos and replaces them with its own logo. Thus, users who use AR glasses are subtly exposed to this ad by seeing how many people around them are wearing clothing of this brand. Surely this must mean the brand is of good quality, right? Why else would so many people be wearing it?*

3.5.5.1 Construction Process

To construct this scenario, we first considered what marketing techniques a clothing brand could use to increase its sales. One way of doing this would be to increase

the exposure a consumer has to that brand; for a clothing brand, this could involve having people a consumer interacts with have an item of that brand. Thus, an individual would see their friends, family members, and strangers wear a shirt bearing the same brand. We arrived at this conclusion by studying the literature, which suggests that such a strategy is likely to work. The more often a consumer sees an ad, the more likely they are to buy the product [45]. Similarly, word-of-mouth advertising (people known to a consumer recommend a product) is a very effective form of advertising [40, 195]; though this scenario is not technically the same as word-of-mouth advertising, seeing a friend wear a particular brand of clothing could function as a pseudo-endorsement. Thus, a consumer exposed to this form of advertising may be more likely to buy clothing from that brand.

We then asked how this could be accomplished through XR advertising techniques. AR advertising would allow a company to overlay digital images onto the real world, including overlaying brand logos over rival brand logos. Extreme Realism could render these logos photorealistic and indistinguishable from reality; and Pervasive Advertising would ensure this happens all the time when AR glasses are being worn constantly. Combined, these aspects would enable a brand to increase the number of times a consumer sees their brand logo by projecting their logo onto existing items of clothing.

Although the consequences may seem trivial (buying one clothing brand because of mistaken beliefs about its popularity), the manipulative principle is still the same: consumers purchasing products under false pretenses.

3.5.6 Scenario 6: Deodorant Crush

> *Wei is a seventeen-year-old teenage boy. By scanning Wei's message chats, activities on social media, and measuring biometric data such as pupil dilation collected through the AR glasses he is wearing, an algorithm infers*

that Wei harbors a secret crush for fellow classmate Jennifer. Waiting until biometric data reveals that Wei is particularly aroused, an ad appears for a deodorant that is a sure-fire way to seduce girls. The spokesperson in the ad bears a striking resemblance to Jennifer.

3.5.6.1 Construction Process

One manipulative advertising technique used currently is that of falsely associating certain positive feelings with a product [199]. In this vein, ads sometimes use sexualized imagery to sell their products [32] — by evoking sexually arousing images with their products, companies hope that users associate the feelings of sexual arousal with the product, and may thus be more likely to buy the product [32]. For instance, AXE, a company that sells male deodorant (among other products) [255], creates ads that feature men using the body spray to seduce women [170]. Some of the demographics AXE targets are teenage boys [222]. We then started to wonder what would happen if a similar deodorant company tried to use XR ads that leveraged sexual arousal, and how XR might intensify this feeling of sexual arousal.

One potential way we thought this could happen is through the data collection capabilities of XR devices. XR devices such as AR glasses can capture large quantities of a user's physiological data [66]. If, through Pervasive Advertising, these glasses are worn at all times, meaning data can be collected at all times, it would be possible to infer when a user is aroused. As such, sexually suggestive ads could be shown in moments when a user is most aroused and most likely to respond to arousal. If the ad leverages XR's ability to create immersive advertisements, the sexual arousal could be further enhanced.

But to add a layer of complexity, the data collection capabilities of XR devices could not only tell when a user is aroused, but potentially infer who arouses them. Algorithms could correlate times when a user is most aroused with data about who they

are viewing or talking to at that time to infer a potential crush or sexual attraction to an individual, and could couple this information with data obtained from sources like social media. Leveraging Hyperpersonalized Advertising, ads could feature avatars and images that are specifically targeted to maximize a user's sexual desires.

As such, we imagined a scenario where a teenager wearing AR glasses was subjected to ads from a deodorant company; ads that would be designed and tailored to maximize sexual arousal in the user. The reason this is manipulative is because this sexual arousal could impact users' evaluation of the product, biasing the purchasing decisions that they make.

3.5.7 Scenario 7: Hunger Pangs

> *Hassan uses AR glasses in his day-to-day life. Among other things, Hassan uses these glasses for navigation — he can input a destination, and arrows will appear to indicate what direction to go in. Unbeknownst to Hassan, the AR glasses are equipped with physiological sensors that can detect subtle changes in sweat composition, using this as a heuristic for determining Hassan's hunger levels. When Hassan is feeling especially hungry, the navigation app leads Hassan in particular directions that have him walk right past an unhealthy fast food restaurant. The ruse works, and Hassan finds himself eating at this unhealthy restaurant more and more often.*

3.5.7.1 Construction Process

The vast data collection capabilities of XR devices mean that a user's physiological state could be readily inferred. We asked ourselves what physiological states would companies be interested in measuring. One we identified is hunger; it stands to reason that users are more likely to enter restaurants or buy snacks when they are hungry,

since when they are not hungry, they may be less interested in food.

But would it be possible for such sensors to measure hunger? One of the symptoms of hunger is sweating, caused by low blood sugar [77]. At the same time, there is a rise in wearable sensors that are capable of detecting sweat [197]. It would be plausible to assume that there could be AR devices with sweat sensors. Perhaps the sweat sensor could be marketed as a useful add-on to allow for a great variety of applications (for example, it could be used by fitness apps to track a user's exercise and exertion; or be part of an app to measure how sick a user is feeling), or just be part of a sensor bank integrated into the glasses' temples.

What could companies do with this information? For inspiration, we looked at how advertising functioned in Nintendo's AR location-based game, Pokémon Go. Nintendo struck partnerships with restaurants so that consumers gained special prizes for going to certain restaurants [59]; by placing prizes in certain locations, Nintendo managed to direct people to these establishments. Thus, we imagined situations in which through a similar manner users are nudged into walking by certain restaurants, but based on their hunger levels.

The manipulative portion of this scenario occurs when Hassan is brought in front of the fast-food restaurant precisely when he is hungry. On his own, Hassan perhaps would have chosen a different restaurant. Maybe if Hassan is running late to an appointment and needs a quick bite to eat, the restaurant is the only one he has the time to go to — but through a different route, perhaps other, healthier restaurant choices would have become available.

3.5.8 Synthesis: Manipulation Techniques and Risks

The seven scenarios we constructed highlight different ways in which advertising in XR can be manipulative. Some scenarios are manipulative in ways that are possible today, but are amplified and exacerbated in an XR environment (e.g., Military Games,

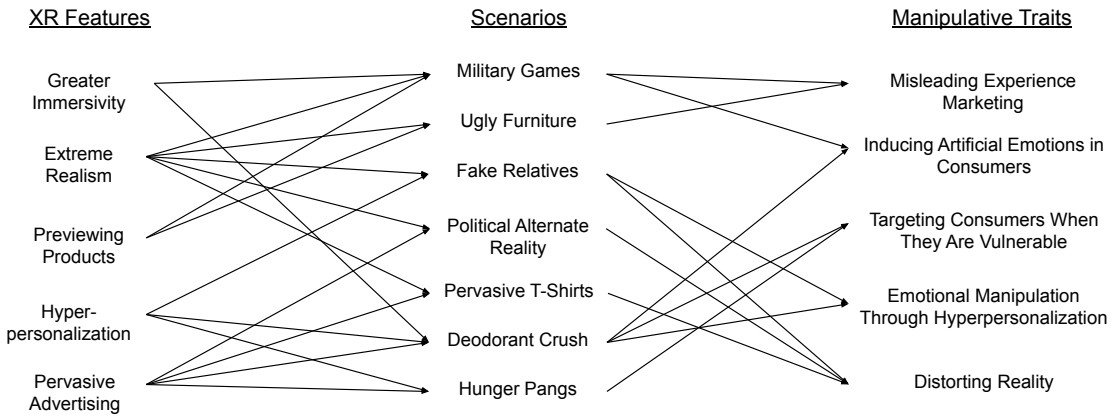

Figure 3.1: Figure linking the identified XR advertising characteristics; the constructed scenarios; and the respective manipulative mechanisms.

Ugly Furniture). Other scenarios are more futuristic and rely on unique features of XR devices (e.g., Deodorant Crush, Pervasive T-Shirts). Some scenarios work through similar mechanisms, others are vastly different. To make sense of these scenarios, we summarized five key mechanisms through which the presented ads are manipulative.

The first is **misleading experience marketing** (Military Games; Ugly Furniture). As we expanded in Section 3.4.3, one of the biggest promises of XR advertising is that of experience marketing — showing XR users products through XR technologies before they purchase them. Although the products seen may seem real, the previewed products will not be the actual products, but rather, digital recreations of them. Manipulation occurs when these experiences are doctored to present experiences and previews that are better than reality. While doctoring advertising images is not unique to XR, there is the danger that these manipulations are more effective in XR due the realness of the experience (XR users living through an experience and interacting with an actual object).

The second is the **inducing artificial emotions in consumers** (Military Games; Deodorant Crush). XR technologies can create artificial experiences for people to live through. Even though the experiences may be artificial, the feelings and emotions

they generate in users are very real [203]. If the feelings are positive and particularly powerful, they may bias consumer's evaluation of the product. The immersiveness of XR and the ability to simulate lived experiences (instead of seeing experiences on a screen) could make these emotions more powerful, and so more effective.

The third is **targeting consumers while they are vulnerable** (Deodorant Crush; Hunger Pangs). The vast data collection capabilities of XR devices mean that consumers may be presented with ads at times when they are emotionally vulnerable or especially susceptible to a certain product. The exploitation of such emotions may override a consumer's ability to rationally evaluate the ad, potentially causing consumers to buy and engage with products they would not otherwise.

The fourth is **emotional manipulation through hyperpersonalization** (Fake Relatives; Deodorant Crush). Leveraging the vast data collection capabilities of XR devices, and with the rise of deepfake technologies (technologies that can make realistic photos and videos of fake events; such as celebrities making statements they haven't made) [217], XR ads can be created that simulate individuals who have significant emotional sway over a consumer (e.g., a trusted figure, or a figure the consumer has affection for). This technique is one that will not be unique to XR devices, since deepfake technologies and vast data collections will presumably be present in other technologies as well (e.g., online news, social media). But it will likely be present in XR advertising, meaning it deserves consideration as one of the key features of manipulative XR advertising.

The fifth is **distorting reality** (Fake Relatives; Political Alternate Reality; Pervasive T-Shirts). This danger is most relevant to AR glasses and other future AR/MR technologies. As seen in the scenarios, ads in XR graphics have the possibility of hiding reality or changing it, by changing what the consumer sees. This is especially important for determining consumer behavior. Reality (or more accurately, what people *believe* to be reality) affects people's behavior. If a person's understanding of

what constitutes reality is compromised, they may act differently, and buy different products, than they would under a different reality.

3.6 Research Challenges

In the previous section we highlighted five ways in which XR advertising may be manipulative: misleading experience marketing; inducing artificial emotions in consumers; targeting people when they are vulnerable; emotional manipulation through hyperpersonalization; and distortion of reality. From a technological perspective, these scenarios are plausible; the technology exists to make these scenarios real, and even though some scenarios (e.g., those that require a distortion of reality) require a degree of photorealism and device sophistication beyond current capabilities, technologies are trending in that direction and so it is likely that these scenarios will be realistic in the near future. Past precedent of how businesses have leveraged advertising also suggests that some businesses will attempt to manipulate consumers into buying their products — either through the ways described here, or through new techniques.

However, XR advertising is still in its infancy. XR devices have not yet achieved mainstream usage, in part due to the cost and bulkiness of the devices. Though XR marketing campaigns exist, they have not yet entered mainstream consciousness or form part of major advertising strategies, and spending on XR advertising is dwarfed by the spending on advertising in other mediums [33, 234]. As such, the manipulative scenarios we described are at the moment just that — scenarios. At this point, little is known about whether those scenarios will be realized, or what their effects on consumers will be.

This is where researchers need to step in. To properly mitigate the problem of manipulative XR advertising, we need to better understand not only what manipulative scenarios are and how they impact consumers, but also understand: what are possible

intervention strategies? How can we mitigate risks of manipulative XR advertising in these and other scenarios? How might we provide guardrails for XR advertising that ensure advertising is fair and not harmful to consumers?

As a way of bridging this knowledge gap, stipulated by the constructed scenarios, we describe research challenges to investigate and ultimately mitigate the harms of XR advertising. We first lay out what research challenges remain to better understand and address manipulative XR scenarios; then propose several ways to approach these challenges. This is not meant to be taken as the definitive guide to XR manipulative advertising research, but rather, as the start of a conversation around what are the questions that need to be answered, which ones are worth answering, and what methods and approaches are best suited or required to answering them. By explicitly laying out some approaches to answer the questions, we hope to provoke reflection and conversation by and with researchers, developers, designers, consumers, and policymakers that are impactful, meaningful, and conducive to conducting research in this area and expanding what we know about XR advertising and manipulation.

We highlight four main research challenges, each with specific research questions: (1) analyzing and monitoring the XR advertising landscape, (2) privacy risks of XR, (3) unpacking the immersiveness of XR, and (4) developing XR ad literacy. These challenges and research questions are summarized in Table 3.1.

3.6.1 Analyzing and Monitoring the XR Advertising Landscape

To properly understand the effects of manipulative scenarios in XR, it is important to lay the groundwork and **understand what are the capabilities and types of XR advertisements that exist, and what types of XR advertising scenarios consumers are actually being exposed to**. The background section of this thesis is an example of such work; however, a deeper analysis is warranted.

For example, while XR advertising techniques have been discussed in the litera-

Research Challenge	Research Questions
Analyzing and Monitoring the XR Advertising Landscape	• What XR ad techniques are used in the field? • Categorize available XR ad experiences and relative prevalence. • Are certain XR ad scenarios limited to certain countries, businesses, or sociocultural contexts? • Who are the companies that are developing XR ad experiences? • What manipulative techniques are present in XR advertising?
Privacy Risks of XR	• Understand what data XR advertisers can collect. • Understand what data XR advertisers do collect. • Analyze privacy policies, terms of service, websites, patents, and other relevant documentation companies that advertise in XR. • What impact will this data collection have on consumers? • How could this data be leveraged for manipulation? • Involve consumers and understand what are (un)acceptable data collection practices. • Intervention strategies to mitigate harms from malicious data collection.
Unpacking the Immersiveness of XR	• Examine whether XR ads are more immersive than traditional ads, and what factors influence this immersiveness. • Explore the interaction between XR ad immersiveness and ad effectiveness. • Explore impact of increased immersiveness on consumers ability to rationally process an ad.
Developing XR Ad Literacy	• What are ways to increase consumer's XR ad literacy? • What interventions allow consumers to better navigate XR ads? • Are there mechanisms to detect misleading and subtle advertisements?

Table 3.1: Summary of identified research challenges to further unpack and understand manipulative XR advertising, and potential research questions within each challenge

ture, we have a limited understanding of what XR advertising techniques are actually used in practice. To move beyond anecdotal examples, it is important to systematically analyze existing types of XR advertisements in order to categorize XR ad experiences that are available and determine the prevalence of different ad types. Are certain XR ad scenarios limited to certain countries, businesses, or sociocultural contexts? Some work exists in this area, such as companies giving insights to marketers about the future of XR advertising [284] and scholars performing content analyses on AR ads [89, 265]. However, most of this work has focused on AR advertising, with much less focus on VR. Moreover, given the rapid development and change of the availability and type of XR technologies and advertisements, these developed taxonomies must be re-examined, challenged, and updated frequently to learn what new types of advertising scenarios develop.

Furthermore, how and why companies develop XR advertising experiences deserves further investigation. For example, **who are the *companies* that are developing XR ad experiences?** Are most XR ad experiences developed in-house by corporations (e.g., large corporations having their own XR advertising division) or by specific advertising agencies? Have middle-men advertising networks emerged that connect companies and advertisers with XR publishers, similar to how Google AdMob connects companies and advertisers with mobile app developers? Knowing who are the stakeholders involved in XR advertising and understanding their goals and motivations will shed light on what type of manipulation they might engage in, and what interventions are more likely to be effective.

Regarding manipulation in XR advertising specifically, we should ask: **what manipulative techniques are present in advertising?** There is ample documentation of manipulative strategies, dark patterns, and nudging techniques that are used in traditional forms of advertising [14]. Do these techniques also appear in XR ads? How frequently? Several papers have canvassed existing ads as well as digital ex-

periences for manipulative techniques [4, 180, 213]; a similar methodology could be applied to examine XR advertising for the manipulative characteristics we described.

3.6.2 Privacy Risks of XR

Two of the identified harms — targeting consumers when they are vulnerable and emotional manipulation through hyperpersonalization — rely on the ability to collect vast quantities of consumer data through XR devices, including physiological data. XR's ability to collect consumer data not only underpins XR advertising manipulation techniques, but also many other ethical risks of XR devices, such as surveillance by law enforcement agencies, potential discrimination by employers, and loss of autonomy [189]. With regards to examining the privacy risks of XR technologies, there is still much to be learned.

Guzman et al. conducted a thorough review of security and privacy research in Mixed Reality [113]. They highlight open research challenges, such as better understanding the scanning capabilities of current MR devices and developing 'best privacy practices' for developing MR applications. We second their calls to action, and highlight some further research challenges specifically geared at the privacy risks within the context of XR advertising.

One of the first challenges is to **better understand what data advertisers *can* collect and infer in XR, and what data do/would they collect?** This would involve examining XR devices to understand what sensors exist in these devices and what data can be collected, and monitoring these devices over time as new sensors are added to consumer-available devices. More specifically to advertising, there is a need to analyze the privacy policies, terms of service, websites, patents, and other relevant documentation of companies that advertise in XR or that develop XR apps and devices to better understand their data practices and potential privacy risks that might emerge from industrial research and development activities. Another approach

would be to directly examine the data traffic of XR devices and XR advertising experiences to understand what data is being collected and streamed to a manufacturer's backend. This has been done successfully in studying IoT devices (e.g., see [123]).

Another challenge beyond knowing what data is collected is to understand **what impact will this data collection have on consumers**. For example, researchers found that eye gaze direction could potentially be used to infer a user's sexuality [206]. Guzman et al. wondered whether the scanning capabilities of current MR devices could be used to detect the physiological signals of bystanders [113]. Are there similar connections between physiological data that an XR device can collect (eye direction, gait, hand position) and a user's sensitive traits (sexuality, personality)? More specifically, does any data correlate to consumers' shopping habits, purchasing preferences or intent?

Alongside knowing what information can be collected about consumers, another challenge to explore is determining **how this information could be leveraged for manipulation**. For example, does tailoring an ad to a user's unique personality traits make an ad more effective, and how effective is this targeted persuasion?

Alternatively, following Guzman et al's call for developing best data practices, it would be valuable to **involve consumers so as to understand what are acceptable and unacceptable practices with regards to consumer data collection for use in advertising.** Consumers may be comfortable with some data being used to target ads, but not others, depending on the sensitivity of the data and what the data is used for [183, 268]. Using vignette studies, focus groups, qualitative interviews, and surveys, consumers' preferences can be learned and used to inform what are adequate data collection practices, as well as inform mitigation strategies. Adams et al. developed a code of ethics for VR developers co-created with VR developers [1] — a similar approach using participatory design more tailored to advertising could yield a useful resource for best advertising practices for both advertisers and

XR developers seeking to monetize their apps through advertising.

Furthermore, we need to be asking **what are intervention strategies that mitigate the potential harms from this data collection.** For example, what tools can we create to give consumer's agency and control over this data collection process? Could a system similar to smartphone 'permissions' work? What about informing people that the ad they are seeing is based on data collected by their XR device (e.g., "You are viewing product X because our records detect you are personality Y, based on eye-tracking data collected from your Oculus Rift S") — how should such messages be worded, how should they be integrated into XR experiences, do consumers find this messaging informative and useful, and does it help consumers resist the manipulative effects of XR advertising?

3.6.3 Unpacking the Immersiveness of XR

Another feature of XR advertising that underpins many manipulative techniques is the increased immersiveness and realism in XR devices. The increased immersiveness can make generated images, objects, and experiences seem real, provoke strong positive emotions in users, and even alter a consumer's perception of reality — all of which may manipulate consumers into buying products they do not need.

All these techniques hinge on the assumption that XR advertising is more immersive, and therefore, more effective. Although most literature suggests that this is the case [228, 269], there is by no means a firm consensus [90]. More work is needed to **fully explore the assumption of XR ad immersiveness and its impact on persuasion and ad effectiveness**. Immersiveness is important to ad manipulation; some scholars have even posited that immersiveness is *inherently* manipulative, given its impact on consumers' ability to perceive ads. The increased immersiveness and interactivity can potentially sabotage consumers' ability to critically evaluate an ad's message, through either inducing positive feelings in the user, which may inhibit the

user's resistance strategies to the advertising's arguments [110, 159] (especially true if the ad is interactive in a playful manner [130]); or through the increased cognitive load of being in an immersive and interactive environment, meaning that fewer cognitive resources can be spent critically evaluating the ad's message and enacting resistance strategies to counter the ad's message [110], making the ad more convincing. Given the impact on consumers' ability to rationally and logically process ads, this could constitute a form of manipulation.

Whether XR ads are more immersive or not than traditional ads, and what factors influence this immersiveness, should be studied with experiments and user studies. One key question to ask is whether the immersiveness of XR advertising (and its subsequent effectiveness) is partially due to the novelty of the technology (as has been suggested by some scholars [122]), and whether users become immune or desensitized to this immersiveness. This could be accomplished by conducting longitudinal studies with VR users to understand how their sense of immersion changes over time, using validated scales for measuring immersiveness and/or physiological sensors.

More specifically to advertising, another challenge is to investigate **how increased immersiveness impacts consumers' interactions with ads in manipulative ways**. Prior work has suggested that immersive ads are more effective than non-immersive ads; and in the context of XR technologies, that immersive XR ads are more effective than non-immersive XR ads [50, 109, 261, 269]. However, there is some nuance to this effectiveness. Feng et al., for example, find that 360°-video ads (a form of XR advertising) were *not* more effective than 2D-video counterparts if the ad had a low or high level of narrative structure [90]. Similarly, Leung et al. find that although VR advertisements were more effective in the short term, in the long term traditional ads were more effective [149]. Thus, it is not a foregone conclusion that XR advertising, by being more immersive than traditional ads, would also be more

effective. Teasing out this connection is vital to determining what are the effects of increased immersiveness on consumers.

3.6.4 Developing XR Ad Literacy

Ad literacy is defined as the ability to navigate and process advertisements: "*an individual's ability to recognize advertising and to understand its persuasive intent*" (exact quotation given by Hudders et al. [125], originally citing Wright et al. [279]). Aspects of ad literacy include the ability to properly identify when something is an ad, and being able to distinguish ad messaging from truth (e.g., what claims are true versus what claims are exaggerations).

In the context of XR advertising manipulation, **ad literacy is necessary to enable consumers to navigate XR advertising and resist potential manipulative effects.** Ad literacy could help people identify manipulative XR advertising, or at least know how to verify whether product previews are accurate depictions of the product they are selling. Ad literacy could potentially help consumers be aware of the dangers of photorealistic advertising, and develop techniques on how to recognize photorealistic advertising when it happens.

There are many research challenges in this area of ad literacy. First, **what are ways to increase consumers' XR ad literacy?** How should educational interventions or trainings be designed and delivered so that they help consumers increase their ad literacy? Delving more specifically into manipulation harms, can educational trainings help consumers recognize photorealistic advertisements and be more skeptical of experience marketing?

Alongside this challenge of increasing ad literacy is the need to understand it. **What does advertising literacy mean in the context of XR advertising?** Could we measure it? If so, how? Some ad literacy scales exist (e.g., [214]) — however, to our knowledge, no validated scale exists for XR advertising. There is a need to

adapt existing scales to XR advertising. Once it is possible to reliably assess ad literacy, we can question what the impact of ad literacy is on resisting manipulation. Does higher XR ad literacy correlate with higher resistance to manipulative ads?

Moving beyond ad literacy on an individual basis, we can ask what software interventions can help consumers better recognize advertising. In the context of photorealistic ads or subtle advertising techniques such as product placement, does labeling the ad help? And if so, what should ad labeling look like? There can be a lot of nuance to a label, with the positioning of the label and what language it uses potentially influencing whether people see the label and how they react to the ad once it has been labeled and brought to their attention [148, 275]. Moreover, how can labels be developed in ways that both inform consumers of subtle ads that are happening but do not severely impair the XR experience the consumer wants to enjoy?

On a more technical side, **are there mechanisms or tools** that can automate the detection of subtle AR digital overlays when they are happening **to aid in labeling and identifying these ads?** Such work could borrow from work done on identifying deepfakes and digitally altered images [3, 167, 283], but would have to be adapted to XR contexts.

3.7 Conclusion

In this chapter, I present a study that constructed scenarios to explore how XR advertising could be manipulative. Although this study focused on XR, the findings are still applicable to understanding VR advertising. In particular, we learn that VR advertising is characterized by greater immersivity, vast data collection capabilities, hyperpersonalization, and the ability to preview products in unprecedented ways. As a consequence, we learn key ways VR advertising can be manipulative, including misleading experience marketing; inducing artificial emotions in consumers; and

targeting consumers when they are vulnerable.

This study is a first step towards understanding how manipulation can function in VR advertisements. One research challenge I highlighted is the need to analyze and monitor the VR advertising landscape, in order to better understand how advertising is used in VR, which of the afore-mentioned manipulative techniques are being pursued by advertisers, and see if there are any harms that require addressing. To that end, the next chapter presents a study addressing this research challenge by analyzing current examples of VR advertisements to identify the manipulative techniques they utilize.

CHAPTER IV

Manipulation in VR Marketing: An Analysis of Virtual Reality Marketing Experiences

4.1 Introduction

In the previous chapter, I used scenario construction to identify ways in which VR advertising could be manipulative once VR technologies become more sophisticated and mainstream. Through this work, we got a deeper understanding of the harms that are to come, as well as an overview of research challenges in the space.

One such research challenge was the need to better understand existing VR advertising trends and practices. Understanding existing VR advertising practices is important to understand the risks VR advertising can pose. First, by unearthing the behaviors advertisers are currently engaging in, I provide insights as to what techniques in the prior chapter are being pursued and which ones more or less likely to be realized. Second, it may unearth harms that need to be addressed right now; although VR advertising is not yet mainstream, there are VR advertisements that exist; and to the extent that they do exist, there may already be manipulative risks present that are worth addressing.

To that end, in this chapter of my thesis, I present a study examining *existing* VR advertisements in order to identify manipulative techniques within them. Specifically,

I carried out a walkthrough of 87 Virtual Reality Marketing Experiences (VRMEs) to better understand the VR advertising landscape, and the manipulative risks they may exhibit. I further analyze the privacy policies of these VRMEs to understand what privacy risks they pose and whether user data is being used to power advertisements (e.g., to hyperpersonalize advertisements as predicted in Chapter III). By focusing on current VR artifacts and analyzing existing risks (as opposed to the prior chapter which focused on how risks may be in the future), this chapter provides a complementary perspective on the manipulative risks of VR advertisements.

A note on terminology: I use the term Virtual Reality Marketing Experiences (VRMEs) as opposed to VR advertisements to describe the VR experiences we analyzed because some of the VR experiences we encountered were hard to classify as strictly advertisements, such as a virtual movie theatre where one could watch trailers for a movie and purchase movie chapters to watch, or a branded game where one collected Dorito chips while avoiding enemies. However, these VR experiences still served to promote and market a good or service, and I wanted to include them in our analysis. The term VRME better described and encapsulated these types of experiences.

Through this work, I contribute a snapshot of the VR marketing landscape and a categorization of VRME types (Open-Ended Exploration, Journeys, Arcade-Style Marketing Experiences, Embodied Games, Virtual Showrooms, and Product Usage Simulation). I further identify multiple manipulative techniques in VRMEs, including heightened gamification; embodiment of characters; the recreation of distressing moments in VR; a lack of appropriate exit options; and proxemic interactions opening weblinks without user knowledge.

This study was conducted in 2021-2022 alongside Shwetha Rajaram, Selin Fidan, Gina Herakovic and Florian Schaub. I note that throughout this chapter I write using first person plural terms (e.g., 'we', 'our') to reflect the collaborative nature of this

study.

4.2 Manipulative Techniques in Marketing

In this section, I expand on the definition of manipulation in marketing that I discussed in Chapter II by diving into greater detail on concrete manipulative techniques that have been identified in the literature. These techniques form the basis of the walkthrough we carried out in this study. Knowing these techniques and why they are manipulative underpins the analysis in this chapter—understanding these techniques is crucial for understanding our approach and method.

4.2.1 Lying

Lying and deliberately misinforming consumers about a product is a manipulative technique since promoting falsehoods sabotages consumers' ability to make informed purchase decisions. Lying can take numerous forms; it can be as blatant as factual misinformation (e.g., saying a car has certain features which it does not) or more subtle (e.g., altering photos of products to make them seem more appealing, or having misleading graphs with misaligned axis and improper scaling) [63].

4.2.2 Appeals to emotion

Several marketing materials make appeals to emotion to increase their effectiveness. Emotions such as nostalgia [54], disgust [61], sexual arousal [64, 260], pleasure [64], humor [64], and fear [61] can impact how consumers respond to marketing [200]. In certain circumstances, emotional appeals can be considered a manipulative technique [63]. Rather than persuading consumers to purchase a product through argumentation, strong appeals to emotion could bias consumers' thought processes and override informed decision-making [63, 199].

4.2.3 Gamification

Gamification in marketing is the process of incorporating game-like elements and mechanics into advertisements [224]. Gamification can increase the effectiveness of a marketing appeal, although the exact mechanism by which this happens is still unclear [259, 262]. One popular theory is that gamification elicits positive emotions in consumers; consumers then associate these emotions with the product being advertised, making the product more appealing [259]. Another theory is that gamification makes marketing experiences more stimulative and interactive than non-gamified counterparts, which can overwhelm consumers [241]; this could mean that consumers have fewer cognitive resources to critically evaluate the ad's message and enact resistance strategies to counter the ad's persuasiveness [44].

We argue that gamification should be considered a manipulative technique since it follows the same mechanisms that define manipulative advertising: convincing consumers to buy a product using techniques that do not rely on informing a consumer about the product or allowing for informed decision making; instead, gamification relies on psychological techniques to subtly alter consumers' perception of the product.

4.2.4 Overriding consumers' resistance strategies

When consumers are exposed to marketing, they sometimes enact resistant strategies in response [95]. There are many different types of strategies, including avoiding the ad (e.g., by looking away, ignoring the ad, changing TV channel, or closing an ad), contesting and counter-arguing the ad, or self-validation (e.g., "I don't need this product!") [95].

Sometimes, marketers use techniques to counter consumers' resistant strategies [95]. To prevent consumers from avoiding ads, marketers may force consumers' attention to an ad (e.g., forcing consumers to watch an ad prior to playing a video, requiring consumers to take some action prior to skipping an ad) [95]. Marketers may use

the 'disrupt then reframe' technique, i.e., using a disruption or sudden twist in their messaging to distract consumers and reduce their ability to counter an ad's messaging [95]. One prominent case of this is the use of 'subtle' marketing that tries to hide the fact that it is marketing. Techniques such as product placement [226], native advertising [229], and advertorials [104] are all subtle and difficult to immediately recognize as marketing, meaning consumers may react differently to the message [95]. Since these techniques prevent consumers from making informed decisions, we argue that they are manipulative techniques.

4.2.5 Dark patterns

Dark patterns, or deceptive design, are intentional design choices aimed at "*mak[ing] you do things that you didn't mean to, like buying or signing up for something*" [39]. It is a broad definition covering a wide range of techniques, such as misdirection (design choices that force consumers' attention on one area to distract from another area), obstruction (unnecessarily making a process difficult in order to dissuade consumers from a certain action), or obscuring information from consumers (e.g., preventing accurate price comparisons) [39, 107, 168]. Some work has explored dark patterns in VR and related technologies [49, 252, 267]; for example, by changing what a user is seeing in a VR headset, it could be possible to redirect the user's interactions in VR and change what buttons they press, what objects they pick up, where the user walks to, etc. [49, 252]. This work, however, has often focused on dark patterns in VR standalone experiences rather than whether the dark patterns are in VR advertisements.

Dark patterns are by definition manipulative, since they attempt to guide consumers toward choices they otherwise would not make by deliberately sabotaging the ability to make rational and informed choices.

4.3 Method

To understand the current landscape of VRMEs and what manipulative techniques are present in existing VRMEs, we carried out the following steps: *(1)* developing a shared understanding and working definition of VRMEs, *(2)* assembling a corpus of VRMEs, *(3)* developing an analysis sheet and protocol, *(4)* carrying out a walk-through of each VRME.

4.3.1 Defining VRMEs

In our study, we define VRMEs as follows:

> *"A VR marketing experience (VRME) is a VR experience whose primary purpose is the promotion of a brand, product, or service."*

We emphasize the use of *primary purpose* in our definition. Many experiences could be said to promote brands, products, and services. For example, VR games that contain product placement are primarily games that entertain the user, but they also promote the product that is embedded. It is unclear, however, whether these experiences are relevant and would yield meaningful findings. Other 'gray areas' we considered included music videos, documentaries, and educational experiences. While the definition of advertising we use in Chapter II would encompass materials that helped promote a certain world view (as some documentaries might) it was a near-impossible task to separate VR experiences that were aiming to manipulate users into a certain mindset in order to persuade certain actions versus VR experiences were purely educational. As such, we scoped down our definition of VRMEs to experiences that primarily promote products and services in order to unearth richer insights from our data, rather than spending time and energy studying experiences that may not be relevant to this study.

For a similar reason, we excluded experiences that were *just* 360-degree videos. We

felt that a VR experience that was just a 360-degree video was going to be extremely similar to a traditional, non-VR marketing video. Thus, the insights gained from these types of experiences would provide little insight into evolving marketing approaches in VRMEs.

4.3.1.1 Examples of VRMEs

To illustrate the types of VR experiences we analyzed, we showcase two experiences that fall under the definition (see Figure 4.1). The first is *IKEA's VR Experience*.[1] It is a short experience which introduces users to IKEA furniture, allowing users to walk around a virtual house, explore furniture options and learn about them. The experience exists primarily to promote IKEA furniture, and so, it is a VRME. Another VRME is *Expedia Cenote VR*.[2] This VR experience, made by Expedia (a travel company), introduces users to the Cenotes, which are natural cave formations formed in the Yucatan Peninsula. It lets users walk around a virtual Cenote and displays facts about the Cenotes. At the end of the experience, users are encouraged to travel there in real life. Since the VR experience promotes tourism to the area, it is a VRME.

To ensure that members of our research team would implement our definition uniformly when determining whether a VR experience was a VRME, three of the authors analyzed 40 randomly sampled VR apps from the Steam Store[3] and independently classified them as being or not being VRMEs. We discussed examples where there was disagreement and categorized an additional 30 apps, until high inter-rater reliability was reached (Free-Marginal Kappa of 0.82 across three coders, which indicates high agreement).

[1] https://store.steampowered.com/app/611120/IKEA_VR_Pancake_Kitchen/
[2] https://store.steampowered.com/app/858380/Expedia_Cenote_VR/
[3] https://store.steampowered.com/vr/

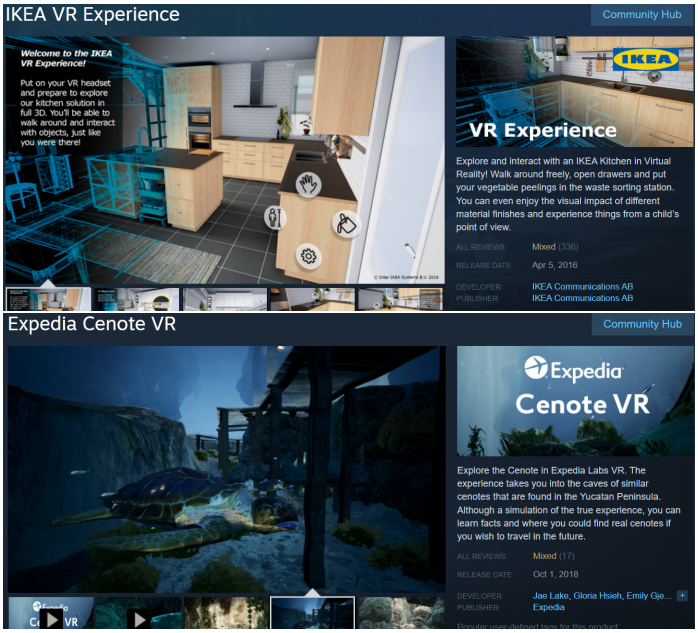

Figure 4.1: Two prominent VRME examples. (Top) A screenshot showing *IKEA VR Experience* experience on Steam. (Bottom) A screenshot showing *Expedia Cenote VR* experience on Steam.

4.3.2 Assembling a corpus of VRMEs

To assemble our full corpus, we searched for VR experiences from the Oculus Quest Store,[4] Oculus Rift Store,[5] and the Steam Store. We chose these stores because of their popularity and compatibility with commodity headsets (e.g., Oculus and HTC devices). Since there were no keywords we could use to filter our results and search for marketing experiences, we manually reviewed all listings in these stores. For the Oculus stores, we selected 'Browse All' for Quest[6] and Rift[7] to find all VR experiences. For Steam, we entered a blank search term, and filtered by VR Only and VR Supported.[8] To scope down our search, we did not include unreleased or 'early access' experiences. We also excluded experiences which did not offer an English version of the experience. In total, we reviewed 6,498 listings in the Steam store,

[4]https://www.oculus.com/experiences/quest/
[5]https://www.oculus.com/experiences/rift/
[6]https://www.oculus.com/experiences/quest/section/1888816384764129
[7]https://www.oculus.com/experiences/rift/section/1736210353282450/#/?_k=2grfip
[8]https://store.steampowered.com/search/?sort_by=Name_ASC&vrsupport=401%2C402

1,388 in the Oculus Rift store, and 341 in the Oculus Quest store, for a total of 8,227 listings analyzed. We assembled the corpus February to May 2022. Three authors subdivided these results to code the VR experiences, categorizing each app's status as being a VRME either as a *Yes*, a *No*, or *Maybe*, whereby *Maybe* served to flag uncertainty about an experience that should be reviewed collectively by the three coders.

To determine whether a VR experience was a VRME, the authors analyzed the app's description, metadata (e.g., price, genre, developer), trailer videos, and images, seeing whether the experience matched up to our shared definition of a VR marketing experience. Items we considered were: does the experience's store description explicitly mention it was a branded experience? Were there references to real-world brands and services present in the VR store page, either in the description or in the store page? Did users post comments on the VR store page mentioning that this was an advertisement? Does the experience cost a lot of money to purchase (in which case it is likely that the VR experience is not a marketing experience, but rather, a standalone product), or is it free?

For example, one experience we classified as a VRME is *Beyond Tokyo*.[9] We determined this was a VRME in the following ways. First, the experience heavily promoted Japan and travel to Japan with statements such as *"With Beyond Tokyo, we're excited to share all this with you, in virtual reality, so you could be as excited as we are in exploring Tokyo, and eventually travel there in real life as well"* in the description. Second, one of the publishers is All Nippon Airways, a Japanese airline company. Although the experience costs money ($4.99), the description and the fact that it was made by a Japanese airline company led us to believe this was a VRME that promoted tourism to Japan.

Through this process, we analyzed and labeled all experiences across the stores.

[9]https://store.steampowered.com/app/884460/Beyond_Tokyo/

After removing duplicates across stores, we identified 71 *Yes* and 721 *Maybe*. Then, we collectively reviewed the *Maybe* examples and decided whether to include then in our corpus following a discussion and majority voting. This yielded a corpus of 106 VRMEs. We closely inspected the 106 VRMEs and determined that seven were out of scope. Furthermore, 12 had tech issues which we could not resolve. Three experiences did not have English versions, and so were excluded from analysis. After removing these experiences, our final sample consisted of 87 VRMEs. Out of these experiences, 73 were from the Steam store and 30 from the Oculus stores. 16 experiences were found in both stores.

4.3.3 Developing the analysis sheet

With our corpus assembled, our next step was developing an analysis sheet to guide the walkthrough [175]. The goal of this analysis sheet was to provide a way for us to capture relevant information about the VRME, including what manipulative techniques were present in the experience.

We created an initial version of the analysis sheet by synthesizing related work on manipulative advertising and VR advertising. We then selected a random sample of VRMEs from our corpus and examined them using our analysis sheet, iteratively improving and refining our analysis sheet until we were satisfied with the level of detail it provided. After several rounds of iteration, our analysis sheet captured the following.

First, we captured *basic information* about the VRME. This included the title and URL of the experience; the year the VRME was published; the store in which it was published; the type of product being advertised in the VRME; the number of reviews the experience had (as a rough proxy for how many users had used the experience); the rating of the experience; and what devices the experience supported. All this information could be found on the store page itself without opening the app.

Second, following Alcañiz et al. [8], we captured the interaction techniques in the experience. Thus, our analysis sheet captured information about whether the experience was 6DOF or 3DOF, the input and output mechanisms, and the types of movement allowed in the experience. Inspired by Herskovitz et al. [120], we further examined the types of interactions allowed in the experience (Observing content, Creating content, Transforming content, Activating content).

Third, to capture what manipulative techniques were present in the experience, we studied the literature for prominent manipulative techniques we could expect to find in VR marketing (see Section 4.2 for details). Thus, we included sections in the analysis sheet to capture the level of gamification in the experience; the setting in which the experience took place (e.g., fantasy, science fiction, etc.); what appeals to emotion were present in the experience; whether the user embodied any avatars or characters within the experience; and whether there were any dark patterns present in the experience. Furthermore, we familiarized ourselves with marketing literature to understand what the broad principles behind manipulative techniques are, and we made a space to note down any additional manipulative techniques we might find. This provided the flexibility to account for novel manipulative techniques that are not found in prior literature. We did exclude one manipulative technique from our analysis: that of lying and misinformation. We did this because it was not feasible to measure deception. To truly test whether a VRME was deceptive, we would have to have access to the products and services these goods were promoting, and do a cross-comparison to see how accurately these products were portrayed in the VRME. This was both time and materially prohibitive.

A full copy of the analysis sheet can be found in Appendix A.

4.3.3.1 How did we capture emotion?

Capturing emotion or emotional appeals was a tricky prospect compared to other manipulative techniques that were easier to capture and record. Emotions are highly subjective, and dependent on who is experiencing the content and what emotion it generates in them. Two people could play through the same VRME and experience different emotions. In the marketing literature, emotions are often captured using validated scales where participants rate what emotions they felt when undergoing an experience [152, 271]. However, this requires a large number of participants to watch the marketing materials and report their emotions. Using this approach within the research team did not seem appropriate.

Instead, rather than capturing what emotions we felt when playing through the VRME, we captured what emotions the advertiser likely *intended to elicit in consumers*. For example, was there sexually suggestive imagery or audio (implying the VRME is trying to elicit sexual arousal)? Were there jumpscares (implying the VRME is trying to elicit fear)? Were there jokes (implying the VRME is trying to elicit humor)?

To understand what emotions to capture, we read relevant marketing literature [10, 54, 61, 64, 81, 200] to identify prominent emotions advertisers have used to market products: disgust, excitement, fear, guilt, humor, joy, nostalgia, sadness, and sexual arousal. We also left space to note down other emotions that the VRME may be eliciting: this gave us the flexibility to capture emotions that were not captured in the above list.

4.3.4 Analyzing VRMEs

Analysis of the VRMEs was done collectively by multiple authors, with at least two authors analyzing each experience. I was present for the analysis of all VRMEs.

We used a walkthrough approach to analyze the VRMEs [157, 245]. Walkthroughs

are systematic playthroughs of software artifacts where the objective is for the researchers to use an app, software, or program as it is intended to be used by users [245]. Walkthroughs imitate everyday use of a product in order to understand how users would experience this product, and can be used to surface issues or tensions in a product, such as issues relating to usability of an app [245]. Walkthroughs have been used to study technologies such as mobile apps [157], multi-media authoring tools [131], office systems [134], and digital reading systems [13].

In our walkthroughs, one author was assigned to play through the app, with the goal of completing the experience from start to finish, encountering all of the immersive content and interactions it had to offer. For diegetic experiences, we followed the in-app guidance to explore the scenes (e.g., voice over, text instructions, visuals cues for which objects to interact with or where to navigate to). For apps which offered free exploration, we attempted to navigate to all visible locations in the scenes, click all 2D UI elements, and select salient 3D objects to trigger subtle or hidden interactions. Experiences were analyzed using either an Oculus Rift, an HTC Vive, or an Oculus Quest, depending on what headset the VRME supported. The other authors were tasked with watching the live-streamed first-person view of the experience on a monitor and taking notes in the analysis sheet. To ensure that we discovered as many elements of the scene as possible, we watched the trailer videos and read other users' comments on the app store pages to surface any additional interactions we may have missed in our initial play sessions. We recorded first-person video of each session.

After playing through the experience, members of the research team collectively discussed the experience, and revised and updated the analysis sheet as needed.

4.3.4.1 VRME category creation using affinity diagramming

To better understand the types of VRMEs in our sample, we used affinity diagramming [223] to group them based on their similarities. We accomplished this through

the online tool Miro.[10] We were particularly interested in understanding the different VRME formats, the interaction techniques and types they allowed, and how different products were portrayed within a VRME. We were also interested on whether there were particular clusters of VRMEs that allowed for the same interaction, or that portrayed products in a similar manner.

This grouping allowed us to create a categorization of the VRMEs we had discovered. For each grouping, we identified the factors that linked the experiences together, using these to characterize the grouping and inspire the naming for the category. While some classifications of virtual marketing already exist in prior work [227, 269], their classifications are much broader in scope—including AR marketing and the use of in-store VR marketing—than the VRMEs we analyze. We analyze a specific type of VR advertisements; standalone VR marketing apps experienced through commercial virtual reality headsets. Thus, our categorization helped us better understand VRMEs on a much narrower scale.

4.3.4.2 Privacy policy analysis

One manipulative technique identified in Chapter III is how VRMEs might collect vast quantities of user data, which could be used to hyperpersonalize experiences for consumers in ways that target their vulnerabilities. As such, we wanted to see whether VRMEs collected users' data to personalize experiences.

To observe whether this practice was occurring, we studied the privacy policies of VRMEs. Specifically, we documented whether VRMEs had a privacy policy, or another document that described its data collection practices (e.g., EULA or ToS). One author, who had experience analyzing privacy policies, documented what data the VRME collected and whether this data was used to personalize and target the experience towards users.

[10] https://miro.com/

4.3.5 Limitations

Here we discuss limitations of our approach.

One limitation was how we inferred whether a VR experience was a VRME. Unfortunately, there were no 'objective' metrics to determine whether an experience was a VRME or not, such as a store tag or other indicator. Within this context, our approach (having multiple people agree on a definition and independently rate experiences as VRME or not, as well as leaving room for questionable experiences for the whole research team to discuss) seemed reasonable and we are confident that it yielded a reliable classification.

We acknowledge that there may be VR experiences that could be classified as VRME that we might have missed in our analysis, and some VR experiences which we classified as VRMEs which others may have excluded. We do not make authoritative claims to have found *all* VRMEs or that these are the only manipulative techniques that are being used. However, we did review *all* VR experiences that we could find in two popular stores, giving us reasonable confidence that our data has provided a comprehensive snapshot of the VRME landscape and the manipulative techniques being used at the time of analysis. Future work can and should cover gaps that we may have missed, such as exploring other stores (e.g., Viveport, SideQuest), analyzing potential gray areas, and repeating this study in a few years to assess how VRMEs may have evolved.

Another limitation is how we identified manipulative techniques within an experience, particularly appeals to emotion. Rather than looking for 'objective' features and traits, the search for manipulative techniques was somewhat subjective by nature. This is a limitation inherent to qualitative methods such as the walkthrough approach we used here; since the researcher is the measurement instrument, findings may vary depending on the subjective experience of the researcher [264]. We tried to ameliorate this by having at least two researchers analyze each experience and

familiarizing ourselves with appropriate literature beforehand so we had a thorough understanding of the traits we were looking for.

4.4 Findings

In this section, I describe the findings of our study. We start by characterizing the VRMEs in our corpus; specifically, we describe the basic information of the 87 VRMEs we analyzed, including the years the VRMEs were published, the length of each experience, and the products they were advertising. Of note, we discover a large number of publishers and developers making VRMEs, and many different types of products being advertised through VR. We then describe the VRME categories we identified through affinity diagramming: Open-Ended Exploration, Journeys, Arcade-Style Marketing Experiences, Embodied Games, Product Usage Simulation, and Virtual Showrooms. We follow this with the key manipulative techniques we discovered in our corpus, including high levels of gamification and appeals to emotion; the use of distressing events to promote products; and a lack of quick exit options. We conclude by discussing the findings of our privacy policy analysis, where we find that numerous VRMEs do not offer a privacy policy; and for those VRMEs that have a privacy policy, most are an umbrella privacy policy that is not specific to the VRME.

4.4.1 Corpus characterization

The VRMEs were released from 2015 to 2021. Most experiences were released in 2017 (27) and 2016/8 (16 each). Interestingly enough, there seems to be a downwards trend in number of VRMEs released, with only five experiences published in 2020 and nine in 2021. We speculate this could be due to the COVID-19 pandemic leading to a depressed output.

We saw a wide range of products being advertised, including Movies and TV Shows (21), Technology (14), Tourism (12), Food and Beverage (8), Housing and Design

(7), Careers (6), Video Games (6), Automotive (5), Education (3), Miscellaneous (3) (including a VRME promoting paint, one promoting chainsaws, and one promoting hot tubs), and Sports (2). We also saw a wide number of publishers and developers behind the VRMEs. For the 87 VRMEs, there were 81 different developers and 82 different publishers. The maximum number of VRMEs per publisher or developer was two experiences.

We used the number of reviews as a proxy for how popular these experiences were. VRMEs had mostly low usage rates, with a median number of 23 reviews across both stores. However, a few VRMEs were very popular, with reviews in the hundreds or even thousands. These were mostly VRMEs related to promoting movies, such as *Jurassic World: Apatosaurus* (23,311 reviews), *Spider-Man: Far From Home Virtual Reality* (1,767), or *Coco VR* (924).

In the Steam store, experiences were split between positive ratings (26) and mixed (21). Only four VRMEs had negative ratings. A further 24 VRMEs had too few reviews to determine a rating (Steam requires a minimum number of reviews before issuing an official rating). In Oculus, the ratings were slightly more varied. Seven VRMEs had a rating of 4 stars or above (out of 5). Three VRMEs had a rating of 3-4 stars out of 5. Four VRMEs had a rating of 2-3 stars, and only one VRME had a rating below 2 stars. Overall, this would indicate that users of these VRMEs are mostly enjoying them. However, we must heavily caveat these results due to self-selection bias in which users leave reviews, as those are people who downloaded the VRME and made the effort to post a review. Thus, these opinions may not represent the views of the average VR user.

In terms of length, the experiences were relatively short, with a median length of 13:05 minutes, a mean of 14:53, a minimum of 2:18 and a maximum of 45:00. These times are to be taken with a grain of salt. Some experiences are technically endless (e.g., an experience where one can openly explore a city at their own pace); other

VRME times depended on our own ability to complete tasks.

4.4.2 VRME categories

Through affinity diagramming, we grouped the VRMEs into six overarching categories: Open-Ended Exploration, Journeys, Embodied Games, Arcade-Style Marketing Experiences, Product Usage Simulation, and Virtual Showrooms. These categories are not mutually exclusive—some VRMEs can ostensibly be part of multiple categories. We grouped experiences into categories based on a number of prominent dimensions, including the level of interactivity; the level of gamification; the ways the product was embedded in the marketing experience; the type of product being advertised; and the linearity of the experience. Next, we describe the six categories we identified and how they relate to the above dimensions. A full list of the VRME categories can be found in Table 4.1.

4.4.2.1 Open-Ended Exploration

In VRMEs within this category, users spawn in a main area from which they can choose to warp or spawn to multiple other areas. In each area, the user is presented with information about that area—such as a 360-degree video or photos, text blurbs, and occasional mini-games. Once those have been viewed, the user is returned to the main area, from which they can visit other areas to see more educational information (or revisit areas they have already visited). These information blurbs often provided information about the product.

ScreenSkills—First Day on Set is an example of a VRME in this category. This experience advertises jobs within the film and theatre industry by placing the user in a 360-degree photo-sphere of their first day on set, from which different way-points could be accessed. Each way-point took the user to locations from which different 360-degree videos would play, explaining what a certain job on set entailed (e.g.,

Table 4.1: Table showing VRME categories, what products were associated with each VRME category, and whether there were any manipulative experiences associated with that category

VRME Categories	**# Exp.**	**Description**	**Primary Product Types**	**Main Manipulative Techniques**
Open-Ended Exploration	18	Users freely explore an area and can warp to different 'zones' to learn information about a product (e.g., through 360 videos or text blurbs)	Mostly Tourism, but other product types use this VRME category as well	Appeals to emotion Lack of appropriate exit options
Journeys	13	User is taken on a scripted, linear experience (or journey) across various landscapes. Limited forms of interaction	Wide variety of products	Appeals to emotion Lack of appropriate exit options
Embodied Games	14	User embodies a specific character (e.g., a super hero) and plays through a narrative game as that hero	Almost exclusively Movies / TV Shows	Embodying avatars Appeals to emotion Lack of appropriate exit options Gamification
Arcade-Style Marketing Experiences	11	Short, simple minigames with high replayability value	Mostly Food and Beverage, but other product types use this VRME category as well	Appeals to emotion Lack of appropriate exit options Gamification
Product Usage Simulation	8	Users get to 'test out' products in a virtual environment	Wide variety of products	Gamification Lack of appropriate exit options
Virtual Showrooms	23	Users are placed in a virtual room resembling a shop floor or a showroom where users can examine a virtual recreation of a product	Housing and Design, Videogames, and Movies / TV Shows	Lack of appropriate exit options

make-up artist or sound technician).

Another VMRE in this category was *Daylight's End VR Edition*. In this VRME, users spawned in an abandoned warehouse in a dystopian, zombie-infested landscape. The user had a gun and could shoot at items in the warehouse, but could not move outside of the warehouse. In the warehouse, the user had the option to watch various trailers for the movie "Daylight's End," and purchase various chapters of the movie.

For the most part, Open-Ended Exploration experiences were in the middle in terms of interactivity. These experiences allowed users to walk around and explore areas at their own will; however, the environments were not very responsive to user inputs. Open-Ended Exploration usually ranked low in terms of gamification, although some VRMEs in this category did have small mini-games or sections that were gamified. As the name implies, these sections were usually open-ended and were not very linear. The products were usually directly embedded in the experience, in that the VRME usually allowed the user to learn more about a certain product (e.g., learn more about a tourist destination prior to going there).

We identified 18 experiences in this category. Most related to Tourism (9) but several other categories were promoted using this VRME type, such as Movies and TV Shows (3), Careers (2), Sports (1), Education (1), Automotive (1), and Food and Beverage (1).

4.4.2.2 Journeys

Journeys occur when a user is taken through a linear walk-through in VR. While there may be limited forms of interaction (e.g., the user has to press a button in order to advance or can choose what doorway to enter), for the most part, the experience is scripted and the user has little control over where to go or what to interact with. Journeys were often set in unusual locations made possible through VR. Examples included walk-throughs of the human body, voyages through fantastical lands, or

Figure 4.2: A screenshot of the *WellTown* VRME, which belongs to the Open-Ended Exploration VRME Category. In this VRME, the user could warp to several areas in New Zealand, where they would be presented with useful information about New Zealand culture and various New Zealand attractions.

journeying through space and time.

For example, in *SpaBerry: VR Experience* the user is placed in a SpaBerry hot tub, with a narrator explaining various features of the hot tub. Concurrently, the hot tub teleports across various locations (a desert, a snowfield, and a forest), At one point, the user can use voice commands to change the color of the hot tub and activate or deactivate bubbles in the hot tub (showcasing the voice recognition software of the hot tub). See Figure 4.3 for a screenshot of the experience.

Another example is *Kellogg's Gut Bacteria Reef*. This VRME takes the user on a narrated journey through the human body via a molecular-sized submarine. The user is guided through the body to learn about the diverse organisms of the gut. The user is also tasked with creating a healthy gut flora, choosing between fruit, nuts, and Kellogg's cereal, and shooting these out of a cannon to defeat the bad bacteria.

BeefeaterXO is a journey that leads the user through three dreamlike scenes intended to introduce different products by creating various fantasy environments around them. The experience included strange and distressing scenes such as fighting a cyclops in a Muy Thai ring, or a voice telling the user to choose between being a

Figure 4.3: A screenshot of the SpaBerry VR Experience. In this VRME, the user was transported across various landscapes whilst a narrator explained the benefits of owning a SpaBerry.

slave or a pig.

We found 13 experiences that matched this category, with a wide variety of products being promoted: Movies and TV Shows (4), Food and Beverage (2), Automotive (2), Technology (2), Education (2), and Miscellaneous (1)

4.4.2.3 Embodied Games

In Embodied Games, the user takes control of a character and proceeds through a narrative in which the user must complete several objectives as that character. Oftentimes, these characters were ones that formed part of an existing media franchise (e.g., movies and TV shows). These experiences were highly gamified, at times being almost indistinguishable from ordinary games. Embodied games were often linear.

For example, in *Spiderman Far From Home Virtual Reality*, the user embodies the superhero Spiderman. Playing as Spiderman, the user utilizes Spiderman's powers (shooting spider webs out of their hand) to defeat a giant robot monster from destroying a fictionalized New York City.

In the experience *Virtual Cop*, narrated by a virtual police dog, the user becomes a New Zealand police officer trainee. The user is immediately sent to investigate an

Figure 4.4: A screenshot of the *Virtual Cop* VRME, which is part of the Embodied Games VRME category. In this VRME, the user embodied a rookie police officer and their first day in the station, where they learned about being a police officer and completed various tasks as the police officer. In the screenshot, the user is investigating a crime scene.

active burglary situation. From there, the user is able to choose between a tour of the police station, learn about community policing and police communications, or continue working on the active investigation. See Figure 4.4 for a screenshot of the experience.

In *HBO's Silicon Valley: Inside the Hacker Hostel* the user is placed into the TV series world of Silicon Valley, and is tasked with completing a "to-do" list by exploring the environment around them. Tasks were centered around the TV series, as well as interactions with characters within the show.

There were 14 experiences in this category, with 13 of those experiences relating to Movies and TV Shows, and one relating to Careers.

4.4.2.4 Arcade-Style Marketing Experiences

Arcade-Style Marketing Experiences are short, simple games with high replayability, where the objective is maximizing a score. Unlike Embodied Games, Arcade-Style Marketing Experiences are not linear, and users play as themselves rather than a specific character. Oftentimes these VRMEs had local or even global leader-boards, encouraging users to compete against others. These experiences were highly gamified

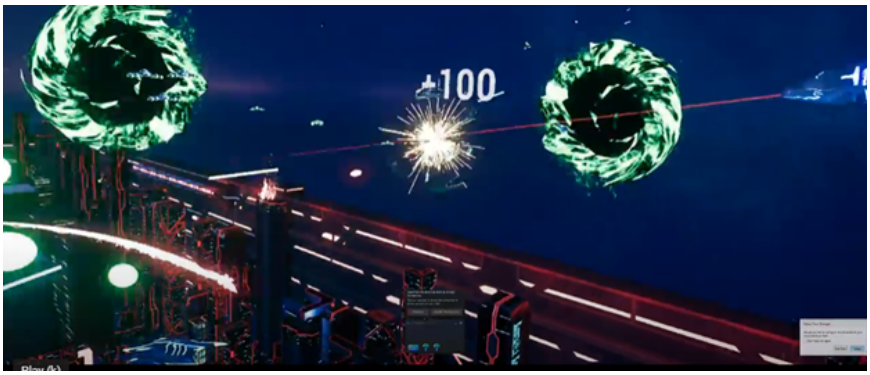

Figure 4.5: A screenshot of the *MSI Electric City: Core Assault* VRME, which is part of the Arcade-Style Marketing Experiences VRME category. In this VRME, the user is tasked with protecting a virtual city (which resembles an MSI motherboard) from invading spaceships. The user can shoot lasers using their controller. The user gets points for every ship they destroy.

and interactive.

One example is *Gatorade's Beat the Blitz*. The experience begins in an American Football stadium, with former football quarterback Peyton Manning narrating the user through the experience. The user plays a game where they have to throw footballs through rings while avoiding enemy tackles. With each hit from the opponent players the user's screen would blacken around the edges indicating one's "Gatorade hydration meter" (symbolized as six orange bottles on the big screen) had decreased. Once the user's hydration meter reaches zero the screen fades from flashes of red to black. From there Peyton Manning guides the user through the human body to highlight the importance hydration has for your heart and brain's optimal function. The player then returns and can play again to beat their high score.

MSI Electric City: Core Assault begins in a futuristic cyberscape environment with a menu offering two modes of game play, time attack and survival mode. Within the game, users are tasked with defending an MSI motherboard from attacks from enemy spaceships by shooting at these spaceships using the VR controllers. See Figure 4.5 for a screenshot of the experience.

We identified 11 experiences in this category, with a wide variety of products being

advertised. Most related to Food and Beverage (5), but other categories included, Technology (2), Careers (1), Miscellaneous (1), Video Games (1), and Tourism (1).

One interesting feature of Arcade-Style Marketing Experiences are the various ways that products are embedded in these VRMEs. For some experiences, the user would directly interact with a product being advertised (e.g., one experience had users directly cook Ichiran Ramen noodles). In other experiences, products appeared in the game, as either interactive objects or collectibles that would grant users special powers and abilities. Lastly, some products featured prominently as part of the background or world the player is in, but were not a product the user actively uses or engages with in the game.

4.4.2.5 Product Usage Simulation

Product Usage Simulations allow users to try and test out products in a virtual and sometimes gamified environment. These experiences were often short and highly interactive.

For example, *Camera Simulator by Canon Labs* begins with a menu where the user can customize different aspects of a Canon camera. The user is then transported to a virtual environment such as a forest, where they can teleport to different points, take photos, and further customize camera settings. See Figure 4.6 for a screenshot of the experience.

B. Braun Future Operating Room showcases the potential of surgery in the future by transporting the user into a futuristic nanobot simulation wherein they are tasked with removing damaged vessels from different areas on the patient's body. At the end of the experience, the user is presented with achievements labeling them as doctor.

While there is some similarity to Arcade-Style Marketing Experiences, in Product Usage Simulation, all experiences center around trying out a product one will eventually purchase or use. This felt substantially different from Arcade-Style Mar-

Figure 4.6: A screenshot of the *Camera Simulator By Canon Labs* VRME, which is part of the Product Usage Simulation VRME Category. In this VRME, the user uses a Canon Camera to talk pictures of a fantastical landscape. In this screenshot, the user is in the process of taking a picture through the Canon Camera.

keting Experiences where the product may feature mostly in the background: in Arcade-Style Marketing Experiences, the product may be an interactive object, but the VRME is not meant to be a preview of what the product can do or how it will act in real life. In Product Usage Simulations one feels as though one is using the actual product, rather than simply being exposed to the product.

We found 8 VRMEs in this category: Technology (3), Careers (1), Housing and Design (1), Education (1), Tourism (1), and Miscellaneous (1).

4.4.2.6 Virtual Showrooms

In Virtual Showrooms, users are placed in a showroom or shop floor, where they can see digital recreations of the products that are being advertised. The user can freely walk around the floor to examine the product from various viewpoints, and can sometimes interact with the product in a limited fashion (e.g., lifting it up or changing its color).

Figure 4.7: A screenshot of the *Relay Cars* VRME, which is part of the Virtual Showroom VRME Category. In this VRME, the user could walk around a virtual shop floor, look at various cars, and learn more information about them.

For example, *RelayCars* provides the user the ability to view, customize, and learn about an assortment of different vehicles. The user also has the option to step inside a 360 photosphere of each selected car. See Figure 4.7 for a screenshot of the experience.

The Emirates VR Experience gives the user the option to explore a Boeing 777 and A380. The user can openly explore and interact with the Boeing 777's economy, business, and first class cabins, as well as the A380's first class cabin, spa, and lounge area.

This VRME category is similar to Product Usage Simulations, except that in virtual showrooms one *observes* the product being sold, whereas in Product Usage Simulations one *uses* the product being sold. To highlight this distinction, we look at *IKEA VR Experience* (a virtual showroom), and *IKEA VR Pancake Experience* (virtual product usage). In *IKEA VR Experience*, the user gets to walk around a virtual house and observe IKEA furniture to learn more about the furniture items. In *IKEA VR Pancake Experience*, the user does not just observe IKEA products; they use IKEA kitchenware to make pancakes for their family. Moreover, Product Usage Simulation were usually highly gamified, whereas virtual showrooms did not have many game-like elements. Virtual Showrooms are also similar to Open-Ended exploration; the key difference between them is that Virtual Showrooms take place in a single room or area and focuses on digital recreations of products to be sold,

whereas Open-Ended Explorations allow users to travel to multiple location and the focus may not be directly tied to the product that is being sold (e.g., it could be information about a company more broadly).

We identify 23 VRMEs that belong to this category; Housing and Design (7), Movies and TV Shows (6), Technology (6), Automotive (2), Food and Beverage (1), and Tourism (1).

4.4.3 Manipulative techniques

In our analysis we identified a number of manipulative techniques used by VRMEs in our corpus. VRMEs make use of gamification and interactivity; embodying avatars; and appeals to emotion. We also note the use of distressing events and controversial tasks as manipulative and potentially harmful techniques. More often than not, VRMEs do not provide adequate exit options to users. Lastly, two VRMEs used proxemic interactions to open web links without a user's knowledge, which we identify as a dark pattern with potential security risks.

4.4.3.1 High levels of gamification

Most VRMEs we saw had some level of gamification. Several (27) VRMEs were very game-like and indistinguishable from ordinary games. But even those experiences that were not games still had game-like components in them, such as playful interactions with objects (being able to pick up and throw objects around), mini-games embedded within VRMEs that had their own high scores and objectives (e.g., how many pancakes the user can cook in two minutes), or lights and sparkles appearing when a user presses a button or selects an option. All of these showcase highly gamified, interactive, playful VR marketing experiences. Some VRME categories were more gamified and interactive than others; Embodied Games and Arcade-Style Marketing Experiences were very gamified, whereas Journeys and Virtual showrooms

were less gamified. However, even the least gamified VRMEs still had interactive techniques that could be classified as game-like and/or playful.

Gamification in of itself is not particularly harmful or dangerous, and in fact, can make VR experiences more fun and enjoyable. However, in the context of advertising, gamification can impact the effectiveness of a VRME in manipulative ways by falsely associating the positive emotions of play with the brand being promoted [259]. This could subvert the way a user processes a VRME's message and their decision on whether to purchase a product.

4.4.3.2 Embodying avatars

We found many VRMEs (35) that had users embody certain avatars or personas. This technique was most present in Embodiment Games. In some VRMEs, the user embodied an avatar with a specific goal in mind, such as a rookie football player learning to improve their skills, a person on their first day on the job, a police recruit, or a boxer in a boxing ring. Of these VRMEs, a subset (14) had users personify characters from existing franchises. Some of these characters were famous and established characters (e.g, in *Spider-Man: Far From Home Virtual Reality*, the user played the part of Spiderman), and others were unknown characters in existing franchises (e.g., an unknown member of the Resistance helping out Han Solo escape capture by Imperial forces, set in the Star Wars universe). A few VRMEs (4) ascribed certain traits and characteristics to users—so while no specific characters were embodied, certain traits and features were. For example, *IKEA VR Pancake Kitchen* was an experience where users had to cook pancakes for their family. Thus, while no specific character was embodied, one did embody being a parent and having a family to take care of. Other traits that were embodied included being wealthy or being a pet owner.

The embodiment of avatars can influence how users perceive a VRME's message. If a VRME features a product heavily and it has users embody positive traits, users may

subconsciously associate that product with the desired trait—a type of associative advertising [199]. Alternatively, playing as a specific character may make users act in ways similar to that character, or possibly identify more with that character [5, 27, 94].

4.4.3.3 Appeals to emotion

Several VRMEs appealed to a user's emotion. These emotions included: excitement (38), joy (25), fear (30), humor (24), disgust (7), cuteness (6), nostalgia (4), sexual arousal (4), guilt (3), and sadness (2). Furthermore, we noticed that the VRMEs might induce emotions in users in an *indirect* manner. We call this indirect because it is unclear if the developers deliberately wanted to elucidate these emotions in users or whether it was a by-product of the nature of the VMRE. These emotions were frustration (when a VRME required us to complete a task, and we were unable to complete it), elation (when we succeeded at completing a particularly difficult task), and nausea (in the case of badly optimized experiences which caused dizziness). Appeals to emotion were common across all VRME categories, with the exception of Virtual Showrooms, where appeals to emotion did not feature as prominently.

Certain emotional appeals can be considered manipulative [63], especially in cases where the emotion is felt strongly enough to sabotage the user's thinking process. Particularly the use of sexual imagery [64, 260], humor [64], and nostalgia [54] can increase a marketing campaign's effectiveness. This is especially critical in VR, where emotions could be felt more strongly and viscerally than in a non-VR medium [191].

4.4.3.4 Distressing moments recreated in VR

Expanding on the idea of appeals to emotion, we found that several (16) VRMEs subjected users to particularly distressing experiences in VR. These included falling from a building, dying, passing out due to dehydration, being eaten alive by a snake, and being hunted by aliens (see Figure 4.8 for the example of dehydration). As out-

Figure 4.8: A screenshot of the *Beat The Blitz* VRME, where the user is passing out due to dehydration. As can be seen, the vision is narrowing and turning red. During the experience, loud palpitations were heard.

lined above, the use of fear can be manipulative, especially in particularly distressing situation. More worryingly is the possibility that these experiences could cause emotional harms upon users.

A corollary to this finding is how a few VRMEs (3) had users enact what could be perceived as controversial activities–tasks that users may have moral objections to. In our analysis, we identified smoking drugs out of a bong, jumping off a building, and shooting oneself in the head as such activities. Most of these activities were optional, but some were required to play through the experience.

Similar to the appeals to emotion, distressing events were not tied to any specific VRME category, although we did not see them used in Virtual Showrooms.

4.4.3.5 Lack of appropriate exit options

For a lot of VRMEs (51), once the user started a VRME, it was very difficult to pause or exit the VRME. To quit the VRME, one had to either fully exit the experience using the built-in Oculus or Vive menus (i.e., a lengthy press of the Oculus/Vive button), or physically remove the headset. As a consequence, it became very difficult to exit these VRMEs. The lack of appropriate exit options was common across all VRME categories.

The lack of appropriate exit options is not unique to VRMEs as it seems to be a common feature of other types of VR applications. However, it is particularly concerning in the context of marketing since it limits a user's ability to avoid and resist marketing messages [95]. Furthermore, the (in)ability to skip ads is a health and safety issue; as outlined above, there are some VRMEs with distressing content that could cause emotional harm to users. There may be VRMEs with other harms, such as VRMEs that contain flashing images; VRMEs that contain excessively loud noises; and badly-optimized VR advertisements that induce motion sickness in the user. If consumers cannot easily skip VRMEs, they may be subjected to these harms.

We did want to highlight that some VRMEs allowed users quickly and easily exit the experience. *We Happy Few: Uncle Jack Live VR* had a toy lighthouse labelled "Exit" within easy reach of the user at all times; at any time, the user could pick up the lighthouse and exit the experience (at least to the main menu). Other examples had exit options near the controllers, (e.g., one could turn the VR hand controllers and use the other hand to click on an exit button), or easy 'pause' buttons from which one could exit.

4.4.3.6 Proximity used to trigger actions

Two experiences (*Expedia Space Needle VR* and *Expedia Cenote VR*) used the user's location in VR, e.g., standing in a certain spot, to open a link in the user's web browser. There was no indication within the app that standing in that spot would open a website, or that one had been opened—it was only visible once one had exited the app that the website had been opened.

As a consequence of this technique, users may inadvertently open links they do no want to open. In these two VRMEs, the links opened to a booking page for the relevant tourist destinations. However, one could imagine this technique being used to open different links, such as a shopping cart or checkout page, or even malicious

links (e.g., to malware).

4.4.3.7 A note on misleading experience marketing

One manipulative technique that I speculated on in Chapter III is that of misleading experience marketing, in which VRMEs might use misleading digital recreations of products to deceive consumers. While our study did not explicitly assess whether product depictions were accurate or deceptive, we noticed several VRME categories in which deception could take place and would be particularly harmful. Many VRMEs, most prominently in the Open-Ended Exploration category, made factual claims about the world, in an attempt to educate or teach the user about the world. If these claims are false or misleading, it could deceive consumers into certain actions. *Kellogg's Bacteria Reef* was a Journey VRME where users took a tour of the human gut. Part of the VRME involved a narrator explaining that fiber is essential to have a healthier gut—fiber that conveniently is present in Kellogg's cereal. If this information is incorrect, then this may deceive consumers into making purchases under erroneous assumptions of how the world works. Similarly, Virtual Showrooms and Product Usage Simulations would be particularly prone to misleading experience marketing, since they directly show the products a user would purchase.

Another possible deceptive practice we observed occurred with how certain products were represented. For example, *NBA 2KVR Experience* was an Arcade-Style Marketing Experience where the user had to play basketball. A user could select various power-ups in the form of energy bars and drinks; for example, buying a Gatorade drink improved one's accuracy in-game, or buying a G-Fuel protein bar increased one's in-game stamina. It could be argued that this marketing technique offers a distorted view of the usefulness of these products; maybe users leave the experience thinking that drinking Gatorade drinks does increase one's basketball shooting accuracy in real life, similar to how it increased it in-game. See Figure 4.9 for details.

Figure 4.9: A screenshot of the *NBA2K VR* VRME, which is part of the Arcade-Style Marketing Experiences VRME category. In this VRME, the user competes in several basketball minigames (e.g., shooting hoops). As shown in the screenshot, user can buy several products such as Gatorade or G-Series energy bars to increase one's quickness, accuracy, or stamina within the game.

These examples demonstrate the *potential* for deception in these VRME categories, even though we want to reiterate that we did not empirically evaluate whether any of the marketing messages are misleading.

4.4.4 Privacy policy analysis results

We studied the privacy policies of the VRMEs to assess their privacy risks, see whether they collected user data, and whether they used this data to tailor and target the VRME towards individual users (e.g., alter content towards a user's preferences and tastes). 26 VRMEs provided working links to a privacy policy; a further 12 VRMEs provided a link to either an End User License Agreement (EULA) or a Terms of Service (ToS), but not a privacy policy. All these links were found in the store page, with none being shown within the VRME. The presence of these links was highly correlated with the store the experience was found in; all VRMEs in the Oculus stores provided a privacy policy and/or Terms of Service, as Oculus requires a privacy policy link as part of the publishing process. In contrast, only 17 out of 73 VRMEs on the Steam store provided a privacy policy or an EULA. In fact, 13

experiences that were present in both Steam and Oculus stores provided a privacy policy in the Oculus store, but not in the Steam store. Out of the experiences that had privacy policies, EULA, or ToS documents, 29 collected some information about users, and 23 mentioned using the data to either personalize or target advertisements and marketing materials.

One interesting note is that 24 VRMEs linked to privacy policies or terms that were not specific to the VRME, but rather, were umbrella policies of the publisher. For example, the VRME *Spiderman: Far From Home Virtual Reality* was developed by Sony, and the privacy policy it provided was Sony's overarching privacy policy [11] rather than one specific to the VRME. By contrast, only 14 were specific to the experience.

4.5 Discussion

Our findings provide insights into the current landscape of VR marketing experiences, including how manipulative techniques are being used in VRMEs. In our discussion section, we first summarize our findings. We then discuss what we learn about manipulation in VR marketing, and how our findings sit in conversation with existing literature on manipulation in VR. We conclude this section by discussing potential design and policy interventions to mitigate the identified issues.

4.5.1 Current state of VR advertising

Our study contributes a snapshot of the current VR marketing landscape. First, we observed that a wide variety of companies across sectors utilized VRMEs. While some industries were more represented than others (Movies and TV Shows in particular stood out), all manners of industries used VR to promote their products. This suggests that VRMEs are being explored broadly as marketing opportunities. Second,

[11] https://www.sonypictures.com/corp/privacy.html

we observed a large number of different publishers and developers making VRMEs, suggesting that the development of VRMEs is an open and vibrant field.

Borrowing from Wedel et al.'s classification of VR and AR marketing [269], almost all of the VRMEs we encountered were in the pre-purchase stage of the consumer journey—that is, encouraging consumers to purchase products. One exception was *Daylight's End VR Edition*, which allowed users to buy movie chapters and watch them in a virtual environment (and rewarded users who bought chapters with in-app guns the user could shoot).

Our findings show that current VRMEs are both highly interactive and very gamified. This finding is significant in that these traits, perhaps above all others, are what differentiates VR advertising from non-VR advertising. There are gamified and interactive non-VR advertisements, but these are the exception rather than the norm. In VRMEs, gamified and interactive advertising *is* the norm.

One detail we observed is that current VRMEs generally did not feel particularly sophisticated. The VRME's were mostly standalone experiences, rather than being fully integrated into apps or larger experiences. The look and feel of the VRMEs felt somewhat unpolished; several VRMEs crashed or faced technical difficulties, and some were badly optimized to the point of inducing nausea. This suggests that VRMEs are still in their infancy, and there is a long way to go, technologically speaking, before the full potential of VR marketing is realized.

4.5.2 What we learn about manipulation in VR advertising

We uncovered various manipulative techniques in the VRMEs we analyzed, including some that have been predicted by the literature (gamification, embodiment of avatars, and appeals to emotion) as well as new ones (distressing events, lack of exit options) and a worrisome dark pattern (proxemic interactions used to open links). This highlights the need to include physical and emotional harms in assessments of

potential harm of VR marketing.

4.5.2.1 Manipulative techniques we uncovered

First, we confirm the presence of various manipulative techniques that I uncovered in Chapter III, namely gamification, interactivity and appeals to emotion [202]. We also confirm the embodiment of avatars [5] as a technique that is employed. These results might not be the most surprising; however, seeing these techniques being used in practice reaffirms and validates respective predictions in prior work and advances the conversation from 'what *could* happen' to 'what *is* happening'.

We also highlight a lack of appropriate exit options as a concerning trend among VRMEs. This lack of exit options creates VRMEs that are hard to exit and avoid, consequently force users' attention on them. In an advertising context, this means that consumers cannot enact traditional ad-resistance strategies (e.g., avoidance). Not only does this constitute a manipulative technique, it also poses a safety issue in the case of a distressing VRME which a user needs to exit quickly; without the ability to quickly exit a harmful experience, a user could suffer undue harm. We emphasize that this lack of exit options is not unique to VR advertisements—many VR experiences also lack appropriate exit options, and so we cannot say whether the lack of exit options in VRMEs is an intentional design decision by marketers, or simply a reflection of current VR development practices. Regardless of intention, the effect is the same: VRMEs that are hard to exit and avoid possibly increase the effectiveness of VRMEs in manipulative ways.

In terms of dark patterns, we observe the presence of proxemic interactions being used to open links without a user's knowledge or consent. This type of interaction technique has previously been described in the literature [108], but it was interesting to see how this technique was used in practice. The potential harm with having proxemic interaction invisibly trigger the opening of links is that users may open

links they do not want to open, or open links they are not even aware of being opened. The effects of this may range from annoying (opening a link that interrupts the experience) to possibly dangerous in the case that users open links to malware or phishing sites. This interaction technique could be used for actions beyond opening links; one could imagine marketers using a user's location to trigger other events. For example, a VR shopping app could measure when users stand in a certain location, and use this to trigger a purchase. If there is no clear guidance that this can occur, users may unwittingly walk into these trigger locations.

4.5.2.2 VR advertising may cause physical and emotional harms

The use of distressing and controversial events in VR, alongside the lack of appropriate exit options, highlight how potential harms from VRMEs extend beyond manipulation and deception to include physical and emotional harms. In the literature, discussions of VR marketing harms have centered on privacy and manipulative risks (e.g., see [118, 119]). While there has been extensive work looking at the potential of VR more broadly to cause physical and emotional harms [5, 31, 49, 143], the presence or potential of such harms in the context of VR advertising has previously not been studied. From our observations, it is clear that physical and emotional harms can occur in VRMEs. Distressing VRMEs causing emotional distress in users, users being forced to recreate controversial events in VR, nausea due to badly optimized experiences, physical harms in case of VRMEs requiring strenuous physical activities the user cannot perform, and other physical and emotional harms present in non-VRME experiences, can translate to VRMEs—all compounded by an inability to exit the experience quickly. As such, researchers and developers looking to make VR a safer experience for all should consider advertising as another place where these sorts of harms may occur.

4.5.2.3 VRMEs' privacy implications difficult to assess for consumers

We analyzed the privacy policies of various VRMEs to determine their data practices. Many VRMEs did not provide a privacy policy in the first place, which should imply that these VRMEs do not collect user data. However, we are aware of at least one VRME (*Beyond Tokyo*) which did not provide a privacy policy, but still allowed users to send verbal feedback to the developers—presumably this means that on some level the company collects user data and does not provide a privacy policy detailing how this data is collected, stored, and used. This raises the question of whether there are other VRMEs that similarly do not post a privacy policy, but still collect user data and use it to personalize the VRME content. While a prior analysis of VR experiences found that most data collected through VR apps was not used for advertising purposes [248], the lack of privacy policies prevents consumers from understanding what data is collected about them and how it might be used.

However, even for those VRMEs who did have a privacy policy, the policies were often too vague to actually understand the VRME's specific data practices and privacy implications. Many privacy policies we analyzed—which often were overarching privacy policies for the brand rather than the specific VRME—claimed to personalize marketing materials for users, but the vagueness of the policies made it unclear to what extent personalization occurred in the VRME and whether it might be privacy-invasive or manipulative. For example, showing a user content based on their geolocation and inferring a user's sexual preferences and using this information to customize the appearance of a VR avatar to increase the effectiveness of a VRME both fall under the description of personalizing marketing materials, but users may have vastly different responses and acceptance levels to these practices.

4.5.3 Design and policy implications

Alongside a better understanding of the current state of VR marketing, our study surfaces concerning trends in the VR marketing space. Issues such as the recreation of distressing events in VR and the use of proxemic interactions to open links may cause real harm to consumers and require further attention.

People may be skeptical that these harms are worth addressing. Current VRMEs have relatively low engagement (as indicated by the low median number of reviews), require users to seek out and opt into these standalone apps, and are not particularly sophisticated. However, as companies start to embed advertisements more fully into VR experiences in the form of in-app VR advertisements, and VR experiences become more sophisticated, some of the risks we have identified are likely to become more widespread and harmful if not addressed. We make the following design and policy recommendations to address some of the concerning trends our study has identified.

4.5.3.1 Allow users to quickly exit VRMEs

We identified multiple distressing or controversial experiences in VRMEs. The immersive nature of VR headsets means that traditional evasion methods (e.g., looking away to ignore the ad) do not work the same way for VR marketing. VR headsets are bulky and often difficult to take off. It would be too burdensome to remove, especially in a distressing situations, where one may have to readjust and remove various straps before quitting the experience. Therefore, it is important that VRMEs offer quick exit options. Such quick exit options are more than simply a way to help consumers skip ads; it is primarily a safety feature to allow users to quickly bypass content that is distressing, disturbing, and in the case of badly optimized marketing materials, nauseating and possibly harmful.

While both Oculus and SteamVR offer a 'quick menu' button to exit out of a experience, these menu buttons exit the whole experience. This may work to exit

standalone VRMEs, but in the case of in-app advertisements, users may be forced to miss out on good content and shut down entire applications, all to avoid one disturbing moment. Furthermore, in moments of panic or distress, users may not readily see or remember the quick exit menu button. Oftentimes in VR, controllers do not appear as controllers, rather they are represented as digital hands. For inexperienced users, or those undergoing a distressing ad, it might be difficult to remember to press this button on the controller or even find the button on the controller to press it while wearing the headset.

Some of the VRME we examined featured good exit options, which we encourage VRME developers and platform providers, such as Meta, to incorporate (see section 4.4.3.5 for details). These exit options should, at a minimum, be easy to access; constantly present (meaning that the user does not have to remember complex buttons on the controller to activate); and allow the user to pause and exit the experience relatively hassle-free. However, there are other considerations that need to be taken into account: Knibbe et al. [137] highlight how exiting VR can be disorienting, and make design recommendations on how to exit VR experiences safely and comfortably, such as using 'soft' transitions to slowly ease users out of a VR environment.

From a policy perspective, it could be mandated that VRMEs have a quick exit option, and penalize marketers who do not allow their users to easily exit or bypass their ads.

4.5.3.2 Develop guidelines for acceptable VRME behavior

Our findings demonstrate the need for guidelines on acceptable and unacceptable behaviors in VR to avoid instances where users are forced to carry out controversial actions as part of a marketing experience, or are made to experience distressing situations. While our findings provide insights in how VRME experiences might be distressing or problematic, more work is needed to develop respective guidance or

codes of conduct for marketers developing VRMEs.

Alternatively or in conjunction with such guidelines, VRMEs could display a content warning both as a label in the app store and at the beginning of the VRME indicating potentially distressing actions or situations that a user might be required to participate in as part of the VRME.

4.5.3.3 Proxemic interaction should not open links outside the experience

While we only found two instances of VRMEs using proxemic interactions to trigger the opening of a link, it is a dangerous enough technique to warrant special consideration. We propose that opening any link outside of the VR experience through actions within the VR experience (e.g., clicking, in-app location) should display the link to the user and require explicit confirmation from the user before the link is opened, as well as giving the user the option to not open the link.

4.5.3.4 Standardize privacy policy requirements

It was jarring to see that the same VRMEs appeared in one store with a privacy policy and in the other without. This demonstrates the important role of the platform provider in setting reasonable requirements for VR apps to ensure that platform users are provided with information about an app's data practices. Moreover, privacy policies should be specific to the VRME rather than general privacy policies for the companies. This would allow users to better understand (1) what data is the VRME collecting specifically and (2) how that data is used inside the VRME. Our analysis demonstrated that current VRME privacy policies are useless for consumers in attempting to understand those two aspects.

In the case that a VRME does not collect any user data, this information should still be conveyed to users. This did happen in some VRMEs—*IKEA VR Pancake Kitchen* had an EULA that unequivocally stated "IKEA will not collect any user

data in connection with the use of the Software." This would benefit consumers (who can trust that the VRME will not collect any additional data) as well as the VRME manufacturer, since privacy-conscious users might be more willing to try out a VRME if they know it does not collect any user data.

4.5.3.5 Clearly label VRMEs and other marketing materials in VR

Having studied VR marketing experiences extensively, we argue that there is a need to explicitly label VRMEs as marketing. Labels should encapsulate not only standalone VRMEs, but also some of the grey areas we discussed (such as product placement). There are already models for how this can work: for example, the Google Play store lets users know whether an app contains ads and/or in-app purchases. VR storefronts, such as the Oculus store and the Steam store, should similarly indicate when VR experiences contain in-app marketing, as well as which experiences are standalone marketing materials, and which ones contain branded content.

This labelling is important for two reasons. First, this will help consumers better recognize marketing experiences. As mentioned in section 4.2.4, hiding the intent of a marketing experience is a manipulative technique which prevents consumers from making informed choices. Mandating disclosures would bypass this problem and allow consumers for a fair evaluation of a VRMEs message.

Secondly, from a perspective of research and legislation, labelling VRMEs makes them a lot easier to study and monitor. A significant portion of time and energy in our study went towards searching for and classifying VRMEs—having a label, tag, or filter through which one could easily obtain VRMEs would make them easier to analyze, from both a research perspective as well as a regulatory one (e.g., finding and auditing VRMEs to see which ones are compliant with relevant legislation).

4.6 Conclusion

In this chapter, I presented a study where we performed a walkthrough of 87 Virtual Reality Marketing Experiences (VRMEs) to understand the VR marketing landscape and identify the current use of manipulative techniques within VRMEs. We provided a categorization of VRMEs, and find VRMEs make use of several manipulative techniques; of particular concern are the use of distressing events in VR and the lack of exit options. Our findings demonstrate the importance of considering the potential for VR marketing to cause physical and emotional harms in addition to manipulation. Finally, we discuss design and policy recommendations to mitigate some of the discovered harms.

Together with Chapter III, we now have a firm understanding of the potential ways VR advertising can be manipulative. Chapter III predicted that VR advertisements would employ the affordances of the VR medium to make ads that are immersive, interactive, and gamified; and we confirm that VR advertisements are indeed highly gamified and interactive. Chapter III highlighted emotional appeals as a possible technique VR ads employ; this study confirms that VR ads make emotional appeals, and we observe the use of distressing events as one such appeal. We confirm that VR advertisements can and do allow consumers to preview products before buying them, by allowing consumers to inspect in great detail virtual recreations of physical products. We further identify a lack of exit options as a risk that was not captured in Chapter III.

With this understanding, I now pivot towards approaching the manipulative risks of VR advertisements from the perspective of VR users—those who use VR and be most negatively affected by VR advertisements. In the next chapter, I propose a study that examines VR user attitudes towards VR advertising and possible manipulation within, in order to contextualize the manipulative techniques identified so far and get a holistic sense of the harms and risks they pose.

CHAPTER V

Understanding VR Users' Attitudes Towards VR Advertisements

5.1 Introduction

Up to this point, I have presented two studies looking at VR advertising. The first (Chapter III) used scenario construction to anticipate manipulative risks of VR advertising. The second (Chapter IV) studied existing VR advertisements to understand the current marketing landscape as well as understand current manipulative risks. Together, these chapters provide a detailed look at the manipulative risks of advertising in VR. The key findings from these chapters include: the use of interactivity, immersion, and gamification; how companies could leverage user data to hyperpersonalize VR advertisements towards users, and how currently VR marketers often do not provide privacy policies to let users know how their data is being used; the use of emotions, most concerning of which is the use of distress; and the potential for misleading experience marketing that deceives users as to the quality and nature of products being sold.

In this chapter, I complement this analysis of VR advertising risks by incorporating the voices of VR users. As the ones who will experience VR advertising, VR users will be the ones to feel the impact of manipulative advertising; as such, understand-

ing their perspective on these risks is paramount to properly address the harms of manipulative VR advertising, since this will shed insights into what risks should be prioritized and addressed first. Furthermore, VR users provide a different perspective on VR advertising, and they can highlight risks that the prior two studies may not have uncovered. Thus, in this chapter I present a study to understand VR user attitudes towards VR advertising. Specifically, this chapter answers the following research questions:

1. What are VR users' attitudes towards VR advertisements?
2. What are the main concerns and worries that VR users have regarding VR advertisements?
3. What manipulative risks of VR advertisements are VR users particularly concerned or worried about?

To answer these questions, I conducted an interview study with VR users to understand their attitudes, thoughts and concerns regarding VR advertising. Specifically, I interviewed 22 VR users and asked questions about their interactions with VR advertising (if any) and their general attitudes towards VR advertising, including perceived benefits as well as concerns. Finally, I used scenarios to probe about specific manipulative techniques identified in the prior two chapters by presenting scenarios describing VR ads that incorporate these techniques, and gauging VR user reactions to them.

Overall, we found that participants had several concerns regarding VR advertising, including worries about in-app VR ads breaking the immersion of VR experiences, inescapable and annoying VR ads, privacy risks, and physical harms. Participants also thought VR advertising could be useful for previewing products before purchasing them and they could help monetize the VR ecosystem. With regard to manipulation, some participants expressed concern about manipulative advertising, others seemed

to not consider manipulation a concern or a serious risk. This was mediated by several factors, including resignation that manipulation will always be a part of advertising and an illusion of invulnerability.

Through this work, I augment and strengthen the findings in the prior two chapters. I unearth additional concerns that prior studies did not uncover, and reveal that participants' attitudes regarding manipulation are more complicated and nuanced than what we might have initially anticipated.

This study was conducted in 2023, and was carried out with fellow co-authors Selin Fidan and Florian Schaub. I note that throughout this chapter I write using first person plural terms (e.g., 'we', 'our') to reflect the collaborative nature of this study.

5.2 Background and Related Work

In this section, I review related work examining users' attitudes towards advertising, both generally and VR advertising.

5.2.1 User attitudes towards advertising

When studying consumer attitudes towards advertising, scholars have found that consumers hold negative views towards advertisements [287]. Key concerns raised by consumers include the possibility of manipulation [9, 238], irritation [204], the promotion of inappropriate topics and use of disturbing and embarrassing images (e.g., ads with suggestive content) [2, 9], and a lack of trustworthiness and credibility by advertisers [225, 286, 287]. In the case of targeted advertising, consumers have expressed privacy concerns over how their data is collected and used [238].

Having said that, there are also features of advertisements that consumers appreciate and view positively. For targeted advertising specifically, consumers like the relevance and convenience they provide [98, 290]. Consumers also appreciate inter-

active ads [281]. Moreover, consumers appreciate having a large degree of control over the ads they see (as a consequence, when consumers have little control over the types of ads they see, these ads are viewed negatively) [251, 290]. Looking beyond individual advertisements, some studies indicate that as an *institution*, advertising is generally seen as positive [198, 238]. Consumers value the role that advertising plays in the economy, allowing consumers to learn about products and services available [198]. In the case of the internet, consumers mention that advertisements help keep popular internet services free of charge for users [238].

To complicate matters, there are numerous mediating factors that influence how consumers perceive ads, such as gender [30] or country of origin [198]. Lastly, attitudes towards advertising can change over time. For example, Zanot [286] conducted a literature review of studies on advertising, showing that general attitudes towards advertising trended negatively over time (from 1930s to 1970s).

5.2.2 User attitudes towards VR advertising

There has been less work looking explicitly at attitudes towards VR advertising. Presumably, many of the benefits and concerns listed above apply; however, there may be unique features of VR advertising that consumers do or do not appreciate. Burton and Schlieman [46] looked at comments on 360-degree video advertisements to gauge consumer attitudes. They find that users appreciate the novelty of the format and the feeling of presence VR advertising offers; however, there are complaints over technical issues (e.g., lag, lack of intuitive controls) limiting the experience. In looking at the use of VR marketing in sports, Kunz and Santomier find that consumers look forward to VR as a way to allow for 'fun' interactions [141]. The study I present in Chapter IV found that VRMEs receive mixed to positive reviews on their store pages, implying neutral to positive attitudes towards VR advertisements. However, there are a few signs suggesting users may reject VR advertising: Meta, a company that

has created its own VR ecosystem, recently tried implementing VR advertisements on its platform, and consumer backlash was so severe it was forced to halt these plans [142]—implying consumers hold very negative attitudes towards advertising in VR.

Expanding on consumer concerns regarding VR advertising, some work has examined VR user concerns of VR technologies more generally—while not specifically focusing on VR, the findings still apply given they cover the medium VR ads take place in. In exploring VR users' perception of risks, Adams et al. [1] find that users have concerns around security (e.g., malicious applications), privacy (VR headsets collecting vast amounts of user data), and well-being (including harassment, physical harms such as vision damage or motion sickness, and psychological effects). Other work has corroborated user privacy concerns [181]. However, there is little work beyond this examining VR user attitudes and perception of risks with regard to VR. While there is plenty of work examining the harms and risks VR technologies pose, very little of it is from a user perspective (e.g., asking users what their concerns and attitudes are).

5.2.3 Takeaways from related work

There are a few takeaways from the related work. While there has been work examining consumer attitudes towards advertising, much less work has looked at attitudes towards VR advertising. Some work has tangentially covered this topic (e.g., by examining attitudes towards a specific type of VR advertising, or looking at attitudes towards VR in general), but an in-depth examination into VR users' attitudes towards VR advertising is still missing.

Despite the lack of work directly examining VR user attitudes towards VR advertising, we can make some inferences as to what VR user concerns are likely to be. One well-documented concern is that of privacy, which presumably will carry over

towards VR advertisements. Similarly, we can reasonably expect a lack of trust in advertisers, and VR users to consider VR advertisements to be irritating.

However, there are many remaining questions that need to be answered. In particular, it remains to be seen VR user attitudes towards seemingly contradictory features. For example, how will VR users view the gamification and interactivity of VR advertisements? On the one hand, interactive ads can be viewed positively [281], and gamification can contribute to a 'fun' factor that consumers appreciate in VR ads [141]. However, gamification can lead to manipulation, which is a facet of advertising users are concerned about [238]. A similar argument could be made for hyperpersonalization. Consumers appreciate the relevance and personalization that targeted advertising brings [98, 290], but will this still be the case where even the content of the ad is hyperpersonalized towards each individual user in potentially manipulative ways?

In this study, I fill this gap and answer these questions by directly examining VR user attitudes and concerns regarding VR advertising. In the next section, I describe my methodology in detail.

5.3 Method

In this study, we carried out semi-structured interviews with VR users to understand their perspectives with regard to VR advertising. Semi-structured interviews allowed me to gain deep insights into VR users' attitudes towards VR advertisements.

Regarding participants, we recruited VR users since they are the primary users of VR technologies. By having experience in VR, these participants have unique insights as to how VR environments work, and can better imagine advertising in that medium and possible concerns within. Additionally, these users are more likely to have experienced advertisements in VR, and can speak to these accordingly. Our study was reviewed and deemed exempt from oversight by the University of Michigan's

Institutional Review Board (IRB).

5.3.1 Recruitment

We recruited participants using online forums dedicated towards VR projects, most notably prominent VR subreddits (including Vive_VR, VRChat, OculusQuest2, OculusGo, Oculus, HoloLens, WindowsMR, LearnXR, WebXR, WebVR). We chose to recruit through these avenues since we felt it would reliably recruit participants with VR experience.

In our recruitment message, participants were invited to complete a screening survey, where they indicated their experience using VR devices, experience with VR advertising, and their attitudes towards advertising. We measured attitudes towards advertising using Likert items taken from Petrovici and Marinov that asked participants to rate advertisements on a 7 point scale on measures such as good/bad, useful/useless, and necessary/unnecessary [198]. We then computed a sum of the Likert items and used this sum as a heuristic towards participant attitudes towards advertising; higher scores indicated the participant viewed advertisements negatively, and lower scores that the participant viewed advertisements positively. We excluded participants who had not used VR before. Furthermore, we based our selection on who to invite to the interview based on the attitudes towards advertising to ensure there were a mixture of voices represented in the sample (positive, negative, and neutral). Following Zeng et al., [287], we also asked whether the participants had used an ad blocker and whether they liked seeing ads online. This helped further contextualize participants' attitudes towards advertising and provided us with data points we could probe about in the interview.

We also used the screening survey to collect demographic information about the participants, using questions collected from Hughes et al [126]. A copy of the screening survey can be found in Appendix B.1.

Gender		Age		Country	
Man	16	18-24	7	USA	12
Woman	3	25-34	10	Canada	4
Non-binary	2	35-44	2	Denmark	1
Transfem	1	45+	3	Italy	1
				Netherlands	1
				Portugal	1
				Scotland	1
				United Kingdom	1

Table 5.1: Table showing participant demographic information, including gender, age, and country.

5.3.2 Participant Demographics and VR Usage

In this section we summarize participant demographics. In the text, I highlight important takeaways to contextualize our sample. Furthermore, all of the statistics can be found in the following tables: Table 5.1 contains information about participants' demographics, Table 5.2 contains information about participants' VR usage, and Table 5.3 contains information about participants' attitudes towards advertising and experience with VR ads.

Participants skewed male and young: In terms of gender, 16 participants identified as men, three as women, two as non-binary, and one as transfem. This gender disparity is reflective of general VR usage statistics, which skews male [233, 237]. It could also be driven by our choice of recruitment platform (Reddit), which also has a largely male user base [235]. Most of our participants (17) were in the age range of 18-35, two participants were aged 34-44, and three participants were older than 45. This skew towards younger individuals reflects the fact that people in those age groups are more likely to be interested in and use VR [236].

Experienced VR users: In terms of VR usage, most participants were experienced VR users. 18 participants had over three years of experience using VR devices, and

Frequency		Time using VR		Reason		Headset	
Daily	6	>5 years	8	Gaming	22	Oc. Quest	17
Weekly	10	3-5 years	10	Social VR	14	HTC Vive	11
Monthly	5	1-3 years	2	Watching videos	13	Oc. Rift	10
<Monthly	1	6-12 mo.	2	Fitness / well-being	11	Index	7
				Education	5	S.O. Plus	4
				Work	3	Oc. DK12	1
				Content Creation	2	Oc. Go	1
				Art	1	Lenovo Explorer	1

Table 5.2: Table showing information about participants' VR usage, including how often they used VR, how long they have used VR for, the reasons for using VR, and what headsets they used. Note: Oc. is shorthand for Oculus. Index refers to the Valve Index. S.O.Plus is the Samsung Odyssey Plus.

all participants had owned a VR headset for at least six months. Similarly, over half of our participants (16) used VR either weekly or daily, and only one participant used VR less than monthly.

Gaming primary VR use case: With regards to why participants used VR, all 22 participants used VR for gaming purposes. Other reasons participants used VR for included social VR (14), watching videos (13), and fitness and well-being (11). 19 participants mentioned using VR for at least two purposes. For VR headsets, the most commonly used VR headsets were the Oculus Quest and Quest 2 (17), the HTC Vive (11), and the Oculus Rift. 18 participants had used more than one headset.

Varied attitudes towards advertising: Our participants varied greatly in terms of their attitudes towards advertising. For the advertising score that we used to infer their attitudes towards advertising, participants could have obtained a minimum score of 7 or a maximum of 49. In our sample, participant scores ranged from 13 to 49. One participant had a score less than 14; one participant had a score between 14 and 20; five participants had a score between 21 and 27; six participants had a score between

ID	Seen ads	Ad attitude	ID	Seen ads	Ad attitude
P1	Yes	13	P12	No	23
P2	Yes	33	P13	Unsure	25
P3	Yes	45	P14	Yes	32
P4	Yes	41	P15	No	42
P5	No	26	P16	No	39
P6	Yes	37	P17	No	39
P7	Yes	49	P18	Yes	30
P8	Yes	25	P19	Yes	26
P9	No	30	P20	Unsure	19
P10	Yes	29	P21	Yes	47
P11	Yes	33	P22	Yes	42

Table 5.3: Table showing participant VR usage statistics. The *Seen ads* column indicates whether participants had seen VR ads prior to participating in the study. The *Ad attitudes* column was the score we calculated in the screening survey to determine the participant's attitude towards advertising. Higher scores indicate more negative attitudes towards advertising. Possible scores participants could have gotten ranged from 7 to 49.

28 and 34; four participants had a score between 35 and 41; and five participants had a score higher than 42. While our participant sample skewed towards slightly negative views regarding advertising, we observe that positive, negative, and neutral attitudes regarding advertising are represented in our sample.

Over half of participants had experience with VR ads: 14 participants had already experienced VR advertisements prior to participating in the study, with a further two participants being unsure if they had seen a VR ad.

5.3.3 Interview Protocol

The interview protocol consisted of the following sections. First, I asked questions about participants' general thoughts regarding advertising. This was done to ease participants into the interview and help them become comfortable talking to me. It also allowed me to distinguish which of their attitudes towards VR advertising are

specific towards VR advertising versus ones carried over from advertising more generally. Next, I asked questions about their VR usage and whether they had encountered VR advertisements: if so, I followed up with probing questions to understand what VR advertisements they had seen and what had been their reactions towards seeing these ads. After that, I transitioned towards talking about participants' general attitudes towards VR advertisements, and probing into what benefits and positives they see to VR advertisements as well as what drawbacks and concerns they see. I also asked participants to imagine what VR advertising could look like in the future.

5.3.3.1 Scenarios

In the final part of the interview, I presented scenarios to participants about specific instantiations of VR advertisements. The use of scenarios as interview probes can be an effective way to gauge user attitudes and concerns towards technologies, particularly emerging technologies (e.g., see [11, 43, 111, 121, 210]). Participants may not have had exposure to VR advertisements; and to the extent they have seen VR advertisements, these ads may not be particularly sophisticated or demonstrate some of the traits imagined in Chapter III. By using scenarios, I grounded discussion around specific manipulative features of VR advertising.

While there are many features and manipulative techniques we could have focused on, there are three in particular that stood as the most interesting to study, given that there were no clear indications from prior literature as to how participants would perceive these techniques, and there were arguments on both sides as to whether participants would appreciate or reject the techniques in question. The first feature is the interactivity and gamification of VR advertisements, given the interesting contrast between gamification making ads fun vs making ads potentially manipulative. The second feature is hyperpersonalization, given the contrast between consumers appreciating personalization versus being wary of the privacy risks they may impose.

The third feature is the ability to preview products, since this is one of the key and defining features of VR advertising; however, it could lead to misleading experience marketing and new avenues for false advertising.

For each feature, we created a short vignette describing a VR advertisement with that specific feature. The vignettes consisted of text describing that vignette as well as images to help participants visualize it. Each vignette was created through an iterative process. We first drew inspiration from the scenarios created in Chapter III and the VRMEs encountered in Chapter IV to create an initial version of each scenario. We then revised and interated on the scenarios to make them clearer and distinct from each other, trying to remove as many confounding variables to ensure participants' focus was only on the manipulative technique in question.

Soccer Shoe scenario to show gamification: To show gamification, we were inspired by gamified VRMEs such as *Gatorade's Beat the Blitz* and *NBA 2KVR Experience*. In the scenario, the user chose among several soccer shoe models, each one providing a different power and ability. The user then played through a minigame where they had to score goals against a team of enemy goalkeepers. Finally, the user was invited to purchase soccer shoes. The manipulative disclosure consisted of two parts: first, revealing the gamification of the scenario and how companies were trying to leverage the fun feeling of a game to get consumers to associate the fun of a game with the shoes. Second, we revealed that the game made it very easy to score, so the user would falsely associate feelings of success in the game with the shoes. We called the scenario Soccer Shoe scenario, since the ad is selling soccer shoes.

Soda scenario to show hyperpersonalization: To show hyperpersonalization, we were inspired by existing in-app advertisements as well as by the Hunger Pangs scenario in Chapter III. We deliberately created this scenario as an in-app advertisement to differentiate it from the other scenarios that featured standalone ads. In the

scenario, the user is playing through a VR game when they get interrupted by an in-app ad. The ad consisted of a 360-degree video of people dancing and drinking soda, and the music in the background matches the user preferred music genre choice. The manipulative disclosure consisted of two parts: first, revealing that the VR headset collected data such as in-game performance and biometric data to customize the ad with the users preferred music taste; and second, revealing that the VR headset detected when the user was most tired and thirsty to show the ad then. We called the scenario Soda scenario, since the ad is selling soda.

Furniture scenario to show misleading experience marketing: To show product previewing, we were inspired by VRMEs such as *IKEA VR* and *SpaBerry VR Experience*, as well as the 'Ugly Furniture' scenario in Chapter III. In the scenario, the user entered a virtual world where they could look at furniture and place it around their home. The manipulative disclosure showed that the digital previews were doctored and made it seem the furniture was of much higher quality than in reality. We called the scenario Furniture scenario, since the ad is selling furniture.

To not bias participants, we avoided leading language that indicated whether the feature is positive or negative. We then probed as to the participant's general reactions to the vignette, and if the scenario seemed particularly exciting or concerning (and why). After getting initial thoughts on all vignettes, we disclosed the mechanisms underlying how a particular technique or feature could be manipulative (e.g., in the case of the Furniture scenario, we explained how the digital assets could be misleading). We included the disclosures because some participants may not have known how a technique can be manipulative, and their attitudes towards a technique may change on learning this information. However, we took care to disclose this information *after* getting initial reactions to the vignette, to still understand participants' unfiltered attitudes towards the scenarios. We alternated the order we showed the

scenarios to participants to mitigate ordering effects.

The full interview script, including the images we used for the scenarios and accompanying text, can be found in Appendix B.

5.3.4 Interview Logistics

The interviews were conducted remotely through Zoom. Interviews were scheduled to last 90 minutes. In actuality, interview times ranged from 65 minutes to 103 minutes, with a median of 85 minutes and an average of 84. Participants were compensated $40 for their participation, paid through either a mailed check, an Amazon gift card, or a PayPal transfer (whichever the participants preferred).

5.3.5 Interview Analysis

I analyzed the interviews using thematic analysis [243]. Part of this process is coding the interviews [243]. To generate the codes, I used an iterative approach, starting with a set of deductive codes [175] and refining the codebook by analyzing the interviews and modifying the codebook until it captured all important themes. This approach allowed me to focus on participants' attitudes towards VR advertising, while maintaining the flexibility to adapt and capture additional themes, such as specific attitudes I may not have predicted or foreseen (e.g., expected benefits of VR advertising). The codebook can be found in Appendix B.4.

5.3.6 Limitations

We chose to use in-depth interviews since they allowed us to both delve deeply into participant attitudes regarding advertising and it let us have a back and forth with participants to ensure that any questions and doubts participants had about VR advertising would be answered—given the futuristic and uncertain nature of VR advertising, having this back and forth was crucial to ensuring high data quality. Our

method choice, however, meant that we were limited in our sample size. Our sample size (22), while typical for most qualitative studies, means that our findings should not be construed as generalizable. This was a necessary tradeoff for us to be able to draw deeper and richer insights from the data.

Another factor impacting the generalizability of our findings relates to where we recruited participants from. Most of our participants were recruited from a single platform (Reddit), although from different forums within this platform; and while participants came from various different countries, all countries were located in either North America or Europe. Similarly, the participant sample was largely male (16) and young (18-34). Furthermore, all participants had some VR experience, meaning that the concerns of non-VR users are missing from our study. Future work can and should cover missing perspectives, including recruitment from other platforms, from other countries, and include people who have limited or no experience using VR applications.

Lastly, there may have been self-selection with regards to our participants. Would-be participants who viewed our survey may have thought we were VR advertisers, and those who have particularly strong feelings against advertising may have decided not to participate out of a fear of indirectly contributing to VR advertising. In fact, we received several comments telling us as much (some of which contained various swearwords). However, the answers we received in the screening survey and the interviews make us confident that some of our participants did have negative views regarding advertising. Thus, while we cannot say what percentage of VR users have negative or positive views regarding advertising, we are confident that their voices were represented in the sample.

5.4 Findings

We found that participants were often wary and skeptical of VR advertising, highlighting worries about ads breaking the immersion and ruining the user's experience; privacy concerns; and physical harms that might arise out of VR advertising. Having said that, views were more nuanced than 'VR ads equals bad'—participants did think that VR advertising had some advantages, such as allowing users to preview products (a trait perceived as being interesting and useful) and helping monetize the VR ecosystem. With regard to manipulation specifically, we observed a mixture of opinions: while some participants were worried about the possibility of manipulation, others seemed to not consider manipulation a concern or a serious risk. On further analysis, we observed that this lack of concern was explained by a resignation towards manipulative advertising, a belief companies would not engage in deception, and a belief that they would not personally be influenced my manipulative techniques.

We organize our findings as follows. First, we talk about participants' experiences with VR advertising. We next discuss various themes regarding both benefits and concerns participants had regarding VR advertising. Subsequently, we summarize how participants viewed the scenarios we presented and the manipulative techniques within them, and follow this by discussing on a broad level participants' attitudes towards manipulation. Finally, we discuss solutions participants raised as to how to solve some of the problems of VR advertising.

5.4.1 Participants' experience with VR advertisements

To our surprise, a large number of participants (14) had already encountered or experienced VR advertisements. Some of these ads were very primitive; for example, a few participants mentioned seeing ads in VR app menus e.g., a banner ad announcing an upcoming expansion pack or sequel the user could purchase. Other types of VR ads were more elaborate: some participants had encountered VR experiences similar

to the VRME's described in Chapter IV—that is, standalone short experiences that served to promote a brand or service. Oftentimes these served to promote movies or TV shows; participants mentioned seeing VRMEs for Game of Thrones, Skyscraper, and Spiderman.

Participants had also seen advertisements in social VR (e.g., VRChat, AltSpace VR). In social VR there are often individual user-generated worlds that can be visited. Participants mentioned that some of these worlds have posters or billboards that showcase products or brands. Participants were generally ok with this practice since these posters helped support the VR world's creators. P21 described such an instance: *"in VRChat they often have banners and posters inside their world saying, oh you can go to my Patreon*[1] *and you can get extra stuff that I don't mind them too much because they are directly towards that experience that I'm already in'.'* However, a few participants complained that these ads were a too obtrusive, such as P22, who described these posters as *"stick[ing] out like a sore thumb. [It] feels like it shouldn't be there."*

Participants had also encountered ads by VR content creators who had created digital avatars. Some digital creators, when creating a virtual avatar or virtual asset, appended a label, plaque, or even a QR code to the asset. This meant that if a VR user saw the digital asset and were interested in learning more about who created the avatar or purchasing that model, they could scan the QR code in VR to learn more about the creator or even purchase models from that creator. Per P20: *"if you click on an avatar, it'll say 'made by this person', and you can always read the details of your avatar that's on there and it'll say, 'hey, if you want this, go on Discord and we can work out something.'"*

Perhaps the most elaborate type of VR advertising and shopping participants encountered was a virtual VR market. This was an event held in VRChat on a biyearly

[1]Patreon is an online platform where users pay monthly subscription fees to creators.

basis, where users could walk around a virtual market. Companies would set up booths where users could examine, explore, and even purchase products. Some of the products being sold were virtual (e.g., buying new digital avatars for VR), but there were also physical products being advertised, such as Manga comics, energy drinks, food delivery services, and cars. Participants who had experienced VR market spoke positively of the experience, describing it as a fun event they were looking forward to going to. For example, P1 mentioned that *"a lot of people go visit [the market] on purpose. They have a night where they'll go with their friends and they'll tour around the virtual market and kind of interact with every single booth."* Similarly, P11 described the market as a *"big spectacle"*.

All coincided in that these VR ads were often isolated events and not commonplace or mainstream. Furthermore, these ads were often not intrusive, and for the most part, optional ads a user could choose whether or not to engage with.

5.4.2 Attitudes towards VR advertising

Our first research question asked what are VR users' attitudes towards VR advertisements. Our participants were generally wary and apprehensive about advertising in VR. However, views were nuanced, with several participants acknowledging some potential benefits. In this section, we discuss participants' positive and general attidues; we report concerns in Section 5.4.3.

5.4.2.1 VR ads can be useful and informative

VR advertisements were perceived as useful and more informative than non-VR advertising given the ability to better see products in VR. For example, P19 said *"you could just get a much better feel for whatever you're being advertised. So again, the 3D products, stuff like that is a much better representation than just a few pictures online."* P5 felt VR could help in choosing vacation destinations: *"sometimes when*

you're comparing prices of Airbnbs or hotels or whatever online you see something much cheaper. And if you look at Google map, oh it's only about a 10-minute walk from the more expensive place. But sometimes that 10-minute walk can lead you to a whole different area of the place that you might not want to be in. [...] with a VR headset, I could use that to determine if paying the extra money for that whole hotel is worth it." Participants anticipated that through VR, it would be possible to get more information about what a product is like than through non-VR advertising, and thus make more informed choices about what products to buy.

5.4.2.2 Convenience of shopping from home

Another perceived benefit of product previews is convenience, since one did not have to travel to a store to see a product: *"to give an example, I'm a tall person and so if they accurately represent the scale of something, then I wouldn't need to physically go to a car dealership to find out if a vehicle is too big or small. For me, I'd just be able to sit in it in VR and say 'Hey, my height is this, how am I going to fit in this vehicle? What's the perspective I'm going to get? Is it going to be a fit issue?' So in that sense, I think that VR advertising could be interesting"* (P15). Similarly, P12 said: *"I'm definitely a homebody, spend much more time in VR than I do physically going places. I would find it so enjoyable to be able to go through clothing stores and check stuff out without physically going there and really getting the sense that you're properly seeing the product."*

5.4.2.3 VR ads might be more fun

Participants expressed that VR could allow for fun, cool, exciting, and interesting advertisements for two reasons. First, VR and potential VR ads were seen as more interactive than non-VR ads, allowing for interaction techniques that could make advertising novel and fun. For example, P6 highlighted how *"It's kind of cool sometimes*

just to interact and do something you don't do in the real world." P8 highlighted the possibility of gamification in VR advertising "*I think if it's made as a game, I could see myself or others being excited to try it out and [...]play together.*" As such, participants looked forward to game-like advertisements.

The second factor is the novelty of the VR medium. By being new and different, VR ads were seen as offering unique experiences that broke the monotony of non-VR advertising. P12 talked about their experience showing VR ads to friends: *"Anytime that I've brought new VR users to [VR advertisements] it's always a really high novelty experience for them and they always are quick to engage with picking up all of the products. So I think when it's done well, it really, it's a fun little thing."* However, participants also expected this novelty to wear off eventually. Per P14: *"I think that's cool, but I think that will also fade in a couple years when VR advertising becomes mainstream. It's like, ok, it's just another ad."* As such, the notion that VR ads might be fun should be taken with a grain of salt, since it is unclear if VR ads are inherently more enjoyable than non-VR advertising or just novel.

5.4.2.4 VR ads allow for monetization

Monetization of the VR ecosystem was another advantage participants saw regarding VR advertising. This monetization was considered as being positive for several reasons. First, participants mentioned that VR advertising could allow VR content creators to monetize their spaces; in turn, this would encourage and allow for VR content creators to spend more time creating higher quality content for VR, and overall grow the scene. Per P13: *"VR is still small, it's mostly small indie developers that are [creating experiences]. I feel [advertising] could be a very good way for them to make a little bit of extra money to be able to produce even more awesome experiences."* A similar sentiment was echoed by P4: *"Usually if there is more advertising, world creators have a lot more budget to create interesting stuff."* Second, there was a

sense that monetization would fairly reward VR content creators, whom participants mentioned were often small, independent, and worked on their content for free or for very little pay. Per P5: *"people who develop it, they need to be paid for their time and if they're not charging money from me to play it, then they should get that money back somewhere."* Third, participants expressed that monetization would lower the costs for VR headsets and experiences. P5 was generally skeptical of advertising in VR; however, they mentioned that they would be open to at least trying VR ads if they helped bring down the costs for consumers: *"if [VR advertising] brings down the prices potentially, I mean I'm indifferent. That one I could get behind it. I wouldn't say I'll be like 'yay, let's do it'. I'll be like 'ok, let's try it out and see.'"* As such, VR advertising was seen as a force that could help improve the VR ecosystem.

5.4.2.5 ... but distrust advertisers

At the same time, participants expressed distrust regarding VR advertisers and whether they would act in users' best interests when creating VR ads. P13 worried about VR advertisers taking ads *"too far"* in pursuit of money. Similarly, P7 said *"companies just don't have their users' best intentions at heart and will do whatever they can to make sure that you buy their product."* Particular hostility was held for Meta and its CEO, Mark Zuckerberg. Participants brought up Meta's prior behaviors (such as the Cambridge Analytica scandal or their data collection practices) as proof that Meta could not be trusted. A few participants complained about Meta's *"walled garden"* approach (P17) to the VR ecosystem and would prefer a more open approach that is adaptable to the VR community's needs. P16 even described a particularly dystopian VR advertising landscape as the *"'Zuckerberg Wins' scenario"*.

Participants also questioned whether Meta would be able to produce high-quality VR advertisements, due to a perceived lack of quality in Meta's current VR experiences. P1 noted: *"I've been on [Horizons]. [...] when [Zuckerberg] posted the picture*

of him standing next to the Eiffel tower [...] I was like, I could have made that in five minutes. [...] I don't know how they're spending so much money and that is what they're coming up with."

This distrust towards VR advertisers heavily impacted participants' perceptions of VR advertising risks. When discussing risks of VR advertising, it isn't only a question of how VR advertisements could harm consumers: some participants believed that companies would actively pursue detrimental and potentially harmful practices to maximize profits.

5.4.3 Concerns Regarding VR Advertising

Our second research question focused on the main concerns and worries that VR users have regarding VR advertising. Our participants expressed numerous concerns, with an emphasis on how VR ads could ruin VR experiences.

5.4.3.1 Blocking or limiting access to content

One key concern was how VR advertising could be used to block or limit access to content: for instance, VR users being forced to experience a VR ad before loading content. Furthermore, participants felt that the mere presence of VR ads could be distracting. Participants were worried about ads being *"in your face"* (P6, P7, P11, P14, P18, P19), *"obtrusive"* (P11, P16, P21, P22), and *"intrusive"* (P7, P10, P18, P19), with some users worrying about an *"ad bombardment"* (P1, P6, P17, P18 P19).

While ads blocking content is not unique to VR, many participants thought that VR could make this blocking worse. Factors that contributed to this perception were the eye-tracking capabilities of VR headsets (that could measure whether a user has engaged with an ad) and how VR headsets fix screens directly in front of users' eyes. For example, P14 thought that *"the dystopian vision of VR advertising is an ad that gets stuck to your face and your pupils have to focus on the ad for 30 seconds before*

you can skip it". P7 commented on how the VR screens automatically increased the instrusiveness of an ad: *"If you look at [an ad's] intrusiveness on a scale of 1 to 10 on a normal flat screen. If it's a 1 and it's not very intrusive at all, on a VR headset, it's a 3. If it's a 10 on a flat screen, it's a 13."* As such, we see that participants (who had experience using VR) were apprehensive of the features of VR being used to make ads more intrusive and annoying.

5.4.3.2 In-app VR ads could break (or make) immersion of VR experiences

According to our participants, one of the appeals of VR technologies is the ability for VR to create highly immersive virtual worlds. Participants worried about the effects of VR advertising, particularly in-app VR advertisements, on immersion. Per P15: *"[VR] works best when it is an immersive experience. And so if you have something [an ad] that pulls you out of that experience [...] that's going to be detrimental to the user's experience"* Specifically, participants were worried that ads could remind users of the real world: *"if you're just doing something unrealistic, you don't want to actually be reminded of the real world"* (P17). This was seen as particularly problematic when the product being advertised had little to do with the current VR environment: *" [In VR] I feel like I'm sitting in a cockpit of a spaceship rather than my desk chair, and once you start saying, 'Oh also by Clorox', then the immersion's sort of broken"* (P16).[2] Given the very appeal of VR is its immersion, any interruption to that immersion is viewed as being more harmful than in other mediums (e.g., T.V., billboards), where immersion is not the goal.

Having said that, participants also thought that VR ads might enhance the realism and immersion of certain experiences, particularly those that aim to replicate real world locations. P21 brought this up with regard to visiting New York in VR: *"We*

[2]Clorox is a company that produces disinfectant products, and to our knowledge, has little to do with space travel or being on a spaceship.

have adverts in the real world, they're placed all over in the environment. If you mimic that in VR, it almost makes it more realistic in a way because seeing Times Square without adverts would be more jarring, so having real adverts there would kind of integrate the experience more." A similar sentiment was echoed by P13: *"I'm in a real place. This is a real restaurant I can go to in real life. So that might add to the immersion."* As such, if a VR experience is meant to replicate or imitate the real world, seeing ads for real products as would be the case in the real world could contribute positively to the experience.

5.4.3.3 Subtle advertising as a preferred alternative

Participants were so worried about obvious, intrusive ads that broke immersion, many participants stated they would prefer to have subtle ads, such as product placement, that were deeply embedded in the world and did not stand out. For example, P10 stated *"I would rather have a more passive ad rather than a very interactive ad as well as an interactive experience that I'm going into."*. Similarly, P17 expressed that *"As long as I can't explicitly actually notice [the ad], then I'm fine with that."*

5.4.3.4 Privacy concerns

Several participants expressed concerns about VR advertisements invading their privacy. Specifically, VR ads were perceived as having more data collecting capabilities than non-VR ads, and so participants were worried about what data could be collected and how it would be be used. Particular worries were placed on eye-tracking data. Participants worried that this information could be used by advertisers to force a user's attention on ads by tracking a user's gaze and only skip an ad once the user has seen the ad. Other types of data collection participants were worried about that were unique to VR include the collection of physiological data (e.g., heartrate) and information about a user's environment, such as the layout of their home.

A few participants were not too concerned about their physiological data being used to personalize ads in the moment, but rather worried about how their data might be collected and used for other purposes: *"if I give permission for them to check my information, my heart rate, what I'm interested in, how do I know that information is not going to go out there and influence every single other aspect of my life online? And I don't think you can have that guarantee."* (P2). This suggests that, for some participants, the problem is data collection broadly, rather than data being used for advertising purposes.

5.4.3.5 Physical harms

A small number of participants worried about physical harms from VR ads, including overstimulation, loud noises, motion sickness, flashing lights triggering epileptic seizures, and being uncomfortable in the headset (e.g., the headset getting very hot).

Participants mentioned physical harms were a problem of VR more broadly but pointed out unique challenges VR ads presented. One concern were the effects of rough transitions between the VR experience a user is currently in and the VR ad they see: *"If you implemented, say, YouTube advertising as it is right now into VR, that would be pretty rough. Watching something, you're feeling something, then all of a sudden BAM focus shift; you're dealing with camera, focal length, all sorts of things like that that can be motion sickness inducing."* (P16)

Participants also worried that risks of physical harm could be exacerbated if VR ads could not be skipped. In this context, P15 highlighted the importance of quick exit options for VR experiences and VR advertisements: *"once you're in that headset, you're kind of trapped into whatever experience you get thrown into. And so I think that there must be a way if you were in some sort of a known advertising space to just exit that or get out of it, are immediately departed if you find that it's something that is either physically or emotionally or mentally uncomfortable."* This echoes our

calls in Chapter IV for mandating quick exit options for ads in VR.

5.4.3.6 Changing interaction techniques from current experience

Finally, participants were worried about in-app VR ads requiring different interaction techniques than what the VR experience they were in would otherwise require. Per P14: "*I use VR a lot for passive stuff, like big screen to watch a movie when I'm sitting on my couch, if I'm presented with an ad to where now I have to swing my arms around to play a game, that would be very annoying to me because I'm already in the mode of just wanting to sit back and enter a passive experience.*" Participants were worried that the changed interaction techniques could be distracting; annoying; could break the immersion of experiences; and in some circumstances, cause physical harms if the interaction techniques required by the ad are too strenous.

5.4.4 Attitudes Towards Manipulation

Our third research question asked about VR users' concern regarding manipulative VR advertisements. Overall, participants had mixed views towards manipulation. On the one hand, participants did not like being manipulated, and worried about how VR advertising could be manipulative and pose risks to vulnerable populations (e.g., older adults, children, and compulsive shoppers). However, few participants brought up manipulation concerns unprompted; only after we disclosed manipulative techniques for each of the three scenarios did participants expressed respective concern. This suggests that participants had not previously considered manipulation risks in VR. And when confronted with manipulative techniques, several participants dismissed their risks. Next, we first discuss participants' reactions to the three scenarios, followed by overarching attitudes towards manipulation.

5.4.4.1 Reactions towards scenarios

Furniture scenario This scenario was most appreciated by participants for the perceived usefulness of being able to see furniture prior to purchasing it. Some also liked the 'fun' factor of the ad. For example, P20 compared moving furniture around to playing the game 'The Sims.'

Once disclosed, participants disliked the manipulative technique, since it reduced the utility of the ad. P8 explained: *" I might go, well, this thing looks perfect. It pretty much matches the color or the looks that I was going for and then I get the actual thing and it doesn't match in the same way that I expected or is significantly different. That would be a negative thing I'd say."* Participants worried that misleading experience marketing could lead to people buying products they do not want or like.

Soda scenario The Soda scenario was the least liked scenario, mostly because the in-app ad interrupted a VR game.

With regards to hyperpersonalization, participants raised many privacy concerns. For example, P17 was worried about the physiological data being collected: "*If it's not used in a medical sense, you don't need to be trying to figure out my eye dilation.*" Despite the privacy concerns, participants thought that hyperpersonalization could also make ads more enjoyable. For example, P19 said "*if I'm going to be advertised to anyway, I guess maybe it would be better when it's relevant.*" Similarly, P21 said "*It's not the personalization I dislike, it's the information they have collected.*" Thus, a few participants considered hyperpersonalization without data collection acceptable.

However, this permissiveness towards hyperpersonalization was limited to hyperpersonalizing based on music taste—hyperpersonalizing based on thirst was viewed as concerning and manipulative. P13 stated: *"I feel like I'm being manipulated into buying a soda that I wouldn't have bought otherwise [...] to the point where they know how I'm feeling physiologically. If I need to use a bathroom, if I need to drink*

something, that's too far in my opinion."

Soccer Shoe scenario Participants generally liked the Soccer Shoe scenario, praising its gamified and fun aspects, while being concerned about the interaction techniques being forced on users. P16, for example, worried about situations where the user was not doing something interactive prior to seeing the ad: "*If I need to get up off the couch and do something else while I'm watching a movie or something, I guess just the context switch could be irritating.*"

Regarding the manipulation, a few participants worried that gamification could give misleading impressions about the product, particularly for children. P15, for example, worried that *" [If] picking that particular shoe actually modifies a statistic within the game that affects how accurate your hits are with the ball [...] you might run into interesting issues of perception of 'Oh, if I buy these shoes, I'll be super accurate', and then that becomes a [...] truth and advertising issue"* Overall, though, gamification was viewed as less harmful than other manipulative techniques. P17 called gamification "*a generic method*" and not worthy of concern. Similarly, P10 noted "*They're not selling you a fake product, it's not like a snake oil right where they're lying about it. If playing a game that they created causes someone to associate good feeling for the product, sure why not.*" P7 contrasted gamification with hyperpersonalization in the Soda scenario: "*I feel more ok with [gamification] than the use of my data to influence what I'm more likely to purchase.*" As such, while a few participants were concerned about gamification, for the most parts participants were ok with the practice.

5.4.4.2 Several participants concerned about manipulative practices

Looking across scenarios, around half of our participants expressed concerns about manipulation in advertising. Participants were worried about advertisements influ-

encing them to purchase products they otherwise may not have purchased (including unhealthy products) and VR advertisements misinforming consumers about quality of products. For example, P2 said *"I don't like the idea that I'm being subconsciously influenced and manipulated."* In short, participants did not like being lied to or being taken advantage of.

Some participants took it a step further to wonder what negative psychological impacts manipulative techniques might have on users beyond simply purchasing the wrong products. P12 worried about VR advertising that leveraged people's sensitivities, and how this might affect children: *"I would be worried about a lot of body or weight-based things. There's a lot of young people in VRChat. Yeah, so we were talking about earlier things that play on people's insecurities. I would hate to see, let's say it's a world, it's a advertising world that it, it's puts you in and looking at yourself in a mirror and it makes you a bigger person and then makes you a smaller person."* P6 worried about VR advertising being used to radicalize users, saying *"Yeah, I guess it's more almost a subliminal type of brainwashing [...] I think probably would be a bit more pervasive in VR just because you are so immersed and if there's a trusted person or actor that you're into with VR, that person over time can turn you to something that you're not prepared to be into the future."*

These fears about manipulation were about manipulation in advertising broadly, not just VR advertising. However, participants did mention that the fun and immersitivy of VR advertising could exacerbate manipulation effects, particularly for children, senior citizens, and compulsive shoppers, in that ads could be made to be too enticing and convincing. For example, P6 mentioned that one of the downsides of immersive VR advertisements is that one could quickly lose track of the money they are spending and spend more than they otherwise would: *"I guess the negatives [of VR advertising] would be just because of the immersion, it's probably a bit easier to lose track of your finances and stuff like that when you're presented with ads."*

In a similar vein, the ability to preview products could lead to compulsive shopping: *"I know online right now it's already really easy for people to purchase it. But with VR, if they can actually feel the fabric and then try it on virtually have an avatar, then try it on. I feel like it makes it even easier for them to buy it, but be like, try it on looks nice, buy it, buy it, buy it. And then afterwards realize, oh no, I'm broke. [...] I feel like the VR makes it easier [to] cater towards that kind of shopping"* (P5). P12 worried about a combination of both factors; product previews that were fun and engaging being used to promote dangerous products, and claimed it could be worse in VR than in a non-VR medium: *"Let's say instead of a video advertisement for alcohol, it's a world and you go and you can pick the drinks and you drink them and you physically have effects because that's something you can do in VR. You'll make everything a little 'woooo', and then there's kids who are impressionable people or even adults who let's say are trying to avoid alcohol. And then you're put in a non-skippable world where you're standing in a bar and you're being advertised, whatever. I feel like the immersive nature of VR really makes that substantially more dangerous than just watching a video of that exact same thing, picking it up. It seems like it could be worse to me for sure."*

This shows an interesting contrast between on the one hand participants appreciating the immersion and fun-like aspect of VR advertising (see Section 5.4.2.3) while at the same time recognizing its manipulative effects on vulnerable populations.

5.4.4.3 Reasons for lack of concern

On the flip side, there were a substantial number of participants who were not as concerned with the possibility of manipulation. In digging a little deeper, we observed that several factors contributed to this lack of concern regarding manipulation, which we highlight below.

Manipulation will not affect me: Several participants believed they would not be affected or influenced by manipulative techniques, which could play into downplaying the severity of manipulation. For example, for the Soccer Shoe scenario, participants did not think that the techniques used would influence their perspective on the product. On hearing the manipulative disclosure, P10 stated that *'I don't think if I did really well in the game that would motivate me to buy the shoes [...] 'I question whether that will work for me personally"*. P12 was similarly skeptical about techniques such as gamification working on adults more broadly: *"There's no amount of enjoying a game that's going to make me buy soccer shoes. So I think especially adults are wise enough about the standards of advertising and what advertising is that they could still make an informed decision on whether they need [the shoes] or not."* The same applied to P19, who believed that manipulative techniques would not apply to them while acknowledging it might affect other people of the general population: *"I'm less prone to [manipulation]. I don't know. I think a lot of people would just be completely unconscious to it, so it would probably work for a huge amount of people.''* Relatedly, some participants were confident they could detect deception when it was happening, such as P9 for the Furniture scenario: *"You can kind of tell if a website['s advertising is] false based off just how the pictures are and stuff. You're just going to get a vibe for what fake items would look like."* Lastly, a few participants thought that companies could not properly implement some of the manipulative techniques. P9, for example, was skeptical as to whether, in the Soda scenario, it would be possible to personalize an ad with their music interests: *"Also, how effective are they going to be actually figuring out my music taste because I'm into some pretty new stuff and I listen to niche music."*

Although these attitudes ('I won't be affected by manipulation', 'I can tell when manipulation is going on', and 'companies couldn't get it to work anyway') differ, they all fall under one theme: the belief that manipulation doesn't work. This skep-

ticism of manipulative techniques working on them or working as intended could explain their attitudes towards manipulation in VR advertising more broadly, in that if manipulation is not effective, it is not a cause for concern.

Companies would not engage in severe forms of deception: There was also a belief that companies would not try to engage in egregious forms of manipulation. This was not because participants believed companies were good; in fact, as discussed in Section 5.4.2.5, participants generally did not trust companies. Rather participants believed that if companies engaged in very obvious and blatant forms of deception, they would be punished by legal action, by consumers returning products, or by public backlash—given these risks, participants believed that companies would either not dare engage in this manipulation. For example, on hearing the deceptive product previews of the Furniture scenario, P15 said *"if the thing that you're getting is not actually the thing that you're looking at, then we run into truth and advertising issues and once people start actually buying things and finding out that they're not of the same quality as what's being presented in the VR application, then the company's ratings would tank."* Similarly, P4 said *"I feel like it'll be really, really misleading and almost in the field of legal action and people would find about that really, really soon, especially with social media and YouTube and etcetera. So I don't really feel like it's something viable for companies to do."*

Resignation towards minor forms of manipulation: Interestingly, while participants thought that companies would not engage in severe forms of manipulation, they also considered minor forms of deception commonplace and just part of advertising. For example, P12 thought advertising *"has an inherent, sneakiness is the wrong word, but always trying to do whatever is available to make it the most engaging experience where you're going to remember it, have a positive experience. I think that's very much just the nature of advertising."* Similarly, P14 mentioned *"I think there*

will always be false advertising that comes along with any advertising channel."

Consequently, participants were permissive of minor forms of deception given how commonplace they are. P20, for example, was not bothered by misleading experience marketing in the Furniture scenario: *"Because it happens so much, it's nothing that really bothers us or at least bothers me in a sense, then it's kind of like it's almost expected it's going to show up in a lower quality."* P21 made an analogy to how McDonald's advertised products to explain his acceptance of doctored advertising: *"when you buy a thing of fries at McDonald's, the one in the advert is bristling out the top. They all look perfectly crispy, but when you get them they're soggy but you kind of expect them to be that."* Thus we see how resignation towards manipulative VR advertisements influences how participants view and passively accept the practice, or at least minimize their concerns.

5.4.5 Suggested solutions to VR advertising risks

Most of the interview focused on participant attitudes towards VR advertising and risks within them, with a particular focus on manipulation. Through these discussions, participants mentioned several possible solutions that could help address some of their concerns.

5.4.5.1 Government regulation

The most talked about solution participants discussed was effective government regulation. Participants suggested that legislation should regulate how and whether VR advertising can advertise to children, what type of content can be advertised through VR (e.g., can pornography be advertised in VR?), controls over false and deceptive advertising, and limit excessive data collection. The main overarching theme, however, was more abstract: reigning in the power advertisers have. This is probably best encapsulated by P7: *"I think that advertisers have an extreme amount of power*

that needs to be choked back. And if we get to a point where there is a Metaverse type world that everybody interacts with, those advertisers would have near unlimited power if left completely unchecked. And I believe that there would need to be some sort of rules with actual consequences if they break them to keep everything ok."

A few participants, however, were skeptical of government legislation. P17 was wary that government regulations, or indeed any type of regulation, would be done in accordance to what VR users actually wanted and cared about: *"I don't necessarily like the idea of [VR] not being regulated in some way, but in truth it's better than having something or someone regulate it, which may not adhere to all the wants of the actual community".* In a similar boat was P7; even though he wanted government regulation, he was apprehensive of the effectiveness of government legislation. When asked about the possibility of having government legislation to hold VR advertisers accountable, P7 said *"I don't think it would be possible at all given today's political climate. And even if they did make the rules, the rules would probably stipulate a punishment that's a relatively petty fine. And if you're talking about a multimillion or multi-billion dollar corporation pumping out these ads, if it's not actually going to take a chunk out of their wealth and it's just going to be a drop in the bucket, then it's not going to change anything."*

5.4.5.2 Platform providers as alternative regulators

In lieu of government regulation, a few participants highlighted the role that platform providers and VR content creators could play in keeping out bad VR advertisements. The idea was that platforms could more quickly and more effectively kick out bad advertisers than a government could. For example, P7 mentioned that " *It's far easier for Google to say, I don't like these kind of videos and I'm going to make all of them vanish and nobody can do anything about it than it is for the United States Senate to vote on a law to ban whatever videos from the internet.*" Regardless of whether

participants wanted government bodies or private companies to do the regulating, the general theme was the same: have enforceable rules that punished and removed bad actors.

5.4.5.3 Emphasizing choice and transparency

Another solution participants proposed was that of choice and transparency. With regard to choice, this meant allowing VR users to choose when and if to engage with VR advertisements. Solutions relating to the theme of choice included: banning forced advertisements that were unskippable; have all VR advertisements be optional experiences that users opt into; not have VR ads that are right in front of a users' face, and instead, have VR ads in a corner which users could choose to walk into if they chose to; and prevent VR advertisements from gating content. Regarding transparency, participants wanted information on how their data was being collected and used for advertising. For example, P13 said *"I don't really want to exist in the unknown realm to where I don't know how I'm being advertised to. Cause I feel like that just creates distrust to whoever is advertising."*

5.4.5.4 Solutions mitigate concerns, but do not solve them

For all of these solutions, it is important to note that they were not seen as panaceas that automatically solved issues of VR advertising or made VR advertising acceptable. Even if these solutions were implemented, many participants still were apprehensive and wary of advertising. When asked what their reaction would be if VR advertisements were more transparent about their data practices, P7 said *"I would be more ok with it, but it doesn't necessarily mean I would be ok with it, if that makes sense."*

5.5 Discussion

Our study answers three research questions. The first research question asked: **what are VR users' attitudes towards VR advertisements?** Overall we found that participants were generally wary and skeptical about VR advertisements, but many did acknowledge benefits that VR advertising can bring, including monetizing the space, creating new ways for consumers to visualize and interact with products prior to purchasing them, and creating fun and novel types of advertisements. The second research question asked: **what are the main concerns and worries that VR users have regarding VR advertisements?** The main concerns we observed were that VR ads could be very intrusive and ruin the immersion of VR experiences, worries that VR ads would be forced on users and annoying to interact with, concerns about privacy risks, and an overall distrust of both VR advertisers and VR platforms (most notably Meta). The final research question asked was: **what manipulative risks of VR advertisements are VR users particularly concerned or worried about?** To our surprise, we found that several participants were not particularly concerned about the manipulative techniques we presented; on digging deeper, we saw that this lack of concern is potentially explained by an illusion of invulnerability, skepticism that companies would engage in severe forms of manipulation, and resignation towards manipulative advertising.

In this section, we first situate our findings in the literature to discuss what we learned about VR advertising. Next, we explore participants' lack of concern regarding manipulation. Finally, we address the practical implications of our work by discussing how to mitigate key concerns so that VR ads better align with users' needs and wants.

5.5.1 Insights about VR advertisements

This study makes the following contributions to our knowledge of how consumers view advertising and how we should think about VR advertising going forward.

5.5.1.1 General advertising concerns extend into and exacerbated by VR

Our findings closely align with prior work on consumer attitudes and concerns towards non-VR advertising, including privacy concerns [238], worries over shocking content [2], and a distrust of large companies and advertisers [225, 286]. Thus, our findings show that many non-VR advertising concerns extend to and are still present for VR.

While concerns remain the same, participants expressed how respective risks could be exacerbated in VR. Participants highlighted how VR ads could collect more data than non-VR advertisements, most concerning of which is eye and gaze tracking. Shocking content could be worse in VR in that it would be more graphic, visceral, and difficult to avoid.

5.5.1.2 Immersion is a double edged sword

The immersiveness of VR was viewed as a key distinguishing factor between VR and non-VR advertising, with both positive and negative implications. On the one hand, an immersive VR ad could be fun and enjoyable. However, poorly done in-app VR advertisements could ruin the immersion of VR experiences. Prior work has found that people sometimes find ads to be annoying [204]; in VR though, ads may not only be irritating but may ruin the essence and experience of being immersed in VR.

5.5.1.3 VR advertising already a phenomenon in social VR

A majority of our participants had already encountered VR advertisements, showing that VR advertisements are not just a possibility but a reality. Our findings further show that advertising in VR is evolving in ways that often recreate real-world experiences, such as advertising posters, brand tags, and virtual markets.

5.5.1.4 Certain perspectives missing

As discussed in Section 5.3.2, our sample size was largely male, aged 18-34, lived in North America / Europe, and had experience using VR. While this is reflective of general VR usage statistics, it does mean that the voices of other populations are underrepresented in our sample, particularly the voices of users who do not identify as men; users who live outside of Europe and North America; and the voices of those who have not used VR user. This begs the question of what perspectives these user groups may have had, and whether there would be additional insights into the harms of advertising beyond what our current findings suggest. While we cannot know for certain what their perspective would have been, we can make some estimations as to issues participants may have expressed. One issue that has been brought up in non-VR advertising is how advertising can reinforce societal stereotypes, including gender stereotypes [42, 106]. It is possible that had our participant sample consisted of more women (who may be more aware of to gendered stereotypes in advertising), related concerns may have featured more prominently. Ali et al. [9] found that older adults are more likely to encounter deceptive and click-bait ads. While some participants expressed concern over deceptive advertising, with an older participant sample, there may have been more concerns regarding deceptive advertising. Finally, another concern that a different population sample may have raised is VR advertising leaving people behind. Our current population sample was comfortable using VR. For those who do not use VR regularly, there may have been concerns regarding

VR ads being difficult to navigate or skip. Looking beyond VR advertising to VR shopping and commerce, there could be concerns around VR shopping becoming necessary to navigate daily life, and those who do not want (or cannot) use VR being disadvantaged. Future work can and should cover these missing perspectives.

5.5.2 Contextualizing participants' attitudes towards manipulation

Prior work suggests that users are worried about manipulation in advertising [238]. Our findings, however, show mixed attitudes: whereas some participants were very concerned about manipulation in advertising, others were not. We identified multiple factors that may have contributed to participants' lack of concern.

5.5.2.1 Methodology limitations

One factor that could have affected participants' level of concern is how we presented the scenarios. Specifically, we did not use terms that had negative connotations (such as manipulation, deception, lying, or misleading) to avoid biasing participants; however, one consequence is that the impact of the manipulation techniques may have been subtle. Similarly, the scenarios advertised relatively innocuous products to avoid distracting participants from the techniques at hand. As a consequence, none of the products being sold were dangerous, meaning there were no negative repercussions that could befall the consumer: at worst, the consumer would either waste money or have to return a disliked product. It would be interesting to see how attitudes would change if the products being sold in the scenarios were more controversial, such as gambling, tobacco, alcohol, firearms, or political messaging.

5.5.2.2 Illusion of invulnerability

Another mediating factor was a belief that manipulative techniques would not affect them personally. This is a phenomenon that has been termed 'illusion of vul-

nerability' [150] which describes how people either overestimate their own abilities or think that bad things will not happen to them. Prior research has shown that people tend to overestimate their own abilities to resist manipulative advertising messages [115, 150]. As such, it is likely that participants are overstating their ability to resist manipulation (or at the very least, stating it without any evidence to support it).

Concernedly, consumers who are more confident about their ability to resist manipulative techniques may be overconfident, lacking caution when approaching advertisements and so be more likely to fall victim to these techniques [140]. However, this claim is disputed: whereas one study found that this indeed happened with regards to misinformation and fake news [161], a different study found there was no correlation between one's level of confidence in their ability to resist persuasive advertising and how susceptible they were to persuasive advertising. [115].

5.5.2.3 Belief in self-correction mechanisms

Some participants believed that companies would not engage in severe forms of manipulation since they would face legal and consumer backlash. Yet, there is ample evidence that companies do engage in deceptive advertising (e.g., see [84, 85, 153, 288]). The problem is so dire that in 2023, the U.S. Federal Trade Commission (FTC) sent out a warning to nearly 700 companies that "*they should avoid deceiving consumers with advertisements that make product claims that cannot be backed up or substantiated*" [87]. Given the prevalence of deceptive advertising, it would be naive to assume that no company would engage in manipulative VR advertising.

5.5.2.4 Resignation

Finally, participants were often resigned toward manipulation in advertising, echoing the larger phenomenon of digital resignation that occurs *"when people desire to*

control the information digital entities have about them but feel unable to do so" [71]. In fact, literature has identified similar phenomena such as privacy cynicism [160], surveillance realism [67], or capitalism realism [91], which all describe similar themes: disliking a certain outcome, but believing it to be inevitable, unchangeable, and being unable to conceive of viable alternatives. In our study, resignation manifests in our participants considering manipulation not acceptable, but viewing it as inevitable commonplace, and unavoidable; consequently, there is a rationalization whereby the concern is diminished.

5.5.3 Need to further understand lack of concern regarding manipulation

Because of the above factors, some of our participants' lack of concern regarding manipulative advertising should not be taken as a tacit approval of such techniques or as a sign that manipulative techniques are not worth addressing. To better understand manipulation risks and their effects, we propose the following steps for future work. Further studies should explore manipulative advertising in different contexts, with different manipulative techniques, and concerning different products. In a similar vein, we should gather empirical data to better understand how manipulative techniques influence consumers and how to dispel illusions of invulnerability regarding advertising. Once we have a better understanding of the reasons behind this lack of concern regarding manipulation, VR users (alongside other key stakeholders, such as VR advertisers) should be brought in to discuss these questions. For example, Adams et al. [1] brought together VR users and VR developers to create a 'code of ethics' regarding VR development practices. Similar approaches should be taken to define manipulative advertising practices. Other approaches could be the use of participatory design [184], consensus conferences [146], or citizen forums [247].

5.5.4 Aligning VR ads with users' needs and wants

Based on our findings, we discuss ways to design VR advertisements in ways that align with users' needs and wants by highlighting several themes that VR ads should incorporate.

5.5.4.1 Should there even be ads in VR?

Discussing how to align VR ads with users' needs and wants warrants a prior discussion on should there even be ads in VR. Most participants did not want advertisements in VR. When participants discussed the benefits of VR advertising, they often did so begrudgingly from a standpoint of 'how to make the best out of a bad situation' rather than excitedly looking forward to VR ads. Participants' distrust of VR advertisers and skepticism over whether regulation would reflect the needs and wants of the VR community question whether VR ads will even be good for the VR ecosystem.

However, we must acknowledge the pace at which VR advertising is evolving. At a risk of succumbing to the same resignation that our participants expressed, VR advertising seems to be inevitable. Industry trends and statements by key stakeholders in the VR advertising space (including Meta) imply companies will increasingly advertise in VR [116, 139, 256]. On a broader level, all communication technologies that achieve mainstream use develop advertising [147, 230], and there is no indication VR will avoid this trend.

Thus, with the knowledge that advertising is already present in VR and will inexorably expand (barring a societal revolution that sees the overthrow of the current economic model and replaces it with one where advertising ceases to exist), we feel it is more productive to work within these limitations to discuss ways that VR advertising can align with users' needs and wants *while acknowledging* that an ideal scenario might be a VR ecosystem where there are few to no ads.

5.5.4.2 User Choice

Our findings demonstrate the importance of giving users a choice to engage with a VR advertisement or not. VR provides interesting possibilities for this, such as ad content being in locations in a VR world which a user can choose to walk up to or ignore (for example, a poster in a certain room) or whole virtual worlds which users voluntarily choose to enter. The choice should also extend to users choosing what data (if any) users are willing to share with advertisers. VR ads should further not block content. And importantly, VR ads should not be forced on a user's headset and be unavoidable. Companies might be hesitant to create ads that users can skip since they may feel like they lose user engagement. However, VR users did mention that they willingly engaged with unforced advertisements (for example, participants freely choosing to travel to virtual markets), providing interesting opportunities for VR advertising that is beneficial to both users and companies.

5.5.4.3 Contextually-embedded advertising

Another implication from our findings is that VR ads should be embedded into their virtual context—participants were concerned that ads might break VR user experiences. Contextual advertising is *"the display of relevant ads based on the content that consumers view"* [291]. It is already utilized in non-VR mediums—for example, some search engines use contextual advertising by showing ads for products relating to a user's current search term [72]. In VR, contextual advertising takes on a new dimension by contextually embedding advertising into VR experiences in order to enhance rather than break their immersion. In VR experiences that aim to recreate real-life places, there could be ads that would already be in those places. In experiences that are not based on real places, advertisements should promote products related to that experience: for example, a virtual experience that relates to rock climbing could advertise rock climbing gear, but perhaps not diapers. Similarly, the

interactions required for in-app VR ads should closely match the interactions of the VR experience the ad is in. If the VR experience the user is engaging in is passive, then an embedded VR ad should not require a lot of movement or hand gestures to interact with.

5.5.4.4 Balancing subtleness with user awareness of ads

Our findings suggest that in-app VR advertising should not interrupt the immersion VR experiences offer. One option that has been used successfully in non-VR contexts is the use of product placement and themed worlds where the ad is embedded in the background rather than it being loud and interrupting the user. However, this subtlety needs to be balanced with making users aware of advertisements within an experience. Disguising ads as non-advertising content is itself a manipulative technique since this prevents users from recognizing ads and enacting ad-resistant strategies [95]. Our findings, however, suggest that labelling ads is likely not a suitable approach for VR. Thus we need to find ways to balance informing users that something is a VR advertisement without interrupting the immersive experience. One solution could be to inform users of potential advertisements within a VR experience before the user enters the experience. That way the user is aware that ads are present and possibly what shape they take, but once in the experience, there is not too much attention drawn towards the individual advertisement, thus preserving the immersion of the experience.

5.5.4.5 Embrace the interactivity / gamification of VR ads with caution

Participants highlighted the fun and interactivity of VR ads as being one of the main positives that VR advertising can bring. This echoes prior literature, which has shown that consumers generally appreciate fun and interactive advertisements such as advergaming [179]. As such, this suggests that VR adverts that are gamified and

interactive would be appreciated by consumers and should be pursued. This does not mean that all VR ads have to be advergames to be appreciated—something as simple as incorporating playful interaction techniques (such as the placing of furniture around a home) was viewed positively by our participants.

However, this does not mean gamification should be blindly pursued. There are still many unanswered questions about the potential negative impacts of gamification. First and foremost, we cannot ignore the potential manipulative effects gamified VR advertising can have (see Section 4.2.3). Just because participants were somewhat unconcerned about the practice does not automatically mean it is now an acceptable practice—if anything, this lack of concern could potentially make users more susceptible to their influence [140, 161]. Participants highlighted concerns about how children may be influenced by the gamification of advertisements. More research is needed to understand what the impact of gamification is so that we can properly assess to what degree it is an acceptable practice. Moreover, just because participants accept gamified VR advertisements now does not mean they will do so in the future. The appreciation for fun and interactive advertisements may be due to the novelty factor of VR and the fact that not many gamified VR advertisements exist. The overuse of gamification in VR advertisements could lead to a backlash and users could reject these techniques.

In short, gamifying advertisements and making them fun and interactive can be a positive step in making VR ads enjoyable for users. However, we should move with caution, and more work is needed to truly understand the impact of gamification.

5.5.4.6 Encourage product previewing

Participants really appreciated the ability of VR ads to showcase products in high fidelity before purchasing them, viewing this as both useful and convenient. Furthermore, as it relates to manipulation, participants mentioned that product previews

could serve as a way to counter manipulation and lead to more informed consumer choices. If the virtual previews of products are reasonably accurate, participants could learn more information about a product before purchasing it. As such, we encourage VR advertisers to pursue product previews in VR advertising, with the obvious caveat that these product previews should be accurate representations of the good or service they are advertising.

5.5.5 Effective ad regulation and enforcement

Aside from understanding how VR ads can align with VR users' needs, there is still the issue of how to solve instances where VR ads flaunt these rules and are harmful for users. Participants saw the regulatory responsibility with both governments and VR platforms.

With regards to government regulation, participants highlighted that more than legislating individual aspects of VR advertising, it was important that government acted as a counterweight that keeps advertisers in check and can meaninfully enforce punishments. It is not good enough to have rules if advertisers are powerful enough to ignore them: after all, many legal jurisdictions already have laws against deceptive advertising, and yet companies still engage in the practice [84, 85]. Therefore, government regulation should focus on curbing the power that advertising companies have. Steps include implementing stricter antitrust legislation; steeper fines for companies that engage in deceptive practices; and bringing more control and oversight from government bodies onto the advertising field, as opposed to trusting the advertising industry to self-regulate, which has been imperfect at regulating advertising [212].

In parallel, VR platforms should create and enforce rules around VR advertising. VR platforms often have more technological expertise, flexibility, and responsiveness than government regulators. They also have incentives for keeping out bad advertisers so that users do not have negative VR experiences. This makes them prime candidates

for regulating VR advertising on their platforms. However, our findings expose a large trust gap between VR users and these platforms. Past behaviors of VR platform providers (most notably Meta) and large technology companies have soured user's perceptions of these companies. If platforms want to regulate the VR space, we argue that they need to regain users' trust. Without this trust, users will be reluctant to use these VR platforms. Some steps to regain user trust include democratizing the rulemaking process (such as allowing VR users to voice input regarding what types of VR ads should or should not be allowed), being transparent about current and upcoming plans regarding VR advertisements (so that users are not caught unaware by sudden appearances of ads in VR), and prioritizing user well-being over profits.

5.6 Conclusion

In this chapter, I presented a study where my co-authors and I interviewed 22 VR users to understand their attitudes and concerns regarding VR advertising. We found that participants were generally apprehensive about VR advertising, and were primarily concerned about whether VR ads would ruin immersion of VR experiences, that VR ads would be unskippable and be forced on users, and privacy risks. As it relates to manipulation, while participants were concerned manipulation in VR (particularly for vulnerable populations such as children or compulsive shoppers), several participants expressed a lack of concern over manipulative VR advertising: a lack of concern mediated by an illusion of invulnerability, a belief that companies would not engage in severe forms of manipulation, and resignation towards manipulative advertising.

This chapter presents a different view on VR advertising since it is done from the perspective of VR users. On the one hand, we see that participants are concerned with some of the risks identified in prior chapters, such as concerns around the data collection of VR advertisements. We also see areas of dissonance; most notably with

regards to subtle advertising, which while being a manipulative advertising technique is still appreciated by participants as a viable way to help monetize the space without interrupting the user experience of VR. Overall, this chapter provides an additional layer of depth and understanding which nuances and contextualizes the findings of prior studies.

This chapter represents the third study of my thesis. Combined, these three chapters provide insights into the manipulative risks of VR ads from different vantage points, whether it is using speculative methods to look at the future, a more grounded approach looking at existing at existing VR marketing materials, or from the perspective of VR users. In the next (and final) chapter of the thesis, I synthesize the contributions of the chapters and what they *together* tell us about manipulative risks of advertising in VR.

CHAPTER VI

Discussion

In this thesis I set out to investigate the manipulative risks VR advertising poses. Specifically, I asked two key research questions: (1) What are the manipulative risks that VR advertisements pose? and (2) What are VR users' attitudes and concerns regarding VR advertisements? I answered these questions using a three-pronged approach. In Chapter III, I used scenario construction to identify likely ways that VR advertising can be manipulative. In Chapter IV, I used walkthroughs to examine existing VR marketing experiences to understand the current state of VR advertising and if there are any manipulative techniques that are being employed. Finally, in Chapter V, I conducted interviews to understand VR users' attitudes towards manipulative techniques and VR advertising in general.

In this final chapter of the dissertation, I first synthesize the contributions of the thesis and how I answer the research questions I proposed. I next discuss future work that should follow this thesis. Finally, I reflect on the methods I used throughout this thesis and discuss can be learned about predicting the harms of future technologies.

6.1 Synthesis of Contributions

This thesis contributes a greater understanding of VR advertising and manipulation within it. It does so in two key ways. First, this thesis highlights what is unique

about VR advertising. More importantly, this thesis identifies numerous manipulative techniques that VR advertisements are likely to employ. In the next section, I first discuss what is unique about VR advertising. This will inform the subsequent discussion where I walk through the various manipulative techniques this thesis has identified.

6.1.1 What is unique about VR advertising

This thesis has identified numerous manipulative risks of VR advertising. There already exists a lot of literature looking at manipulative risks of non-VR advertising (see Section 2.1.3) and harms in VR more broadly (see Section 2.2.3). As such, in situating the contributions of this thesis in the wider literature, it is important to ask how is VR advertising different from these other contexts that have already been studied, and what lessons can (or cannot) be learned from prior work?

As such, before introducing the manipulative risks of VR advertising, I discuss how VR advertising is unique from two perspectives: (1) how is VR advertising different form non-VR advertising and (2) how is VR advertising different from other VR content.

6.1.1.1 As compared to non-VR advertising

This thesis identifies distinguishing features of VR advertising. Specifically, VR advertising boasts of the following affordances that separate it from non-VR advertising: greater immersiveness, high fidelity product previews, and greater levels of interactivity and gamification.

More immersive The key feature of VR advertising is that it is more immersive than other mediums. This has been charted by the literature [159] and hypothesized about in in Chapter III. Furthermore, Chapter V confirms that this is a sentiment

also shared by VR users. However, one key dimension of the immersiveness that was revealed in Chapter V is not only that ads are immersive; it is that the content VR ads may interrupt is also immersive. As a result, any irritation caused by ads interrupting an experience could be much more disruptive in VR settings than non-VR settings.

Higher fidelity product previews The second key feature is that VR advertising allows for higher fidelity product previews than non-VR advertisements. This was hypothesized in Chapter III, and confirmed in Chapter IV, where we observed that many existing VR marketing experiences consisted of product previews. Chapter V brought some nuance. VR users were very appreciative of VR product previews, viewing it as one of the key advantages that VR advertising could provide. Product previewing can combine the benefits that in-person shopping provides—close examinations of products to be bought—with the advantages that online shopping can provide—convenience of being able to shop from the comfort of one's home and having access to a business' entire catalogue rather than what the store currently has in stock.

More gamified and interactive The last feature is that VR ads are more interactive and gamified than non-VR advertisements. In Chapter IV, we observed that many VRMEs made use of gamification and interactivity, and that it manifested in several ways. Some VRMEs were very game-like, and almost indistinguishable from ordinary games. Others were more subtle, where the ad itself may not have been gamified, but there were several playful and fun-like interactions (such as throwing paintballs at a car to change the car's color). Lastly, Chapter V shows that VR users appreciate and look forward to fun and new types of VR advertising formats. However, this fun factor may be due to the novelty factor that VR advertisements provide. If VR advertising becomes commonplace, this fun factor may disappear.

6.1.1.2 As compared to other VR experiences

When compared to other VR experiences, VR advertisements are unique in two key ways: a general lack of consent or knowledge about what a VR advertisement will entail (particularly for in-app VR advertisements); and changing incentive structures for VR advertisers.

Lack of consent or awareness: The primary difference between VR advertising and other VR experiences is that, in cases of in-app VR advertisements, users may not consent to, or be aware of, the nature of the VR ad content before entering it. When using a standalone VR experience, the user can look at the store description, trailer videos, or user comments: thus, they will have a rough understanding of the type of experience they are using as well as the interaction techniques that will be required as part of that experience. That is not the same for in-app VR advertising. VR users may be aware that a VR experience has in-app ads, but they may not know what those ads will be like, what products they will advertise, and what interactions will be required to navigate through the advertisement. I note that this does not apply to standalone VR advertisements (such as the VRMEs studied in Chapter IV), since they are also opt-in and users must seek them out and download them first. As the VR advertising ecosystem evolves, however, there may be an increase of in-app VR advertising, meaning the issues regarding lack of consent for the ad offerings become more salient.

Different incentives and purposes of VR advertisements: I argue that a second way VR advertisements are different from VR experiences is that VR advertisements may have different goals and incentive structures. The goal of advertisements are to persuade consumers to purchase products, which often differs from ordinary VR experiences, whose goal may be to entertain, educate, or provide a service. These

differing goals mean that even if a VR experience and a VR advertisement have similar content, the motivation underlying them and the way they manifest may differ. For example, VR experiences and VR advertisements may both have shocking content. But whereas in VR content this is likely done to benefit the user and enhance the experience (e.g., as part of a VR horror experience), in VR ads, the goal of this content will be to persuade users to purchase a product, potentially in manipulative ways.

Given these changing incentive structures and motivations underlying actions, the nature of the action may differ, and so solutions applicable to VR content may not apply to VR advertising. Similarly, what might be appropriate in a VR experience context may be inappropriate in a VR advertisement, given that what is done in the former is presumably done to benefit the user and what is done in the latter to benefit the company; research has shown that the motivation behind an action can change how consumers view that action, and so, its acceptability [193, 282].

6.1.2 Manipulative techniques identified

My thesis had two overarching research questions: (1) What are the manipulative risks that VR advertisements pose? and (2) What are VR users' attitudes and concerns regarding VR advertisements? To answer these questions, I provide an overview of the manipulative techniques of VR advertising my thesis discovered. I expand on each technique by discussing what the technique is, what knowledge each chapter contributed to the technique, and how VR users think about these techniques. I contextualize each point in the literature, and discuss ways to mitigate the risks that each technique presents.

6.1.2.1 Misleading experience marketing

The ability to preview products before purchasing them in VR has an interesting relationship with manipulation. On the one hand, Chapter V showed that participants appreciate the feature and view it as a useful way to learn more about a product. On the other hand, Chapter III identified that these product previews can also be deceptive (a.k.a. misleading experience marketing)—virtual recreations of products that mislead VR users as to the quality of product they are purchasing, and misleading previews about what the world is like could lead to a distorted sense of reality and what the world is like. Chapter IV was unable to observe whether product previews in existing VRMEs were deceptive or not, but did observe that the use of product previewing is common, opening up the possibility of misleading experience marketing within them. Chapter V showed that while participants disapproved of misleading experience marketing, participants were skeptical that companies would engage in severe or extreme forms of deception, given the negative backlash they would accrue. Moreover, some participants were so resigned to deceptive advertising that light deceptive 'touch ups' were accepted as being an expected feature of advertising.

Deceptive product previews are not new or unique to VR. There are countless examples of non-VR advertising being deceptive [178]. Furthermore, as evidenced by Chapter V, the practice is so common in non-VR advertising that participants were resigned to deception in VR advertising. As Chapter III discusses, however, in VR misleading experience marketing could be more deceptive given the realism and immersiveness of VR.

The question becomes how to keep the benefits that product previews offer while trying to mitigate the risks of deception. Current laws exist banning deceptive advertising, but given that deceptive advertising still occurs [178], it is unclear to what extent these laws are effective [47]. Greater enforcement is required. More impor-

tantly, the fact that participants were permissive of light 'touch ups' raises an interesting philosophical point: what is the difference between misleading advertising versus presenting a product in its best possible light? Currently, most attempts at making this distinction focus on either the intent of the advertiser (e.g., was there an intentional attempt to mislead or deceive consumers) [47] or on the effects it has on consumers (e.g., did consumers have a false impression of a product after seeing this ad) [48]. I argue that on top of these high level approaches it is important to be as granular as possible and discuss techniques VR advertisers may use. For example, is giving a car a virtual shine or glow acceptable? Is it OK to for universities to let prospective students participate in virtual classrooms with a student body that is not representative of the wider campus demographics, as an effort to make their university seem more diverse than it is? Taxonomies exist of manipulative advertising techniques in non-VR advertising [63], and my work provides starting points to create similar taxonomies for VR advertising that would help understand acceptable versus unacceptable ways to showcase products in VR.

6.1.2.2 Embodiment of characters

The next manipulative technique identified is how VR advertisements can enable users to embody characters with positive traits, such as characters who are strong, fast, happy or belong to a prototypical happy family. Users may then associate these traits with the product they are purchasing. This technique was identified in Chapter IV; furthermore, in Chapter V, VR users mentioned being concerned over how this embodiment might influence children. While prior work has shown that embodying certain traits in VR can influence users' behavior [5, 94], this thesis showcased how this embodiment can (and is) being used in the context of VR advertising. Associative advertising is a common advertising practice [199], but with embodiment in VR, that association could be an order of magnitude more severe. It is not that using a product

is associated with being stronger or faster, in a VR ad, using that product actually makes the user stronger or faster (in that virtual world). It is not that a user sees a happy family using a product, in a VR ad, they will have a happy family. However, Chapter V revealed that some participants may find this embodiment to be a fun aspect of VR ads. Users may enjoy being a superhero or have unique traits they otherwise may not have. As such, the solution to this problem is more nuanced than simply banning embodiment.

To properly mitigate the risk that embodiment poses, I argue that a first step is to understand what are the effects of embodiment on users, and to what extent embodiment influences how VR users view products. This can then inform what actions are appropriate: depending on the magnitude of the impact embodiment has on users, potential solutions could include allowing the use of embodiment as is, adding certain restrictions (e.g., VR ads that have users embody certain characteristics cannot be shown to children), or heavily restricting the practice altogether.

6.1.2.3 Appeals to negative emotions (i.e., shockvertising)

Appeals to emotion are a common advertising technique [63], and can be manipulative when the advertisement makes appeals to particularly strong and visceral emotions (e.g., grief, sexual arousal) that may bias the way consumer views a product [63]. Chapter III pointed out ways in which VR advertisements could make use of emotional appeals, leveraging the data collection capabilities of VR headsets (to know what emotions a user is feeling and how to exploit them) and the immersive nature of VR (to amplify the emotions that are felt) in ways to exacerbate the manipulative risks of emotional appeals. Moreover, as highlighted in Chapter III, the immersiveness of VR could make emotions be felt more strongly. As such, any impact that appeals to emotion could have on users is amplified in a VR context. Chapter IV demonstrated that appeals to emotion are employed fairly often in existing VRMEs,

but the appeal to distressing emotions such as fear and disgust (i.e., shockvertising) warrants particular concern. Shockvertising is not only manipulative, but can also lead to severe emotional harms for users, particularly in VR, where a user would not just be seeing a shocking event, they would be living through it. Finally, in Chapter V we observed that some participants expressed concerns that VR could leverage shame to promote their products, such as a company appealing to a teenager's low self-esteem and using body-shaming to sell beauty products.

The dangers that this type of advertising can cause reinforces the need for guidelines on acceptable and unacceptable VR advertising practices, including what are appropriate emotions advertisers can target. For example, is it acceptable to leverage grief or the death of a recent loved one? What about fears of death? Our findings suggest that negative emotions (such as shame, fear, grief) should not be leveraged.

However, there is an important conversation to be had about what rules should apply if shockvertising is used as a force for good. Charities and NGOs sometimes use shockvertising to promote pro-social behavior, such as showing the graphic effects of smoking (to discourage smoking) [56, 124] or the devastating effects of plastic pollution (to raise awareness about the environment) [65]. This raises the question of whether such practices are acceptable in VR. Is it OK, for example, for an anti-drunk driving campaign to use a VR ad where the user experiences what it is like to die in a drunk driving accident? In looking to determine the ethics of distressing advertising for public health campaigns, Brown and Whiting have proposed a framework that balances effectiveness, proportionality necessity, least infringement, and public accountability [41]. Frameworks such as these should be adopted and adapted to a VR advertising context, ideally with the input of VR users.

6.1.2.4 Gamification

Chapter III predicted that VR advertisements would be highly gamified and interactive, and Chapter IV confirmed that existing VRMEs make extensive use of gamification and playful interaction techniques. However, as seen in Chapter V, many VR users are not concerned about gamification in VR advertisements. While there were worries over how gamification might affect children or how it may present dangerous products to users (e.g., how will a gamified advertisement for alcohol impact someone who is struggling with alcoholism), for the most part, gamification was appreciated and viewed as one of the main advantages VR advertising can offer.

This raises the question as to whether gamification should be considered as a problematic technique for VR advertising. The literature suggests that gamification may subconsciously influence how consumers view products [262], and VR ads presenting dangerous products in gamified environments could mislead consumers as to how dangerous these products might be; however, VR user attitudes imply that gamification should be actively encouraged and pursued by VR advertisements.

We still encourage more work to be done in the area to understand the effects gamification in VR advertising has on VR users. The perception as to whether it should be an acceptable or unacceptable practice will depend on exactly the type and magnitude of effect on VR users. However, based on our findings, it suggests that gamification itself should not be a top priority if trying to address the manipulative risks of VR advertising.

6.1.2.5 Hyperpersonalization

Chapter III presented the idea that the increased data collection capabilities of VR headsets, combined with current trends of increasingly targeted advertisements, may lead to hyperpersonalization—a phenomenon where the ad content is dynamically generated and tailored to each individual VR user. This could quickly become

manipulative in cases where the hyperpersonalization targets users' sensibilities and vulnerabilities in advertising. Chapter V found that while VR users have concerns over the data collection practices that hyperpersonalization requires, the act itself of hyperpersonalizing advertisements is not as concerning; for some users, hyperpersonalized ads may be preferred over non-targeted ads, since hyperpersonalization would (in theory) lead to more relevant and enjoyable advertisements.

This balance between privacy risks and increased relevance is not unique to VR advertisements. Scholars have found that these tradeoffs also appear when considering targeted advertisements in online services [98, 238, 290]. However, the hyperpersonalization possible in VR will be orders of magnitude more invasive and manipulative than existing targeted advertisements. As such, we cannot just rely on prior literature to answer these questions for us.

We cannot say at this point definitively whether hyperpersonalization should or should not be allowed. Our findings suggest that there may be degrees of acceptability: perhaps hyperpersonalization that uses a user's performance in a music VR game to create advertisements with a user's preferred music choice (as was presented in Chapter V) might be acceptable, but hyperpersonalization that uses the physiological sensors on a VR headset to create advertisements based on a user's sexual preferences might be unacceptable. At the very least, if hyperpersonalization is to occur (which we emphasize: we are not necessarily advocating for), VR users should be given both transparency and control over the hyperpersonalization; that is, knowledge that hyperpersonalization is occurring and the autonomy to stop it if they see fit.

With regard to transparency, Chapter IV found that oftentimes VRMEs do not display privacy policies for users, meaning users cannot know the data practices of advertisers. In a future where hyperpersonalization is used, users should be made aware of privacy practices of VR advertisers. This does not mean that users should be bombarded with privacy policies. Privacy policies are notoriously lengthy, complex,

and generally unusable [78]. Furthermore, for very brief advertisements it may be impractical and even annoying to present a full-length privacy policy just for a brief ad. Alternatives such as just-in-time notifications may more be effective at conveying data practices to users [220]. With regard to control, users should be allowed to disable any type of hyperpersonalization if they are uncomfortable with the practice. Ideally, to avoid default bias (whereby users tend to disproportionally choose default settings) [218], hyperpersonalization should be opt-in rather than opt-out, i.e. the default setting for advertisements should be for them to not be hyperpersonalized.

6.1.2.6 Subtle advertisements

As argued in Sections 2.1.3 and 4.2.4, the use of subtle advertising that is disguised as non-advertising content can be a manipulative [95]. Chapter III explored how subtle advertising could be used in VR contexts to manipulate VR users—for example, using subtle ads to distort how participants view reality. Chapter IV similarly found that currently there are no labels that identify VR marketing experiences.

A first instinct may be to label ads prominently, so that users can recognize advertisements when they happen. Labels for subtle forms of advertising are already a requirement in some legal jurisdictions; for example, in the US, social media influencers must disclose relationships with materials they are promoting [86], and the Federal Communication Commission (FCC) states that sponsorships must be disclosed [83]. This will not only inform VR users of when they are being advertised to, but it can also have benefits for researchers and legislators who want to audit and identify ads for study. Chapter V, however, revealed important context showing that addressing subtle advertising may not be as simple as putting clear labels when an advertisement appears. Labels will draw attention to advertisements, which could ruin the VR experience for users. Our participants were very worried about noticeable, intrusive ads, meaning a label highlighting examples of product placement or

reminding users of the real world may be detrimental to the VR experience. In fact, VR users may prefer subtle advertisements that are not noticeable, since that way they can ignore the ads and properly enjoy the VR experience. Thus, work needs to be done to strike an ideal balance between informing VR users of in-app VR advertisements and not drawing too much attention to the extent of it ruining the VR experience.

6.1.2.7 Physical harms

Another aspect of VR advertising I want to highlight is the possibility of physical harms—while this is not a manipulative technique, it is still a harm that is worth highlighting. Chapter IV and V both identified ways that VR advertisements can physically harm users. Depending on the level of interactivity and movements that a VR advertisement requires from users, there may be muscle injuries or users may crash into furniture in their home. VR advertisements can use stimuli that hurts users (e.g., loud noises or bright lights). Badly optimized VR advertisements may cause nausea and motion sickness.

This phenomenon is not unique to VR advertising: the literature has identified ways that VR experiences can lead to physical harms for users [1, 133, 219]. It is still important to explicitly state that one of the risks of VR advertising are physical harms, for two key reasons.

First, the current rhetoric surrounding VR advertising harms often center around privacy risks, and relatively little attention has been paid to the physical harms of advertising. This means that current efforts to regulate VR ad behavior do not center on the physical risks that VR advertisements pose. Second, it is important to separate VR experiences from VR advertising given the unique context of VR advertising: namely, that ads (particularly in-app ads) represent a context switch from a VR experience a user is engaging in and so may require different interaction mechanisms.

This means that if VR ads are to require physical interactions or movements, the user may not be aware or consent to these interactions. A VR fitness game may involve strenuous physical exercise, but the user would have to opt-in to that experience. By contrast, users may not know that an in-app VR ad requires strenuous physical exercise.

Highlighting that a risk of VR advertising includes physical harms helps prioritize efforts governing VR advertising content to cover, not only what can or cannot be advertised, but also what types of interaction mechanisms should be allowed in VR. Specifically, in-app VR advertisements should closely match the interaction mechanisms of the applications they are in, to reduce discomfort. This can be particularly troubling in cases where an in-app VR advertisement changes the virtual setting the user is in. For example, Unity has proposed a virtual room as a form of advertising, which would involve creating doors in VR experiences [256]. Users would walk through those doors to a separate room where they would see an advertisement before returning to the original VR experience [256]. These types of transitions, if mismanaged, can cause discomfort to users. If VR advertisements do transport users to a different world, the transition should be as smooth as possible, with audio, lighting levels, and even environment to be as similar as possible to the experience the user is currently in. The user should be informed that this transition is happening, and opt-into the transition (rather than it being forced on the user).

6.1.2.8 Lack of good exit options

Finally, Chapter IV showed that currently there are few good exit options for VR marketing experiences. Whereas in non-VR contexts it is relatively easy to escape an ad (one can turn away or walk away from the advertisement in question), it is much more difficult to do so in VR, given the bulky nature of the headset. In fact, as shown in Chapter V, unavoidable ads that are forced on users was one of the main concerns

and worries of our participants. Realistically, the only way to avoid an advertisement in VR is for the software in the VR headset to force quit the advertisement. Even closing one's eyes may not work given the immersive audio of the experience, which itself could be harmful in case of extremely loud audio levels or the audio is itself is disturbing.

I argue that the ability to exit ads rapidly is crucial for three reasons. First, from the perspective of manipulation, avoiding an advertisement is a key strategy users employ to resist manipulative advertising [95]. Second, from a health and safety perspective, quick exit options allow users to safely exit VR advertisements that pose emotional or physical harms for users (e.g., VR ads that show shockvertising). Finally, from a perspective of creating VR advertisements that align with VR users' needs and wants, Chapter V indicated that VR users wanted the ability to quickly ignore and hide advertisements in VR. For these reasons, I argue that it is imperative to implement ways to quickly exit VR advertisements. As detailed in Chapter IV, these exit options should, at a minimum, be easy to access; constantly present (meaning that the user does not have to remember complex buttons on the controller to activate); and allow the user to pause and exit the experience relatively hassle-free. Current exit options vary by VR experience, but the only reliable exit option involves lengthy presses of a home button which brings up a home overlay, from which one can quit the app. This may not be appropriate in the case of in-app advertisements, since using this option would shut down an entire application all to avoid one problematic in-app VR ad.

Solving adequate exit options is not unique to VR advertising—it is an open research question how to properly transition VR users out of VR applications [137]. In VR advertising, however, there may be incentives by advertisers to make ads as unavoidable as possible. Presumably, non-advertising VR applications have no incentive to trap users in their experience, since a user would have already paid for

the experience. VR advertisers, by contrast, may want to force the users to experience the ad to maximize engagement with the ad and so increase the likelihood the ad will have an effect on the user. As such, solutions for VR experiences may not apply to VR advertisers, who may try to intentionally skirt these exit options. Dedicated work should go towards understanding what are ways to quickly exit in-app VR advertisements, and legislation or platform providers should mandate that all VR advertisements have this exit option.

6.2 Future work

While this thesis answers questions relating to manipulative advertising in VR, it also raises many more. Throughout this thesis, I have highlighted various aspects of future work that should be pursued (e.g., see Sections 3.6, 4.5, and 5.5). In this section, rather than rehashing all avenues of future work this thesis has identified, I highlight three broad directions for future work.

6.2.1 Explore impact of advertisements on VR users

The studies in this thesis identify and classify manipulative techniques largely based on prior work and what prior research has shown on how manipulative advertising techniques and VR affect VR users. One way to augment these findings is to understand the impact of manipulative techniques of VR advertising on VR users. To what degree do the manipulative techniques presented in this thesis increase purchasing intent? What are the psychological impacts of VR shockvertising on VR users? What is the effect of embodying avatars in VR, and does it change how users perceive both themselves and the world around them?

As such, a critical next step is to study what the impact of some of these techniques are on VR users. This information would help further contextualize the manipulative risks identified with regard to how harmful they are for VR users. Furthermore, this

data will be invaluable in cases where stakeholders need to be convinced to take action to mitigate these harms.

6.2.2 Explore other risks that advertising in VR poses

Manipulation is not the only risk that VR advertising poses for VR users. In this thesis, I have identified other risks that VR advertising poses, such as the risks for emotional and physical harm. Exploring these other risks is crucial for preventing VR advertisements from hurting VR users.

There has already been some work exploring risks that VR experiences pose more broadly. Perhaps the most studied harm has been the privacy risks that VR experiences pose (e.g., see [66, 185, 211]), as well as physical harms [1, 133, 219]). I argue that when studying these harms, it is important to study them in the context of VR advertising. The different context that advertising provides can add nuance to how users experience these harms: for example, shocking content in an opt-in horror VR game might be different than shocking content in a VR ad the user does not expect or want to engage in.

6.2.3 Restrospectives

One final line of future work is to carry out restrospectives—work done several years into the future (e.g., 10 or 20 years) that reflect on studies done in the past. Retrospectives are useful exercises that inform how work done in the past is relevant to today's world, how the field has evolved, and whether there are any open research challenges that remain. For example, Roesner and Kohno carried out such a retrospective to reflect on their work 10 years after their first paper exploring the privacy risks AR devices pose [211]. Their retrospective synthesized work done in the field, but more importantly, it identified open research challenges that still needed to be addressed as well as key areas where AR devices could pose severe privacy risks. By

doing so, they chart a path forward for other researchers looking to study the privacy risks AR devices pose.

Taking inspiration from their approach, a retrospective with the work in this thesis would allow the research community to understand how research has evolved over the years and what are open challenges that remain. Moreover, this restropective could yield deep methodological insights regarding the scenario construction method used in this thesis. A large part of this thesis involved predicting how VR advertising will evolve; thus, a retrospective could understand how the predictions fared. For example, how many of the identified manipulative risks materialized? Were there any other harms that VR advertising exhibits that this work did not capture? This can be used to improve the scenario construction process. By understanding how accurate the predictions were, we can revisit the scenario construction process and understand ways to change the methodology used to make more accurate predictions.

6.3 Reflecting on anticipating risks of emerging technologies

Throughout this thesis, I used a variety of different methods to anticipate the manipulative risks of VR advertising. In this final section of the thesis I reflect on how this process went and the various methods I used to anticipate the risks of VR advertising. I first discuss the ways that the different methods complemented each other, and then discuss challenges I faced in this thesis.

6.3.1 Strengths of using complementary methods

Speculative methods, such as the scenario construction approach used in Chapter III, are powerful tools that can help predict what future iterations of technologies and their harms can look like. In my thesis, I deliberately combined a speculative method (scenario construction) with more grounded approaches focused more on the present (walkthroughs of existing artifacts and interviews with VR users). The combination of

these different methods greatly contributed to the richness of findings in this thesis. This speaks to a broader truth of mixed method approaches, whereby the use of multiple methods complement each other and allow for "*a more complete analysis of the research problem*" [173]. For this section, I want to highlight three key areas of synergy whereby combination of future-oriented approach with approaches grounded in the present yielded two important areas of synergy: contextualizing findings from different studies and uncovering existing risks that require immediate attention.

Contextualize findings The key strength of using observational methods in addition to speculative methods is how they can contextualize and inform the findings of the speculative approach. This can yield useful nuances, and importantly, unearth important contradictory findings, which is particularly important if the goal of research is to mitigate the harms of an emerging technology. In our study, this was best encapsulated by how participants preferred subtle ads over obvious and obstrusive ones. Without this important context, one of our recommendations would have been to clearly label and identify embedded VR advertisements, which could have led to a more annoying VR environment for users. Similarly, while Chapter III speculated about VR advertisements using appeals to emotion, it was analyzing VRMEs in Chapter IV that revealed the dangers of negative emotional appeals and shockvertising.

Uncover existing risks When imagining the harms of future technologies, it can sometimes seem that the harms are far away into the future, and so urgent action is not needed yet. However, just because a technology is not yet mainstream or widely used does not mean it isn't enacting harms; novel technologies, even if not mainstream or popular, could still have a user base that is exposed to the risks the technology poses. As such, the use of observational methods can uncover risks that need to be addressed urgently and so mitigate existing harms beyond the future-oriented harms

that speculative approaches might uncover. For example, in this thesis, Chapter IV highlighted how current VR experiences do not properly disclose their data practices to VR users as well as the use of shockvertising. By highlighting these risks, urgent action can be taken that addresses existing risks, rather than delaying legislation until a technology is established and mainstream.

6.3.2 Challenge: explicit instructions needed for scenario construction

One challenge I ran into is that current guidance for how to create scenarios is not very concrete or defined. This can be particularly challenging for researchers new to the field, since it is unclear how one goes about imagining a scenario, what separates a good from a bad scenario, and what the eventual goal or output should be.

In the scenario construction study, I was as explicit as I could be in illustrating how I created each scenario. I discussed what topics, stories, or knowledge I was drawing on and how I reached the conclusions that I did. This exercise not only helps other researchers who want to imitate the method, but it also serves as a way to reflect on the scenarios that are created. By explicitly thinking about how a scenario is created, it can help the researcher understand how they reached the conclusions they arrived at, identify potential jumps or gaps in logic, and thus improve the scenario.

6.3.3 Challenge: difficult to demonstrate actual harm

Another challenge I faced in this thesis is that, when analyzing the harms of emerging technologies, it was difficult to demonstrate actual harm of these technologies. While I can speculate what risks are likely to be and I can use prior work to justify conclusions as to whether a risk is likely to be harmful, as of yet it is not known what the impact of some of the risks are on VR users.

One challenge and limitation is that, for some risks, the technical capabilities of the technology are not yet sophisticated enough to accurately recreate or test some

of the imagined harms. For example, hyperpersonalization requires a degree of data collection and processing sophistication that current VR headsets do not yet exhibit. For other harms, it would have been impractical to test out what the harms are. For example, in Chapter IV, measuring misleading experience marketing in VRMEs would have been prohibitively expensive, given that the only reliable way to detect deception would have been to purchase the products the VRMEs were advertising and comparing the product we purchased with how it was portrayed in VR.

There are methods that exist that researchers have used to overcome these limitations. For example, Wizard of Oz experiments involve a researcher remotely controlling an artifact to artificially give it capabilities it might not yet have [62, 208]. A follow up to this work could use a Wizard of Oz experiment to mimic hyperpersonalized VR ads for individuals. However, even Wizard of Oz experiments are limited to what is technically available at the time. Another method could be to interview users of a technology, as was done in Chapter V, to understand their perspectives on what is harmful. Such an approach can unearth harms such as emotional harms that a technology causes [99]. However, this relies on users own interpretation of harms or understanding of how a technology could affect them, which may not be accurate, especially if the harm is not yet materialized or if the harm occurs at a subconscious level. For example, in Chapter V, many participants did not think that gamification would influence their purchasing decisions, but it was unclear how accurate these claims were.

6.3.4 Challenge: how to interpret negative results?

Relatedly, it was difficult to understand how to interpret negative results and cases where one did not find evidence of a particular risk or harm. This was particularly relevant for the analysis of VRMEs in Chapter IV. Positive results work extremely well: if there is a risk that has been predicted by the literature, and an analysis of

current artifacts reveals the risk, then the study both validates the risk and encourages others to address the issue, since the study proved that the harm exists. But what if there is a risk that has been identified in prior work that an analysis does not uncover? Does this mean the risk is not of concern? Or is it the case that the risk has not materialized yet, either because the technology is not sophisticated enough or because it has not been implemented? Figuring out how to interpret findings in the face of negative or non-impressive results is a key challenge in studying existing artifacts to determine future harms, especially if those harms are not expected to materialize for several years.

CHAPTER VII

Conclusion

In this thesis, I set out to answer two research questions (1) What are the manipulative risks that VR advertisements pose? and (2) What are consumer attitudes and concerns regarding VR advertisements? I carried out three studies to answer these questions: a scenario construction study (Chapter III), a walkthrough of existing VR marketing experiences (Chapter IV), and an interview study with VR users (Chapter V).

To answer what are the manipulative risks that VR advertisements pose: I carried out a scenario construction study and a walkthrough of existing VR marketing experiences to understand the manipulative risks of VR advertising. My work highlights how VR advertising can be characterized by its increased immersiveness, data collection capabilities, increased interactivity and gamification, and the ability to preview products in high fidelity prior to purchasing them. This, in turn, presents novel risks for manipulation, such as misleading experience marketing (whereby product previews are false and deceptive), the use of distressing events to appeal to user's fear, anger or disgust, gamifying ads so as to make products seem more appealing and fun, ads whereby users embody avatars with certain traits and so falsely associate those traits with the product, and hyperpersonalizing advertisements to target an individual user's sensibilities.

To answer what are VR users' attitudes regarding VR advertisements: I carried out an interview study with 22 VR users to understand their attitudes regarding VR advertising. I found that VR users are generally wary about advertisements in VR, being concerned about how VR ads can interrupt the VR experience, privacy risks, and physical harms. As it relates to manipulation, I found that there are worries about VR advertisements leveraging fun and interactivity to manipulate children or other vulnerable populations such as compulsive shoppers; our findings, however, also show that factors such as resignation towards manipulation being present in advertising, an illusion of invulnerability, and a belief that companies would not engage in manipulation cause some VR users to be relatively unconcerned about manipulative practices in VR advertising.

My thesis demonstrates how VR advertisements can pose manipulative risks for consumers, and that despite the future-oriented nature of the technology, it is possible to combine complementary research methods that analyze this emerging threat to yield meaningful insights as to what the risks of VR advertising are likely to be, and what are possible ways to address them.

APPENDICES

APPENDIX A

Study Materials Used for the Study Presented in Chapter IV: Manipulation in VR Marketing: An Analysis of Virtual Reality Marketing Experiences

A.1 Analysis Sheet

Code	Description
Basic information about the app	
Title	Title of VRME.
Link	URL of VRME.
Language Describing VRME	
Title of VRME	The title / name of the VRME as used in the store.
Store Description	The descriptive text that accompanies the app store page of the VRME.
Store Categories	The categories, or tags, used to describe the VRME.
Audience	
Age Rating	The age rating as described in the app store.
Advertising Product	
Product being promoted	The product(s) being marketed.
Type of Product Being Advertised	Under what broad category of product does the product being advertised fall into.

Developer	Who is the developer of the VRME.
Publisher	Who is the publisher of the VRME.
Supported devices	
HTC Vive	
Oculus Rift	
Valve Index	
Windows Mixed Reality (WMR)	
Other	Write what the other headset is.
Year	Date released.
Purchase Platform	What store the VRME was found in.
Other Platforms Available	Whether the VRME is available in other platforms.
Steam	
Rift	
Quest	
# of Reviews	# of reviews (as a proxy for downloads) that the VRME has.
Rating	VRME rating on the store.
VRME Content	
Description of VRME	A few sentences or paragraphs describing the VRME.
Narrative Structure	
Linear	VRME has a clear beginning and end, with clear guidance on where the user should be at.
Unstructured	VRME has no clear beginning and ending, and it is up to the user to explore what they want to and in what order.
Other	
Type of Narration	How is information conveyed to user?
Audio	
Text	
No narration	No narration of any kind.
Other	
User Experience	
3DOF vs. 6DOF tracking	Support for 3 degrees of freedom (just rotational motion) or 6DOF (both positional and rotational motion, via walking or joystick movement).
Interactions	

"Building Block" Tasks	What are the main ways that users interact with the content?
Observing content	Observing info about a single object or perceiving relational information (multiple objects in the environment).
Creating content	Placing objects at specific locations, drawing content on a surface or in free space.
Transforming content	Moving, rotating, resizing, or deleting an element.
Activating content	Selecting an object or triggering sound, narration, animation, or physics-based motion.
Input Mechanisms	What are the ways users input information to the device?
Head Movement	
Gaze	Different from head movement in that you can hold your head still and just move your eyes (e.g., gaze at an object and receive visual feedback).
Body Movement	
Voice Commands	
Controller Movement	Quest 2, other headsets may offer hand-tracking (usually in addition to controller interaction).
Hand Gestures	
Other	
Input Devices	What devices (hardware) do users use to interact with the environment?
Mouse & Keyboard	
Game Controller	
VR Hand Controller	
Microphone	
Other	
Output Mechanisms	What output does the VRME have?
Visual Content	

	Spatial Sound	Sound is limited to one single point / direction (i.e., it comes from one source) – moving towards or away from the object, or rotating one's head, changes how the sound is heard.
	Not Spatial Sound	Sound does not come from a single point in 3D space. Instead, it is heard at all times regardless of where the user is in the VRME or where they are facing.
	Haptic Feedback	
	Other	
Movement Type		What movement types does the VRMe allow.
	No movement	
	Teleportation	
	Joystick	
	In-Scene warping	
	Other	
Gamification		How gamified is the VRME.
Pure Ad		The VRME does not require any input or interaction from the user, and does not respond. It is almost indistinguishable from watching a video ad on TV, or a print ad in a magazine.
Exploratory		The experience allows free user exploration of objects or of the environment, but it lacks any concrete story or objective.
Very Game-Like		The VRME is indistinguishable from an ordinary VR game.
Playful Interactions		Any playful, unique, or fun interactions that add gamification and/or a game-like component to the experience.
Setting		What setting does the VRME take place in?
	Fantasy & Sci-Fi	
	Superheroes	
	Vacation / Tourist Destination	
	Shop / Showroom	
	Mundane	Places a user would probably encounter in their day-to-day life.

	Existing Media	Existing media franchise.
	Nature	
	Other	
Exit Options		What exit options are available for the user.
Yes		There VRME provides exit options.
	In-experience to main menu	
	Main Menu exit app	
	In-experience exit app	
	ESC button exit app	
No		The VRME does not provide exit options.
	In-experience pause menu (No exit)	
Direct Link to Shopping		Are there ways to direct links for users to shop for products, or learn more about them?
Other		
Privacy Policies		
Link		Link to privacy policy or other document (e.g., EULA, ToS).
Manipulative Techniques From Literature		
Appeals to Emotion		What emotions does the VRME appeal to?
Humor		
Fear		
Sexual Arousal		
Anger		
Excitement		
Joy		

	Disgust	
	Guilt	
	Nostalgia	
	Cuteness	
	Other	
Previewing Products		Does the VRME allow a user to preview or view a product before purchasing it?
	User can use product	The user actively uses the product that is being sold as it is intended to be used. For example, driving a car, or visiting a tourist destination .
	User can view product	User is limited to only viewing or inspecting the product being previewed, but cannot actually use it. For example, the user can see a car in a virtual showroom, but cannot drive it.
Possible Distortion of Reality		The VRME makes claims about the real world, or shows digital recreations of real world products.
Representation of People		People are represented / shown in the VRME.
Embodying Characters		The VRME has the user embody a specific character with certain traits, backstory, etc. (as opposed to just themselves).
Other		Any other manipulative techniques not captured by the above entries.
Miscellaneous		
Time		
	Completion	Time taken to complete VRME.
	Analysis	Time taken to complete analysis.
People Involved		
	Experiencer	Who experienced / went through the VRME.
	Coder	Who sat along experience and filled out the analysis sheet.
Hardware		
	Headset	The headset used to go through the VRME.
	Computer	The computer used to go through the VRME.
Any Additional Notes		Final notes / items of interest not captured by the above entries in the analysis sheet.

Table A.1: Table showing the analysis sheet used for the study presented in Chapter IV.

APPENDIX B

Study Materials Used for the Study Presented in Chapter V: Understanding VR Users' Attitudes Towards VR Advertisements

B.1 Screening Survey

1. I confirm I am 18 years of age or older and I consent to the participation in this study

   (a) Yes

   (b) No

B.1.1 Section 1: Experience Using Virtual Reality

2. When did you start using Virtual Reality (VR) headsets?

   (a) Over 5 years ago

   (b) Between 3-5 years ago

(c) Between 1-3 years ago

(d) Between 6-12 months ago

(e) Within the last 6 months

(f) I have never used VR

3. On average, how often do you use VR?

(a) Daily

(b) A few times a week

(c) A few times a month

(d) Less than monthly

(e) I do not use VR

4. What VR headsets have you used before? Please check all that apply.

(a) Oculus Rift

(b) Oculus Quest / Oculus Quest 2

(c) HTC Vive

(d) Valve Index

(e) HP Reverb G2

(f) Other: _____

5. What do you use VR for? Please check all that apply

(a) Gaming

(b) Education

(c) Work

(d) Social VR

(e) Watching videos

(f) Fitness and/or well-being

(g) Other: _____

6. Please list up to five of your most used VR applications.

B.1.2 Section 2: Attitudes Towards Advertisements

Now we are going to ask about your attitudes towards advertising.

Please rate how you feel about advertising along the following dimensions. In general, I find advertising to be...

Likert items ranging from 1 to 7

7. Good — Bad
8. Valuable — Worthless
9. Important — Unimportant
10. Pleasant — Unpleasant
11. Necessary — Useless
12. Positive — Negative
13. Sincere — Insincere
14. When visiting websites (like news websites, social media, etc.), how much do you like seeing ads? *Likert item ranging from Extremely Dislike to Extremely Like*
15. Do you use an ad blocker on your computer or mobile device? (e.g., AdBlock, AdBlock Plus, uBlock Origin, etc.)

(a) Yes

(b) No

(c) Unsure

(d) Other: _____

B.1.3 Section 3: Experience with VR Advertisements

16. Have you ever encountered any advertisements whilst using VR? This can include in-app VR advertisements or standalone promotional VR experiences.

    (a) Yes

    (b) No

    (c) Unsure

17. (If you have answered yes to the above question) Please describe in a few sentences the advertisement that you encountered whilst using VR (e.g., what product was being advertised, what did the advertisement consist of, etc.)

B.1.4 Demographic Information

In this next section we want to collect some demographic information about you. We do this to better understand the groups of people we are interviewing, which will allow us to contextualize our findings and understand what perspectives are being represented.

18. What is your age? (If you prefer not to disclose, please enter N/A)

19. What is your gender? Check all that apply.

    (a) Man

(b) Woman

(c) Non-Binary

(d) Prefer not to disclose

(e) Prefer to self-describe

20. If you prefer to self-describe your gender, please elaborate here.

21. What is your race or ethnic background?

22. Please describe your race or ethnic background. You can use general terms such as White, Latino, Black, Arab, or Asian or you can use more specific terms like Irish, Mexican, Hawaiian, or Navajo. You can use more than 1 term if you like. If you'd prefer not to disclose your race / ethnicity, please write N/A.

23. Which is your current country of residence? (If you'd prefer not to say, write N/A)

24. What is the highest level of education you have completed?

    (a) Some high school

    (b) High school or associate degree

    (c) Undergraduate degree

    (d) Postgraduate degree

    (e) Prefer not to disclose

25. What was your total household income before taxes during the past 12 months?

    (a) Under $15,000

    (b) $15,000 to $24,999

    (c) $25,000 to $34,999

(d) $35,000 to $49,999

(e) $50,000 to $74,999

(f) $75,000 to $99,999

(g) $100,000 to $149,999

(h) $150,000 or above

(i) Prefer not to say

B.1.5 End of Survey

Thank you so much for completing the screening survey! Please enter your name and email below. If you are selected for the study, we will contact you through that email to schedule an interview.

26. Name: _____

27. Email: _____

28. OPTIONAL Where did you hear about this survey? (E.g., a particular subreddit, a facebook group, etc.)

29. OPTIONAL Is there any additional information you want to share with us?

B.2 Interview Protocol

1. Introduction (5 mins)

   Goal of section: introduce the study, verify that participants are ok being recorded.

   Thank you for agreeing to be a part of this study! Like we mentioned in the recruitment email, in this study we want to understand VR users' attitudes towards VR advertising. The interview should last around 60-90 minutes.

   Before we begin, we want to make a note that we will be recording this interview for transcription purposes. This will be used in subsequent data analysis. All your responses will be kept anonymous, and while quotes may be used in papers or presentations, the quotes will be anonymized and delinked from you. You may stop the interview at any time.

   Do you have any questions about the process before we begin? I am about to start the recording.

   [Start Recording]

   I have turned on the recording. Please confirm you are ok with being recorded by saying "I consent to the participation in this study".

2. Thank you so much! So first, I want to ask about your general attitude towards advertising. In your screening survey, you had [generally positive / generally negative / mixed] views towards advertising. For example, [GIVE EXAMPLE]. Could you expand on your answer?

   (a) Think about the ads you see when browsing social media or news, on your computer or your phone. What kinds of ads do you like seeing, if any?

   (b) What kinds of ads do you dislike the most, and why?

      i. Are there specific ads that you remember disliking?

ii. Is there a type/genre of ad that you dislike in general?

iii. Do you see more ads that you dislike on certain apps or websites?

3. For the next part, I want to talk more about virtual reality. First, if you could tell me a little bit about your experience with VR, how long have you been using Virtual Reality headsets?

   (a) What made you want to use VR?

   (b) What types of applications do you use VR for?

   (c) Which headsets do you use?

   (d) How often do you use VR?

4. Have you encountered advertising within a VR app, such as in-app VR advertisements, or standalone promotional VR experiences?

   (a) Please describe the ad(s) you saw.

   (b) What was your reaction to the ad?

   (c) How often do you encounter VR ads?

5. What about shopping apps or other VR content aimed at selling or promoting products?

6. How likely is it for VR ads to increase?

7. Do you want more ads in VR? Why or why not?

   Thank you for that! I want you to imagine a futuristic world where both VR usage and VR advertising is commonplace. I'll let you think for a few minutes about what that world is like, and then I will ask some questions about it to understand what advertising is like in that world. I'll give you a minute or so to think about it.

8. What are the main benefits, or positives, of widespread use of VR? Any drawbacks?

9. How do you view ads in that world?

10. What are the main benefits, or positives, of VR advertising?

11. Are you excited about any particular aspects of VR advertising?

12. What are the main drawbacks, or negatives, of VR advertising?

    (a) Do you have any concerns or worries about VR advertising?

    (b) Are there steps that could be taken to address these concerns and make VR ads acceptable?

        i. For example, guidelines, certain legislation...

13. In what contexts would advertising be useful / would you want advertising? In what contexts would you not want advertising?

14. How different is VR advertising from non-VR advertising?

    Great! Next, I want to present a few scenarios depicting what advertising in VR can look like. I will first walk through the scenario, and then I will ask you to give your general reactions and thoughts.

    [For each scenario, I took the following approach]:

15. *I present the scenario*

    (a) What are your immediate reactions to this scenario?

    (b) Would you be excited to encounter this type of ad when using VR? Why or why not?

    (c) Is there anything that concerns or worries you about this scenario?

[After showing the scenarios, I moved onto the manipulation disclosures, one for each scenario]

Great! Now I want to revisit some of the scenarios and share some more information about them. Let's return to [SCENARIO].

[I read the manipulative disclosure]

16. What are your immediate reactions to this information?

17. Does this change your attitude towards the scenario?

    Thank you so much! Before concluding this interview, I had two questions to ask:

18. First, are there any questions you expected me to ask but I did not?

19. Second, are there any final comments you want to make on the record? There will be time after this where I will stop the recording and you can ask questions there if you are more comfortable.

B.3 Scenarios

B.3.1 Furniture Scenario

B.3.2 Images

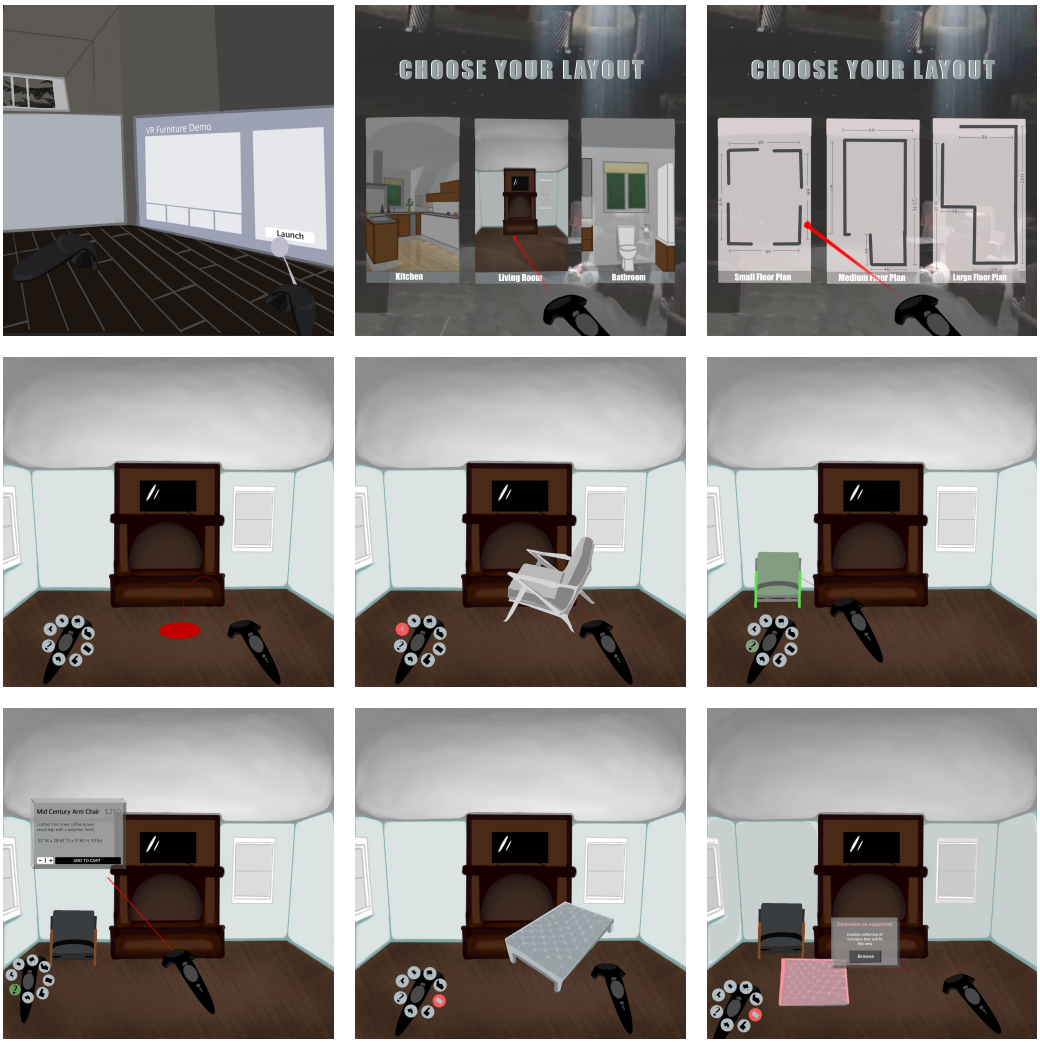

Figure B.1: Images that were shown during the Furniture scenario. Reading order is left to right, top to bottom.

B.3.2.1 Initial Text

A furniture company releases a VR app that allows you to place 3D renderings of furniture into their home, to see how the furniture would look in their home. In this

ad, the VR headset scans your immediate environment to recreate the living room in VR. From here, you can select a whole range of furniture to put into your living room, and see how it looks like. You can even add to cart and buy directly from the app.

B.3.2.2 Manipulative Disclosure

I now want to return to the Furniture scenario. As a reminder, in this scenario, a furniture company allows you to place 3D renderings of furniture into your home, to see how the furniture would look like.

One additional detail about the scenario I want to add is that the company making this ad presents a beautified version of the product that is 'touched up.' In other words, the virtual recreation of the product makes the furniture look a lot brighter, more beautiful, better and of much higher quality than what the product is actually like. Does this information change your opinion regarding the scenario?

B.3.3 Soda Scenario

B.3.4 Images

Figure B.2: Images that were shown during the soda drink. Reading order is left to right

B.3.4.1 Initial Text

The scene starts out with you playing a rhythm based music game, in this case called MusicSaber, where you have to dance and perform certain actions to the rhythm. After a while, you see an in-game VR ad. The ad is for a new type of soda beverage. In the ad, you see people at a party dancing and celebrating whilst drinking the soda. The music in the background matches your preferred music genre choice.

B.3.4.2 Manipulative Disclosure

I now want to return to the Soda scenario. As a reminder, in this scenario you played through a game and in the middle of the game, you received an in-app ad to continue the game. The in-game ad had music that matched your preferred genre taste.

One additional detail about the scenario I want to add is how the VR ad matched your music taste. The VR headset measures and detects your performance with various music types, as well as physiological data such as your heart rate, eye dilation,

and other types of data. It uses this data to infer what music genres you prefer, and then customizes the ad with your music choice. For example, rock music vs EDM. The company hopes that by playing an ad with your preferred music choice, the ad will be more effective.

Another detail I want to add about the scenario is that the VR headset doesn't just detect your preferred music genre. It also uses physiological data to detect when you are most thirsty. It then shows you the soda ad right when you are tired and most thirsty, in the hope that it will be more effective and you will buy it.

B.3.5 Soccer Shoe Scenario

B.3.6 Images

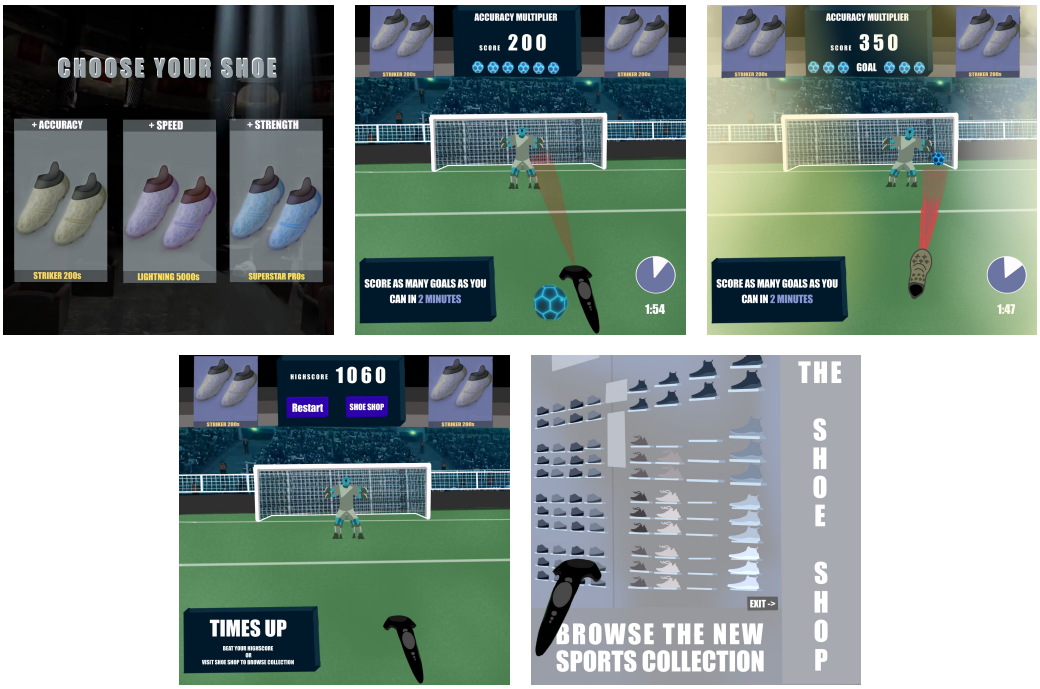

Figure B.3: Images that were shown during the Soccer shoe scenario. Reading order is left to right, top to bottom

B.3.6.1 Initial Text

This VR advertisement is one that promotes a new type of soccer shoe. In this ad, you are first invited to choose one of several different soccer shoe models. Once you have made your choice, you are transported to a soccer field, where you have to score goals against a team of enemy monsters. Soccer balls come flying through the air, and you have to kick them towards a goal guarded by a goalkeeper. Whenever you score, there are fireworks, bright lights, and GOAL flashes brightly. After 2 minutes, the game stops, and you can see how many goals you scored. After the ad ends, you are invited to a virtual shop where you can either buy the shoes or end the advertisement.

B.3.6.2 Manipulative Disclosure

I now want to return to the Soccer Shoe scenario. As a reminder, you got to try some virtual soccer shoes and score goals, after which you had the option to buy those shoes.

One additional detail about the scenario I want to add is that this VR ad is very gamified — it has game-like elements in it. There is some research suggesting that gamified ads are more effective at promoting products. It is believed that by having you play a game, the ad generates positive feelings in you, which you then associate with the product, making you more likely to purchase the product. Does this information change your opinion regarding the scenario?

Lastly, another part of this scenario that I did not mention to you is that the game will make it extremely easy to score goals no matter what you do. In other words, no matter how you kick the soccer ball, you will almost always score a goal. The company does this in the hopes that you will associate the feelings of success of scoring the goal with the shoes, and so are more likely to buy them. Does this information change your opinion regarding the scenario?

B.4 Codebook

Code	Description
General ad thoughts	Participant thoughts regarding non-VR ads.
General ad benefits	Participant expresses benefits, advantages, and/or positives of non-VR ads.
General ad drawbacks	Participant expresses drawbacks, disadvantages, and/or negatives of non-VR ads.
Furniture	Participant attitudes regarding the Furniture scenario.
Postd. Furniture benefits	Participant expresses benefits, advantages, and/or positives regarding the Furniture scenario after hearing the manipulative disclosure.

	Postd. Furniture concerns	Participant expresses drawbacks, disadvantages, and/or negatives regarding the Furniture scenario after hearing the manipulative disclosure.
	Postd. Furniture misc	Participant expresses an opinion towards the Furniture scenario that cannot be classified as either positive or negative after hearing the manipulative disclosure.
	Pred. Furniture benefits	Participant expresses benefits, advantages, and/or positives regarding the Furniture scenario before hearing the manipulative disclosure.
	Pred. Furniture concerns	Participant expresses drawbacks, disadvantages, and/or negatives regarding the Furniture scenario before hearing the manipulative disclosure.
	Pred. Furniture misc	Participant expresses an opinion towards the Furniture scenario that cannot be classified as either positive or negative before hearing the manipulative disclosure.
Soccer Shoe		Participant attitudes regarding the Soccer Shoe scenario.
	Postd. Soccer Shoe benefits	Participant expresses benefits, advantages, and/or positives regarding the Soccer Shoe scenario after hearing the manipulative disclosure.
	Postd. Soccer Shoe concerns	Participant expresses drawbacks, disadvantages, and/or negatives regarding the Soccer Shoe scenario after hearing the manipulative disclosure.
	Postd. Soccer Shoe misc	Participant expresses an opinion towards the Soccer Shoe scenario that cannot be classified as either positive or negative after hearing the manipulative disclosure.
	Pred. Soccer Shoe benefits	Participant expresses benefits, advantages, and/or positives regarding the Soccer Shoe scenario before hearing the manipulative disclosure.
	Pred. Soccer Shoe concerns	Participant expresses drawbacks, disadvantages, and/or negatives regarding the Soccer Shoe scenario before hearing the manipulative disclosure.
	Pred. Soccer Shoe misc	Participant expresses an opinion towards the Soccer Shoe scenario that cannot be classified as either positive or negative before hearing the manipulative disclosure.
Soda		Participant attitudes regarding the Soda scenario.

Postd. Soda benefits	Participant expresses benefits, advantages, and/or positives regarding the Soda scenario after hearing the manipulative disclosure.
Postd. Soda concerns	Participant expresses drawbacks, disadvantages, and/or negatives regarding the Soda scenario after hearing the manipulative disclosure.
Postd. Soda misc	Participant expresses an opinion towards the Soda scenario that cannot be classified as either positive or negative after hearing the manipulative disclosure.
Pred. Soda benefits	Participant expresses benefits, advantages, and/or positives regarding the Soda scenario before hearing the manipulative disclosure.
Pred. Soda concerns	Participant expresses drawbacks, disadvantages, and/or negatives regarding the Soda scenario before hearing the manipulative disclosure.
Pred. Soda misc	Participant expresses an opinion towards the Soda scenario that cannot be classified as either positive or negative before hearing the manipulative disclosure.
Specific techniques attitudes	Attitudes towards specific manipulative techniques.
Gamification	Participant attitudes towards gamification.
Hyperpersonalization	Participant attitudes towards hyperpersonalization.
Previewing products	Participant attitudes towards previewing products.
VR ad benefits	Perceived benefits of VR ads.
Fun interesting novel	Participant expresses that ads can be fun or interesting and novel.
In context	Participant mentions that VR ads can have positive effects if shown in the appropiate context.
Increase realism	Participant expresses that VR ads can enhance the realism of certain experiences (for example, a VR experience that recreates Times Square can have in-app ads to make it feel more like Times Square).
Interactivity	Participant mentions that VR ads can be interactive.
Misc ad benefits	Participant highlights benefits, advantages, and/or positives of VR ads not captured by the other codes.
Monetization	Participant mentions that one advantage of VR ads is that it can help monetize the space. Also includes references to maturing and legitimizing the scene.

Lack of concern	Participant expresses a lack of concern over VR risks because of optimism downplaying the severity of these risks. These include VR manipulative techniques not working on them, or legislation ensuring a harm will never materialize.
Companies would not do this	Participant mentions that companies would not engage in deceptive practices.
Backlash	Participant mentions that if a company engages in deceptive practices, they will face legal or consumer backlash.
Will not affect me	Participant claims that they are not concerned about manipulative risks in VR since they would not be affected by them.
Practical	Participant mentions that VR ads can be practical or useful.
VR ad drawbacks	Perceived drawbacks of VR ads.
Ad bombardment	Participant mentions concern over VR being bombarded and overrun by ads,
Breaking immersion	Participant mentions that advertisements can break immersion in VR or interrupt the experience.
Children	Participant mentions being worried about ads targeting children or children seeing inappropiate content.
Consumerism	Participant mentions that VR advertisements can increase consumerism or take advantage of people with compulsive shopping disorders.
Don't trust companies	Participant expresses distrust in companies in charge of VR or in charge of VR advertisements.
Forced	Participant expresses concern they will be forced to watch ads, or that ads are unavoidable.
Indifference	Participant mentions being indifferent and not caring about VR ads in VR.
Low quality	Participant expresses concern that VR advertisements will be of low quality.
Manipulation	Participant expresses concern regarding VR advertisements being manipulative.
Misc ad drawbacks	Participant expresses other drawbacks, negatives, and concerns regarding VR ads not captured by the previous codes.
Physical harms	Participant mentions that VR advertising can cause physical harms to users.

Obtrusiveness	Participant mentions that VR ads can be obtrusive, intrusive, or that they 'get in the way' of things.
Privacy concerns	Participant expresses concern regarding the privacy risks that VR advertisements pose.
Resignation	Participant expresses resignation towards ads in VR, seeing VR advertisements and problems within them as inevitable, unavoidable, or another part of life.
VR ad solutions	Solutions participant mentioned that would solve some of the concerns regarding VR ads.
Government regulation	Participant mentions that government regulation can be used to solve problems associated with VR ads.
VR ads per participants	Participant predictions regarding VR ads.
Ad frequency	Participant mentions that the frequency of ads will either change or stay the same over time.
Payment matters	Participant mentions that whether the app is paid or not largely affects their attitude or perception regarding VR ads.
VR ad diff	Participant talks about the main differences they see between VR ads and non-VR ads.
VR ads desired	Participant talks about what types of VR ads they would want to have.
Subtle ads	Participant mentions desiring subtle forms of ads in VR, such as product placement.
VR ads encountered	Participant talks about the VR advertisements they have encountered.
VR ads imagined	How participant imagined VR ads would be like in the future.
Digital avatars salespeople	Participant mentions that in the future, VR ads will feature digital avatars and salespeople that sell products to the consumer.
MR AR blending	Participant mentions that in the future, VR will not be purely VR, and instead, will incorporate elements of Augmented and Mixed reality.
Rely on priors	Participant bases their opinion on what VR ads could be like based on their experiences with non-VR ads.
Rely on science fiction	Participant bases their opinion on what VR ads could be like on science fiction.

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