**Master Thesis**

# Guidelines for Augmented Reality Advertising: A Consumer Ethical Impact Assessment Tool

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**Abstract.** Augmented reality (AR) has the possibility to significantly change our daily lives. More head-mounted AR devices are coming to market and a world where we are using these throughout our daily life is becoming more and more feasible. Advertisers are jumping at the opportunity to use the new possibilities that AR offers. Their enthusiasm is well-founded, based on the ability to alter the user's view of reality, sensors collecting data about the user's surroundings, facial expressions, eye movement and more, experts state that AR will be a great persuader. Advertisements are no longer limited to billboards or screens and will be more entangled with real-world objects. Potentially even people could be altered to appear happier when using advertised products. The question arises as to what extent advertisers should be allowed to go and what impact this will have on consumers. This research aims to tackle this question with a set of ethical guidelines for AR advertising. To aid advertisers in following these guidelines, the augmented reality ethical consumer impact assessment tool has been created. Based on a set of questions that the advertiser answers, the tool indicates which guidelines are followed and what should be improved to minimise the harmful effects on their audience. With the guidelines and the tool, this research aspires to spark a discussion about the ethics surrounding augmented reality advertising and make a contribution towards a unified ethical framework for the creation of AR technologies in general.

**Keywords:** Augmented Reality · Advertising · Impact · Ethics

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# 1 Introduction

There is a general consensus among experts that augmented reality (AR) has the potential to change our businesses, society and daily life [16,87,29]. Some experts even claim it can fundamentally change what human beings are [9]. AR enables us to overlap virtual elements over the real world around us [6]. It has already reached the masses through smartphone applications. However, the true potential lies in AR experiences that do not require the user to be tethered to hand-held devices. Head-mounted AR provides a more immersive experience [43] and can be used hands-free, allowing for longer use as it can be used during other activities. While this was once merely a science fiction vision, daily usage of head-mounted AR is becoming an increasingly more viable future [28]. It could navigate us through an unknown city without requiring us to look down at our phones. It could replace the need for a wide variety of physical items like PC monitors, TVs, wall decoration, clocks, jewellery or designer clothing with virtual holograms [55]. And it could, while only visually, change a boring room into the most ecstatically pleasing place on earth [110].

No other field seems to be as excited about these new possibilities as the field of marketing and advertisement [88]. AR conferences are filled with demonstrations showcasing how the technology can be used for advertising [42]. This is no coincidence, research shows that AR has the perfect ingredients for being a great persuader [51]. AR allows businesses to go beyond simply displaying an advertisement in the user's field of view [23]. Companies could virtually alter the appearance of a product [2,23], AR advertisements can be a lot harder to ignore and users could be persuaded without even noticing it [71]. Even though the hardware is not ideal yet [28], marketing applications for AR are being used in creative ways by large corporations [88],[106], and research shows that the use of AR over traditional ads increases willingness to pay [54], brand liking and the perception of an ad's informativeness [78,57].

Current research in AR advertising (ARA) focuses mostly on the opportunities for businesses and the impact it could have on specific sectors. However, with increased influence over how the consumer perceives the world, this powerful tool for businesses could have a significant impact on consumers [23,51]. Previous research [63] has shown that the more frequently a new technology is used in marketing, the closer it will reach the point where it is no longer beneficial for consumers and can have harmful consequences for society. With ARA, companies could alter the way users see a product [23]. For example, a car company might modify the way users see their cars on the road, make their owners look happier, or make cars from competing brands look less shiny or slightly out of focus. Who decides what AR users see and to what extent can this go? That will likely be the first and most essential battle of AR [110]. The goal of this research is to determine much-needed guidelines for the future of ARA.

## 2 Research Approach

### 2.1 Research Question

The aim of this study is to evaluate how ARA can be used to influence consumers and determine guidelines that limit potential harm to consumers. This leads to the following research question:

***What criteria influence the ethical impact of augmented reality advertising campaigns on consumers?***

This research question is branched into two sub-questions:

SQ1. *What tactics can advertisers apply to influence consumers with AR technology?*
In order to predict the plausible future impact of the technique, it is essential to first determine how AR is different from traditional advertising techniques, how it is currently used in advertising and how the technique will most likely be used once it further develops.

SQ2. *What are the key ethical assessment criteria for the use of augmented reality in advertising?*
Once we have established the ways in which AR can be used for advertising, the goal is to establish a set of criteria to which an AR advertisement should adhere to minimise its negative impact on consumers and society.

### 2.2 Research Method

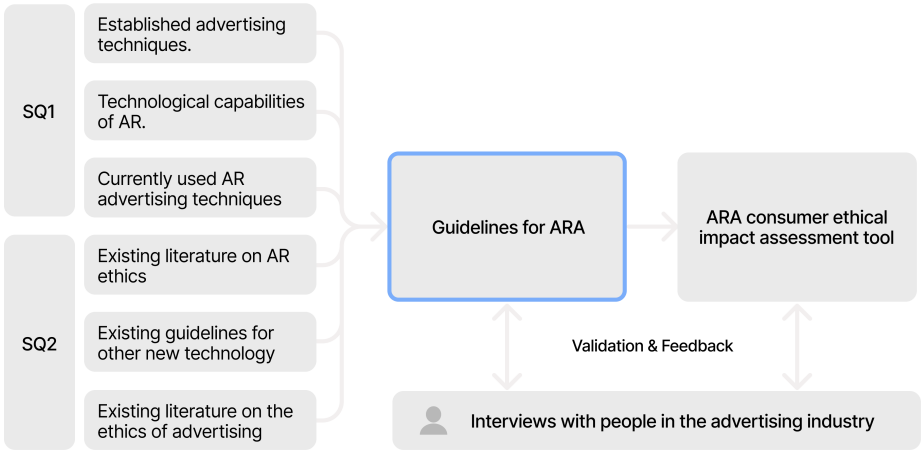
The bulk of this research consists of a literature study. The resulting guidelines are validated with interviews. This section gives an overview of how both methods are applied and outlines the intended deliverables.

**Literature study**
The literature study is conducted with the aim to set up a set of guidelines for ARA. To answer SQ1, the review explores established/traditional advertising techniques, the technological capabilities of AR, and the currently used AR advertising techniques. To answer SQ2, ethical considerations for AR in general and ethical guidelines for other new technologies are examined. Based on the combined results, a set of guidelines for ARA is defined. Figure 1 gives an overview of this setup.

**ARA consumer ethical impact assessment tool**
The set of guidelines is the main focus of this research. However, to make the guidelines applicable in real life, the ARA consumer ethical impact assessment tool is created. This tool consists of a list of questions which test whether an advertisement adheres to the guidelines. To ensure a more simple and efficient usage, they are placed on a website as a dynamic online form. Some answers

will require more questions that go more in-depth. Therefore, the online format is chosen, which makes it easy to ask more follow-up questions based on the previous answers of the user. It is also beneficial that the tool is available online, such that advertisers that are creating new AR advertisements can access the tool with ease. Once an advertiser has answered all the questions, a report will be generated. This report outlines to which guidelines their advertisement adheres. For the guidelines that are not being followed an explanation is given that explains what should be done to follow them.

**Fig. 1.** Research Overview




### Interviews

Because the guidelines and the assessment tool are based largely on theoretic knowledge, industry practitioners are asked for their opinion on practical use. The guidelines and the tool are sent to advertisers, after which they are interviewed. These interviews are used to determine the value of the tool to advertisers and to determine potential adjustments that need to be made to the tool. Advertisers are chosen because they will be the end users and will need to voluntarily choose to use the tool. The sampling of interview participants has been done based on convenience sampling, mostly via existing connections and LinkedIn. All participants needed at least ten years of experience working in the advertising industry or have experience working with ARA. In total, four participants are interviewed. The interviews were conducted online. A semi-structured interview style has been selected such that the participants have the time and flexibility to give all-encompassing and nuanced answers. It also allows the interviewer to explain some background information about AR whenever necessary. Before conducting the interview, all candidates have signed a consent form that follows the guidelines provided by the VSNU Association of Universities in the Netherlands. Before the interview, each participant is sent the ARA guidelines and the tool so that these can be reviewed. During the interview, the participant

is asked about their view on the created guidelines, if they would change anything about the guidelines, if the tool would provide value to their work if they would start working with AR, if they currently measure the ethical implications of their ads, if they would make any changes to the tool and if the final report at the end of the tool provides a useful insight.

### Interview Participants

Redacted for publication

## 2.3 Interview analysis

The interviews took on average 30 minutes. All interviews were conducted in Dutch because this was the first language of the participants. All interviews were conducted online and voice recordings were made. The voice recordings are transcribed locally using OpenAI's Whisper[1] and manually checked alongside the recording to ensure correctness and to assign the speakers. From the transcripts, codes were selected. The codes were written in English to fit the language of this paper. These codes were then combined into themes, and then the themes of all interviews were combined into one list. For all themes that appeared in more than one interview, the duplicates are removed and the frequency of occurrence is noted at the end. From the list of all themes, a final list of overarching themes has been derived. A full overview of the transcripts and the codes and themes in every step of the analysis process can be found on a separate webpage[2].

[1] https://github.com/openai/whisper
[2] https://maxdefroe.nl/ARA-thesis/analysis

### 2.4 Scope and Limitations / Threats to Validity

**Collingridge Dilemma**
Because this research focuses on the societal impact of a technology that is yet to fully develop, it encounters the Collingridge dilemma [18]. Before a technology is fully developed and widely used, it is hard to research what the impact will be, but there is more room to control the unwanted effects with guidelines and legislation. However, after a technology is established, the impact is relatively clear but changing the status quo with new rules becomes a lot trickier [18,38]. While the everyday usage of head-mounted AR displays is becoming more feasible [28], it is currently not a mainstream product yet. While gradually improving [16], the necessary hardware still needs further development [28]. This makes it hard to draw conclusions about its impact on consumers. Van de Poel [53] mentions that anticipating future scenarios tends to result in morally thrilling but often unlikely scenarios. Yet Brinkman mentions that while predictions will never be flawless, it would be wrong to give up entirely and treat all forms of anticipation as hopeless [9]. To tackle the Collingridge dilemma, this research aims not to make a single prediction of how ARA will unfold, instead, a set of guidelines is created that show what should and should not be accepted. While this is still prone to wrong predictions, the guidelines are built upon previous research.

**Hardware assumptions**
As mentioned before, AR hardware is still in development. While most consumers currently only use AR on smartphones and tablets, a growing number of head-mounted devices is being sold [111] and researchers state that everyday mobile usage of head-mounted AR and VR devices is becoming a '*feasible consumer reality*' [28]. For this research, the focus is not on current hardware and capabilities. Instead, the assumption is made that future AR devices will most likely have the following capabilities:

- Context-aware: the virtual elements that are being shown can correspond with the physical environment.
- Immersive: capable of showing virtual elements in high-resolution and full-view such that it provides a realistic experience.
- Comfortable: users will be able to use it for long periods of the day.
- Hands-free: such that users can do most of their daily activities without being limited by the hardware.

**Other limitations**
The interviews are conducted and analysed by the same person who also created the guidelines and the tool that is being validated. Effort has been made to conduct the interviews as objectively as possible, and coding has been chosen to analyse the interviews systematically and minimise bias. Yet, this does not exclude all possible bias and it is still possible that participants give more positive answers compared to when an independent auditor conducts the same interview.

Incorrect use of ARA could also negatively impact the business, e.g. by misrepresenting products or failing to give disclaimers [85]. However, this research focuses on the effects on consumers and does not take into account the negative impact of ARA on businesses themselves.

It is important to note that the goal is not to judge whether ARA is inherently good or bad. The main objective is to determine a set of guidelines. Furthermore, by highlighting both the opportunities that AR creates and the possible negative effects that the use of ARA has on consumers, this research aims to spark a debate about how we want AR to be used in the future and how we could steer its usage in the right direction before it is fully established.

## 3 Definitions

There are various technologies capable of generating or altering reality. While distinctions between each technology exist, academics and professionals have yet to reach an agreement on consistent naming [58]. This section outlines what definitions are followed in this research.

**Augmented reality (AR)**
AR is a technology that superimposes virtual elements upon the real world [4]. AR has been around since Sutherland created a head-mounted device that could display a three-dimensional image that changes perspective based on head movement [77]. Over half a century later, AR has progressed from the theoretical research stage to the point of widespread implementation [16] and has become easily accessible to consumers [50].

The most commonly known examples run on smartphones. For example, AR navigation with Google Maps or IKEA Place, which allows users to virtually try out furniture in their homes [74]. As the technology develops, wearable devices will give a more realistic experience, allowing users to interact with the technology in a more natural way [16]. Devices like Microsoft's HoloLens, the Pico 4 and Meta's Quest Pro set a step in this direction by allowing users to experience AR with a head-mounted display, allowing a wide field of view [119].

**Virtual reality (VR)**
VR is a technology that completely immerses the user's field of view and shows an entirely virtual world [46]. In this virtual world, the user does not see the physical world around them [58]. Unlike AR where the virtual elements are shown on top of the real world around you.

**Extended reality (XR)**
While there is no consensus on the definition of XR, it is often referred to as Extended Reality. For the purposes of this research, we will use the definitions given by the xReality framework [58]. According to this framework, XR is the umbrella term for both VR and AR. The distinction between AR and VR is

based on the use of real-world surroundings. If the physical surroundings of the user are incorporated into the visual experience, then it is considered to be AR. If not, it is VR. In this case, it does not matter whether the user can directly see real-world objects through a transparent screen or whether the real world is being filmed and digitally shown to the user in real-time. Both scenarios are considered AR, as they incorporate the physical surroundings of the user.

## 4 Related work

AR has been used for advertising from the start. Back when AR was still in its infancy, Azuma et al. [3] noted that advertising would be one of the main commercial applications of AR. In more recent years, a growing body of literature emphasises the potential of ARA. Ruyter et al. [64] have focused on the opportunities and challenges. They have created a conceptual framework that compartmentalises specific factors that are involved in how ARA has an impact on customer engagement and behaviour. Their work emphasises the importance of contextualisation. The ability to continuously adapt the content to the physical surroundings of the user is an essential part of ARA and distinguishes it from other advertising techniques [64]. This work provides a useful overview of the techniques that could make AR such an effective advertising tool. It is mostly focused on the challenges ARA needs to overcome before it can reach its full potential. Yet, aside from mentioning that privacy concerns might hinder adoption, Ruyter et al. do not mention the possible negative impact of ARA.

While marketing and advertising are distinctive fields, advertising is often a step in a marketing plan. In the field of marketing, there is a wide array of studies that preach the potential of AR. Scholz and Smith [68] state that the usage of AR in marketing will reinvent the customer experience. They give a framework that helps marketing managers to maximise consumer engagement with AR. Feng [22] indicates that AR has a strong potential to make unique contributions to marketing programs. Alcaiz, Bign and Guixeres [2] conclude that nearly every aspect related to consumer behaviour patterns will change because of AR.

Several considerations for augmented reality advertising have been given by Wassom [85]. In this work, the focus is on the legal aspects of using AR for advertisements. It is primarily centred around disclaimers that inform the consumer about discrepancies between the actual product and the 3D-modelled version AR is showing. This is mentioned as a means to prevent advertisers from defamation claims, not so much to prevent the consumer from being ill-informed.

Most related work concerning ARA focuses on the current challenges of AR and/or how AR can be used to enhance advertising. Literature on the possible downsides of using AR for influencing consumer decisions and the possible effects this could have on our society remains scarce. However, several papers mention the issues that might arise. Finnegan, Zoumpoulaki and Eslambolchilar [23] give interesting insights into how far advertisers could go when using AR. The authors mention that it will not consist of just showing an ad in your field of view. A soft drink producer could make all their cans appear shiny, or even make the

competitor's products look dented and unattractive. And it will not be limited to the product, users of the advertiser's product could virtually appear happier and more attractive while a person consuming the competitor's drink could be made to look sad and/or less attractive. This significantly changes how consumers can be persuaded into making a purchase decision. The authors rightfully note that, as more and more applications of AR are being created, we must be vocal about the dangers to ethics and moral values in society [23]. They also stress the need for a unified ethical framework for the creation of XR technologies [23]. Brohm et al. [10] mention that head-mounted AR will result in increased data collection, which poses privacy issues for both the users and the general public. They predict that *'AR will cause a revolution in individual marketing and a big change in the manipulation of consumers behaviour'*. Slater et al. [71] predict that AR Advertising will be a lot harder to ignore compared to current digital and print advertisements. They also draw attention to the idea that it will be likely users need to pay to remove ads.

Pase [51] outlines a useful set of ethical considerations for the creation of AR applications in general, without specifically focusing on advertising. The author also specifies that AR will be very competent in persuading its users. Because of this, Pase [51] concludes that people creating AR applications must be aware of the importance of ethical behaviour regarding data collection and the persuasive capabilities of AR. In a similar fashion, Brinkman [9] stresses that the effects of AR will be stronger and less obvious compared to VR. AR will be more pervasive, as it can be used during other activities and can use optical illusions to trick users into perceiving the virtual items as physically present. This makes the user vulnerable to persuasion. Brinkman [9] also sketches a scenario in which an advertisement is designed to be frustrating for its surroundings, only to make the neighbours pay to get that advertisement removed. This raises questions about how to govern the virtual space. Therefore, he calls for more research to help discuss the ethics surrounding AR. It is apparent that this is necessary, as recently stated by Du, Liu and Wang [21] future research requires a *'more balanced and critical perspective to examine when AR applications will backfire'*.

## 5 Literature Study

### 5.1 Established advertising techniques

The dictionary of marketing defines advertising as '*the business of announcing that something is for sale or of trying to persuade customers to buy a product or service*' [33]. While previously this was a fitting definition, it would not encompass everything we currently regard as advertisements. Due to technological advancements, the ways in which companies advertise are constantly changing. Therefore, the definition of advertising evolves. The most recent and validated definition of advertising is stated by Kerr & Richards: '*Advertising is paid, owned, and earned mediated communication, activated by an identifiable brand and intent on persuading the consumer to make some cognitive, affective or behavioural change, now or in the future*' [36]. The evolvement of technologies and

advertising itself has blurred the boundaries between different advertising techniques [39]. A decade ago, out-of-home advertising and personalised ads would be distinct categories. With the advent of digital signage on the streets, this is no longer the case [117]. Technology will constantly change the field of advertising. To grasp the current landscape, this section outlines how advertisers utilise present-day technologies to reach their target audience.

**Traditional advertising**
In traditional advertising media such as print, radio, and television, advertisements are planned beforehand and target large audiences at once. While some modern techniques have outpaced this type of advertising in size, it still plays an essential role in the advertising market. The global print advertising market is estimated to be worth US $33.4 billion in 2022 [102], while radio advertising was worth approximately US $35.3 billion in 2021 [100] and television advertising is estimated at US $227 billion in 2022 [101].

**Search engine advertising**
Search engine advertising is the biggest form of digital advertising, the total market revenue is expected to grow to $435 billion in 2027 [115]. Advertisers pay to add a link to their website on a spot above the organic search results in search engines. To make sure their advertisement is shown to the desired users, advertisers choose specific keywords. When a user clicks on one of the search engine ads, the advertiser is charged a set amount for this click. Advertisers often promote their website on a variety of keywords with differing cost-per-click rates [13].

**Social media ads**
Very similar to search engine advertising, are ads on social media. Companies like Facebook, TikTok, YouTube and Twitter allow advertisers to pay for an appearance inside the feeds of their users [15]. Organisations spend generously on social media ads, the worldwide spending is predicted to reach US$268.7 billion in 2023 [116]. Social media platforms gather data from their users such that advertisers can target their advertisement to a very specific type of user [37]. The distinction between ads and organic content is often subtle, often indicated with a small tag stating 'promoted'. Unique to social media is that users can often interact with advertisements. A brand could post an advertisement to Facebook, users can repost this and friends of those users will then see this and might comment on it. This allows for the organic spread of a promoted post, with users sharing the content the advertisements become even more pervasive and lines between sender and receiver become vague [15].

**Branded entertainment / Product Placing**
Blending commercials with entertainment has been around ever since the very first motion pictures were released [31]. When a producer gets paid to show

brands and products inside of their entertainment, this is called product placement. A more pervasive version of this is branded entertainment. This is when the brand or product is woven into the entertainment and fits the storyline or characters. A famous form of this type of advertising is Reeses appearance in E.T. In the film, the chocolate is used to lure the extraterrestrial creature, causing a 65% rise in sales [31]. Overall, it has proven to be a very effective way of overcoming consumer resistance against advertisements [31]. By blending entertainment with commercials, avoiding advertisements becomes harder. This type of advertising is not limited to movies and tv shows. Ever since the 1980's magazines and newspapers have blended advertisements with their content by formatting them as advertorials [12]. A similar tactic has been by blending brand messages with games in so-called 'advergames' [14,80].

**Paid endorsements**

Endorsements are one of the oldest advertising techniques, with the first versions dating back to at least the 1600s and more frequent use starting in the 1890s [69]. These advertisements feature a person, usually famous, promoting a product or service [69]. This can overlap with branded entertainment, as endorsements and organic content are sometimes blended together. Although this type of advertising is age-old, it remains popular today. In many radio programs, hosts endorse certain products or brands [17]. The same happens for TV shows, where US local news broadcasts are willing to promote products and services with seemingly no prior research about the validity of the claims they make [104]. More recently, paid endorsements have undergone another wave of popularity, with the growth of influencers on social media. In 2022, the global market size for influencer marketing was estimated at US $16.4 billion [96].

**Hyper personalisation**

Traditionally, advertisements on TV, radio or billboards are shown based on a previously defined schedule. Advertisers pay to have their advertisement broadcast at a specific time for a set duration. However, to target very precise audiences or even individual users, the advertising space needs to be sold differently. Advertisements no longer need to be broadcasted to a large audience all at once and can be hyper-personalised [84]. The combination of cookie-based user tracking and syncing with real-time per-impression ad buying gives advertisers the ability to target users on their online behaviour and serve them personalised ads based on this.

The growth of online data collection has enabled advertisers to target users based on their previous online behaviour. This practice is known as behavioural targeting [34]. For example, if a user has visited some blogs about perfume, they may then be shown advertisements from perfume brands on other websites they visit. This type of targeting often relies on cookie-based user tracking. Unique user identifiers, called cookies, are stored on the user's device, allowing websites to see what other sites the user has visited [1].

Real-time Bidding (RTB) is a technique where advertising space is sold through an auction for each requested impression [81]. While a user is loading a webpage, in less than 100 milliseconds, an auction takes place [86,84]. Advertisers determine the amount of their bid based on the user's data. The advertising space is being sold to the highest bidder. This technique has had a significant influence on the field of digital marketing [83].

RTB has gradually expanded to a more advanced variation called dynamic creative optimisation (DCO) [40], also called programmatic creative advertising [41]. With RTB, advertisers are selectively distributing pre-made advertisements. While with DCO, the content and graphical elements of the advertisements are generated in real-time to create an even higher level of personalisation [41]. By slightly changing the text, images, colours, banner size or button shapes, and showing these variations to a specific audience, advertisers can test which variation results in the highest conversion rate for a specific type of audience [40]. Lee and Cho [40], predict that the creation of variations in the advertisements will progressively be executed by AI, allowing this process to be even more automated. This adaptation of ads can be highly personalised based on the user's available demographic, geographic, behavioural and psychographic data [89].

**Physical displays**

Physical billboards are a common sight in virtually every city. While these are limited in their personalisation, advertisers use every trick in the book to gather as much data from passersby as possible. With screens as billboards, out-of-home personalisation has become a reality. By tracking nearby smartphones and combining this with data purchased from data brokers, the displays determine the gender, age, race, income, interests, and purchasing habits of the people that are surrounding it [117]. Based on this data, it displays the most effective ads. While the advertisements are not yet completely personal like the ones Tom Cruse walks by in the science-fiction film Minority Report, advertisers go to great lengths to make sure the ads reach the best possible target audience.

It is worth noting that not all countries allow such tracking in public spaces, the Dutch Authority for Personal Data has stated that Wi-Fi tracking [90] and other types of tracking e.g. with cameras is not allowed for such commercial purposes [91]. Yet, cities still struggle with properly enforcing this law [118,108].

### 5.2 Currently used AR advertising techniques

Scholz and Smith [68] have conducted an analysis of more than 50 marketing campaigns that used AR and outline how the current field of ARA can be divided into four types:

- *Interactive Print/Packaging:* a physical newspaper ad or product packaging that triggers a virtual experience when pointing a smartphone camera at it. The first AR advertisement campaign was built by HIT Lab NZ and ran in 2007 in a local newspaper, the ad was for the Wellington Zoo in New

Zealand. It involved printed QR codes that would augment 3D models of animals when scanned with a mobile phone [67].
It allows printed ads to come to life, videos can pop up, products can be shown in 3D hovering above your newspaper or users can test how the advertised furniture fits in their home [85]
In 2019 Burger King ran an ad campaign called 'Burn That Ad' which incentivised users to film McDonald's billboards with an AR app, the app would detect every possible McDonald's ad and then virtually set the billboard on fire [64]. Once users burned the competitor's billboard, they could share this video on social media and a coupon for a free Whopper would be shown [106].

- *Bogus Window:* a display that seems as if it is a window, but instead it is showing a live video feed of what is on the other side, making it possible to alter the video feed or add virtual objects.
  In 2014, HBO modified a bus stop in Vienna to promote its TV show The Walking Dead [68]. The billboard showed the streets as if it was just a glass plane, but instead, it was a TV where a zombie appeared out of nowhere, scaring the commuters at the bus stop. Similarly, Pepsi showed UFOs and tigers on the other side of the billboard [107].

- *Magic Mirror:* a display similar to the bogus window, only now the camera is pointed towards the user. This gives it the effect of a mirror, with the added possibility to alter the video and/or augmentation.
  The Dutch government used this technique in an attempt to combat the bystander effect [85][98]. Large screens above crowded areas showed a live feed of the street. But at the bottom of the screen bystanders would see an ambulance where the employees had a violent confrontation with a group of people. The audience would find themselves in a position where they were just looking at this without acting. This was followed by a message urging people to take action in case this happens in real life.

- *Geo-Layer:* augmenting virtual objects to the surroundings which can be based on the specific location of the user.
  Ice Tea brand BOS made an app where users could plant virtual trees throughout the city for all other users to see [68]. Snapchat has allowed countless companies to advertise using their 'geo-filters'. These filters often contain 3D animations of products or playful animations containing a company logo, which can be added on top of a user's video or picture based on their current location [52].
  An even more popular example of AR advertising is Pokmon Go. This AR location-based game [48] contained advertisements that successfully lured its users to the physical locations of advertisers such as fast food chains and local businesses. However, it was also known that some players chose to turn off the AR capabilities of the app to increase their performance [103] as cited by [64]. Therefore, one might conclude that Pokmon Go's success was not as much caused by AR but was influenced by many other factors, like the

location-based nature or, for many users, the nostalgia surrounding Pokmon. Regardless, the game brought AR to the mainstream [113].

It is clear that many creative advertisers are jumping at the opportunity to use AR to promote their brands, and this has already resulted in very effective ads [22,76]. Research company Hidden Creative compared a 2D advertisement with an AR advertisement and found that, for the AR version, the audience spent more time watching, were more likely to consider buying the advertised product, and gave higher estimates when asked what price they would be willing to pay [42]. Sung, Han and Choi [75] studied how currently available AR techniques can be used in Advertising. The authors state that the psychological mechanisms that control the consumer's decisions, like escapism, are crucial for AR Advertising. They found that the narrative transportation and spacial immersion of AR enhance the consumers' escapism experience which in turn sparks a positive brand attitude [75]. However, many current AR ads, at least partially, owe their success to the novelty of AR. Hopp and Gangadharbatla [30] found indications that people who are more familiar with ARA have a more negative attitude towards it.

Furthermore, the vast majority of widely run ads are made for smartphones, which limits their pervasiveness as users need to hold the device and can't do many other things. The true potential of ARA is yet to be reached. In the short term, affordable head-mounted AR devices will enable users to experience AR without being tethered to a smartphone, and in the long term, contact lenses or implants could make the experience even more pervasive [9].

### 5.3 Technological capabilities of AR

Now that we have familiarised ourselves with the current state of ARA, let us look ahead into what the future might bring. The following section will delineate the current research about the future capabilities of AR and discuss how these could be used for advertising.

In his book on the privacy, laws and ethics evolving around Augmented Reality, Wassom [85] gives four main indications for how AR is likely to be used for advertising in the future. More recent research by Sahu, Young and Rai and Kaviyaraj and Uma [65] stress the important role AI will play within AR. And Finnegan, Zoumpoulaki and Eslambolchilar [23] give a glimpse of the misleading effects ARA could have. These predictions and indications are combined below to outline what is currently known about the future technological capabilities of AR and how these could be used for advertising.

**Better sensors, more surface for advertisements**

Wassom [85] notes that, over time, the sensors in AR devices will become better at detecting specific objects and surfaces and that the world has millions of surfaces that are just '*waiting to be augmented*'. When wearable AR devices become more common, the amount of places to advertise is endless. Outdoor advertising will be no longer limited to billboards, but can be shown anywhere [85]. As

discussed in section 5.1, advertisers already put great effort into making out-of-home (OOH) billboards as personalised as technically possible. With biometric sensors in AR headsets and the public space as a life-size canvas, the personalisation of OOH advertising will drastically accelerate. Who controls what we see remains to be seen.

It could be that users have full control over the virtual additions to the world around them, it could also be the AR device makers, owners of physical spaces or internet service providers who decide what you see. It will likely be a combination of all [85]. Pearson [110] predicts that it will follow similar market dynamics as with current technology, often allowing the user to choose what they see. However, that choice sometimes requires in-app payments to remove ads or the purchase of a more high-end device [110]. No matter how this will unfold, it is certain that this will be a very important battle in the field of AR [110].

**Biometrics**

Wassom [85] also observed how the sensors for detecting bodily features were advancing. Many of the latest AR devices already incorporate hand, head, and eye-tracking sensors [95]. In section 5.1 we touched upon pay-per-click advertising in search results. This trend could continue in AR. In 2011, Google filed a patent [105] for wearable AR that featured 'pay-per-gaze' and even 'pay-per-emotion' advertising [85]. With pay-per-gaze, advertisers would be charged when a user looks at the advertisement. With pay-per-emotion, advertisers could be charged for each person that looks surprised or interested when seeing their advertisement [85]. Likewise, biometric data could be used to show advertisements based on the person's current emotions.

**Location-based advertising**

Similar to sensing biometrics, the surroundings of the user could also play a role in advertising. By their very nature, AR devices have various sensors to detect the surroundings. GPS monitors the location and LIDAR sensors could continuously create a 3D map of the user's surroundings. Traditional online marketing approaches already use large streams of data, yet with AR the amount of collected data could be remarkably more extensive [56,79]. Even the temperature, humidity, light, sound, and air composition could all be utilised to create advertisements that are as fitting as possible for the user's situation [85].

**Increased use of AI**

Recent research endorses the use of AI in AR [65], stating that the combination of these technologies will increase their effectiveness [35] and allow for more immersive and intriguing applications [35]. Currently, most targeted advertisements make use of your previous online behaviour or general interests. However, with Artificial Intelligence (AI), advertisements can be created and placed in more strategic ways. A recent study indicates that AI will have a profound impact on

advertising and marketing [70,82]. Li [41] proposes that the most intelligent ads will not be the ones randomly popping up. Instead, these ads will go beyond predicting the user's interests and will accurately anticipate what the user needs and wants in a specific situation [41]. With AR providing more personal data and unique visualisation abilities, and AI providing the ability to optimise each ad to individuals, it is likely that we will see these techniques working together to generate AR advertisements.

**In-life product placement**
As became apparent in section 5.1, advertisers commonly blend their advertisements with entertainment and other content. With more accurate sensors on AR headsets, product placement would no longer be limited to magazines, TV shows, movies and games. It could convincingly blend with your life. For example, car manufacturers could augment life-size versions of their latest model all around the city even before large-scale production of the vehicle has started. Combine this with personalisation and you could be seeing the car you were just searching for online, virtually pop up in parking spaces everywhere you go. It could also alter real-world products. This can have misleading effects [23]. As mentioned before, soft drink producers could make their cans shinier and the competitors' look dented [23]. Theoretically, they could even make people that drink their product look happier and more attractive. In most countries, it is illegal to damage the reputation of a third-party brand. However, the question remains to what extent this holds. Would it also be illegal to just make competitors' products appear slightly out of focus? Or if the product is never altered, but only the person drinking a competitor's drink is made to look less attractive? Our current laws are unprepared for these new technological changes and will pose unique challenges for policymakers [97,114].

### 5.4 Existing literature on AR Ethics

Various works have researched the ethical impact of AR in general, not necessarily focussed on advertisements. Notably, Brinkman [9] has applied Marshall McLuhans tetrad methodology to AR. This method is made to determine the effects of a new technology on society. Based on this method, Brinkman makes several predictions. Madary and Metzinger [45] give some ethical concerns on the use of VR and related technology. Pearson [110] envisions how AR could be used to turn people on the streets into anything the user would like, likely resulting in the objectification of women. Slater et al. [71] focus on the deceptiveness of AR and VR and most recently, Fox and Thornton [26] focus on the effect of AR on marginalised populations. The section below combines the ethical implications that are mentioned in current research.

**Increased secrecy and individuality**
Due to the head-mounted design, other people can no longer watch along over your shoulder like with smartphones and computers. This will enhance secrecy

and individuality [9]. Users can do anything on their AR device without having to worry about other people noticing this.

**Increased world customisation**
AR will enhance world customisation, the ability to virtually adapt how real-world objects around us will look. Users could modify street signs, lampposts, a neighbour's house or even the weather [9]. Pearson points out this will likely also affect people [110]. Users could modify the way other people look, making others look like cartoons or celebrities. But it is likely to follow a common pattern in technology, using it for pornographic means. It is likely people could start virtually undressing or scarcely dressing other people on the streets [110]. While this can be seen as immoral and in some cases might be classified as sexual harassment, the secretive nature of head-mounted AR it will make it hard to detect, let alone police. A research that focussed on a code of ethical conduct for VR mentioned regulators might need to enforce a certain 'Avatar ownership' [45]. This would give the control of a personal avatar to the user, allowing individuals to express themselves in their virtual appearance and preventing others from modifying this. Such a regulation could apply to both VR and AR.

**Paranoia and surveillance**
Brinkman [9] predicts that the increased secrecy and individuality of AR could turn into increased virtual monitoring of what people use their devices for. It is also unlikely that the data gathered from eye-tracking sensors will be kept private on all devices, as applications will be using this data to function [9].

**Undecided ownership**
In the real world, landowners can decide over their property, but this right currently does not extend to the virtual world [59]. This raises ethical concerns about the use of public and private space. What if someone places a virtual billboard on or very close to your property? [59] Or if someone hides all of your physical billboards with virtual ads [9]. Regenbrecht proposes that city councils could restrict virtual overlays in certain area's, yet this would not solve the issue completely. Brinkman [9] notes that a billboard can be blocked from view without the advertisement being augmented on the property. As long as the user is not on the property themselves, the ads could pop up in front of the user, still blocking the billboard without showing the augmentation directly on the property. With some cleaver use of perspective, this can be done in such a realistic way that the user does not notice that they are not looking at the actual billboard. Slater et al. [71] mention that AR applications could become so deceptive, that we would need industry standardised markers which indicate to the user which parts are fake. They also propose a deceptiveness rating for VR and AR content, similar to how we have ratings for movies.

**Augmented digital divide**
AR could uphold or even increase social divide. New technology tends to reflect

or even reinforce existing social bias [26]. AR glasses will collect more fine-grained personal data, which can be used to better win the user's attention [79]. And the collection and analysis of this data will likely be obfuscated [26]. This poses a harmful situation to all users and society, yet marginalised populations have been disproportionately been affected by certain privacy issues [26]. Besides that, if the use of AR becomes essential to participation in society, this will increase the digital divide. Both between high-end and budget platforms, but also between those that can afford AR devices and those who cannot [79].

### 5.5 Given guidelines and solutions

Some existing works give guidelines for the use of AR. Pase [51] notes several considerations that should be taken into account by developers of AR applications. Madary [45] gives various recommendations for consumer use of VR, most of which are, due to the similar nature, also applicable to AR. These are discussed and combined with previously mentioned works, in the following section.

**Critical Examination**
Developers should critically examine the abilities, intention and desired outcome of their persuasive AR applications [51]. Developers should keep in mind the possible effects of the content they build. Because of the immersive experience, graphical content could lead to viewers suffering psychological trauma [45].

**Disclosure**
A full, accessible and apprehensible disclosure to the end user can limit ethical concerns [51]. This disclosure should be shown at the start of the application and explain what information is gathered, how it is used and for which purposes [51]. As mentioned above, certain content could lead to psychological trauma, users should be made aware of certain content beforehand [45]. Similarly, the technology could be highly manipulative and interact with deeper levels of self-consciousness, users should be made aware of these capabilities [45].

While transparency helps consumers make a more informed decision and could prevent users from harm, it could also be easily neglected. There is a wide array of elements that need to be disclosed, like possible trauma [45], the persuasiveness of AR [45], potential health-impacts [72], specifications on data collection [72], and the possibility of inaccurate representations [72,85]. These disclaimers would likely become lengthy statements. Moreover, in the case of novel and experimental technology like AR, users do not have the required information to make an informed decision [53]. This information is simply not available yet or there are too many factors to take into consideration. Making the user asses what technology they should and should not use will be a demanding and cumbersome task. Simply trusting all users to do so is not a viable solution. Therefore, broader set of moral guidelines is necessary to push makers of new technology into the right direction [53].

### 5.6 Existing literature on the Ethics of advertising

Researchers have been discussing the ethics of advertising for nearly a century [44,11,20]. This section gives a brief overview of what previous works consider to be ethical advertising.

Nebenzahl and Jaffe [47] state that the ethicality of an advertisement is based on the extent to which it harms consumers. This harm can be inflicted by: violating the user's autonomy though control or manipulation, invading the user's privacy and by neglecting to disguise that the shown content is an advertisement and who paid for it. Yet, at the time of this research, the invasion of privacy also mostly involved the fact that consumers are shown ads on the subway and in sports stadia. High scale data collection and personalisation was not an issue yet. The highest form of disguised and obtrusive advertising was product placement. Therefore, the authors consider this the least ethical form.

A decade later, researchers discuss how technological advancements have impacted the ethics around advertising. Their conclusion is that this has resulted in a greater opportunity to act unethically [20,66]. It has, for example, become common to compensate bloggers in exchange for content [66]. More over, advertisers and PR professionals often lack appropriate training on advertising ethics or choose to ignore guidelines [66,61].

In general, the guidelines on advertisement follow a similar pattern. While some guidelines are more in-depth and also discuss more specific scenarios like advertising targeted at minors, in general the ethical guidelines on advertisement follow a similar pattern.

| **Guidelines** | **Sources** |
|---|---|
| Respect the viewer's autonomy<br>- Refrain from manipulation<br>- Refrain from deception | [47] [94,92] |
| Respect the viewer's privacy | [47,20][99,92,91] |
| Transparency<br>- Disclose commercial content<br>- Disclose identity of the advertiser<br>- Disclose collection and use of data | [47,32,66][92] |
| Test & review the effect of ads on individuals | [27] |

While this not an exhaustive list of all specific guidelines, it gives an indication of the ethical standards that should already be followed for regular advertising. Logically, these should also be practised for ARA.

Brenkert [8] states marketing towards vulnerable groups without making appropriate allowances should be considered immoral. However, Palmer [49] disputes Brenkert's claims and states they are based on faulty reasoning. Nevertheless, most guidelines set similar conditions. Either refrain completely from including vulnerable subjects and add proficient protection otherwise. Especially

when it comes to advertising towards minors, there are clear guidelines that aim to protect this group [92,93]. Robertson [62] states that marketing should be a transaction between equals, the consumer must be competent. A competent consumer can tell the differences between quality and price, has the means to buy, knows their legal rights and is knowledgable about the product. Whenever a customer does not have these capabilities, it is considered a vulnerable customer. When dealing with vulnerable groups, one must not exploit vulnerability, even if it is for noble purposes [62]. Marketers should put effort into compensating any vulnerability. This can be done by providing all the information about the product or service, not just mentioning the selling points and by stating the legal rights the customer has [62].

### 5.7 Existing guidelines for other new technology

Besides guidelines that are created for ARA and advertising in general, it is useful to take a wider perspective. Due to its novelty, AR can be classified as an experimental technology and it can also be a very capable persuasive technology [51]. This section highlights guidelines that have been given for these overarching categories.

**Experimental Technology**
Van de Poel [53] states that whenever a new technology is introduced into society, ethical constraints are essential because it could harm individuals as well as society at large. To create these constraints, the author has used a general set of ethical principles: non-malecence, benecence, respect for autonomy, and justice. Based on this, the author derived 16 conditions that should be regarded when using experimental technology. While AR is not a new technology, consumer-level, daily-usable, head-mounted AR certainly is. Therefore, the impact of this to individuals and society is largely unknown.

**Persuasive Technology**
While AR will have even greater persuasion abilities [51,71], persuasive technology is not a novelty, with computers and smartphones being widespread examples. Fogg coined this the field of 'captology', Computers As Persuasive Technologies [24]. Over the last two decades, researchers have dedicated various studies on the ethics of these types of devices. As mentioned by Pase [51], because AR is considered to be a persuasive technology, the theories on ethics from the field of persuasive technology can also be applied to AR. Since the goal of advertising is to persuade an audience [60], these types of ethical considerations seem even more relevant for ARA. Persuasive technology is more persistent compared to humans, it can affect emotions but won't be affected by emotions themselves, it is hard to hold them responsible and their novelty tends to blind users to negative effects [25]:

Berdichevsky and Neuenschwander [5] have created eight principles for designing persuasive technology. In doing so, the authors build upon the rule of

reciprocity, which states that creators of persuasive technology should never aim to persuade a person of something they themselves would not consent to be persuaded to do. However, while this can be a helpful ground rule, it does not ensure a harmless outcome. What the advertiser might perceive as an acceptable advertisement, could be an unwanted form of persuasion to the viewer. Someone who is skilled in making financial decisions and foreseeing the possible outcomes is likely to be less easily persuaded by financial ads, and thus would not mind advertisements to be more persuasive. Therefore, more detailed guidelines are necessary.

## 6 Guidelines for ARA

The literature study analysed the established advertising techniques, the (future) technological capabilities of AR, currently used advertising techniques, existing literature on AR ethics, existing guidelines for other new technology and existing literature on the ethics of advertising. By combining this knowledge, a set of guidelines is constructed. The guidelines and recommendations have been grouped into seven categories. In the following section, each of the seven categories will be discussed.

### 6.1 Autonomy

The topic of autonomy became apparent in various existing guidelines and regulations for advertising. When creating an advertisement, one must respect the autonomy of the intended audience and other potential viewers. Essentially, the viewer must be able to make their own decision, without being misinformed [5,25], manipulated [47],[94,92], deceived [47,25],[94,92] or coerced [25].

AR has significant possibilities to mislead the viewer. It could virtually alter physical products, making them seem more attractive than they are in reality [23]. It is also possible that ads modify the appearance or emotion of a person that is using a product, indirectly causing you to change your opinion of the product. Examples of currently used advertisements that deceive the viewer are those that pretend to be pop-ups, promise fake prices or contain fake buttons to close the ad which instead open the advertised website [25]. For ARA, certain deceptive advertisements could have an even greater impact, by appearing in the user's field of view, they are more intrusive and harder to ignore and harder to distinguish from other content compared to the ads we are currently used to.

In current guidelines, deceptive and misleading advertisements are considered unethical [47,5,25],[94,92]. Since this AR offers new and potentially enticing possibilities to persuade the viewer, it the following guidelines have been constructed to emphasise what lines should not be crossed. For G5 it is good to note that modifications can be purely decorative, informative or entertaining. What the guideline aims to prevent is modifications that are purely used to persuade. Examples of this are blurring competing brands, or putting their products slightly out of focus so that users won't notice the physical appearance, making people

that drink a certain brand of soda seem happier than they actually are or making a normal hamburger look tastier. These are all habits that advertisers have been doing in regular advertisements. So it is enticing to use them in AR as well. Only here, the modification is done to the actual product or user, thereby removing the user's ability to see what the actual product is like. This limits their autonomy.

---

**G1** All communicated messages must be truthful and not misleading or deceptive.
**G2** Refrain from using false affordances in the advertisement.
**G3** Do not abuse the consumer's trust or exploit their lack of experience or knowledge.
**G4** Advertised products must be depicted as realistically as possible. Whenever a virtually depicted product deviates from reality in any way, this discrepancy must be clearly indicated to the user.
**G5** Refrain from modifications to physical products, the users of physical products or the surroundings of physical products with the aim to persuade the viewer.

---

### 6.2 Disclosure & Transparency

Another common measurement that can limit ethical concerns of AR is a full, accessible and apprehensible disclosure to the end user [51]. It is essential that the commercial content is always clearly disclosed to the user, the user must be aware of what is an advertisement. [47,32,66]. Moreover, the identity of the advertising party must be shown [32],[92]. As discussed in section 5.1, blending advertised content with organic content is common practice in current advertising. AR will only give more opportunities for this, as became apparent in section 5.3. Therefore, the guidelines emphasise the following:

---

**G6** All advertisements and sponsored content should be clearly defined as such.
**G7** All potential viewers must be able to easily see the identity of the advertiser, either a company name or a person.

---

### 6.3 Monitor & Adjust

When creating advertisements for head-mounted AR, advertisers are using an experimental technology. This novelty makes it hard to foresee all the possible consequences [53]. While advertisers should anticipate on potential negative results of an AR advertisement, this will never completely remove the possibility of harm. Therefore, as with any experimental technology, it is important to monitor

effects and to be able to cope with unanticipated effects in case they happen [53]. Building on the guidelines given by van de Poel [53] for experimental technology, the following guidelines for ARA have been added.

---

**G8** Test and closely review the effect of the advertisement among a representative sample group that consented to this test [27].

**G9** If the initial test shows no issues, the advertisement should be launched to a smaller audience at first. Ensure that compensation would be available for all potential viewers, limit audience based on this.

**G10** Monitor effects during the small scale trial. Scale-up consciously, only when no issues arise.

---

Aside from avoiding harm, one must design for resilience [53]. And when harm occurs, this should be reversed where possible and otherwise compensated [53]. For ARA this means the following:

---

**G11** Have a system in place that allows all potential viewers to report any issues with the advertisement.

---

This allows the advertiser to respond swiftly in case viewers have a negative experience of any kind.

---

**G12** Before running any advertisement, appoint a person or team responsible for monitoring the tests, responding to issue reports and stopping the advertisement when necessary.

**G13** In the case of harmful consequences, involved parties should receive aid to reverse these consequences.

**G14** In the case of irreversible harm, involved parties should receive compensation.

---

Lastly, the subjects of any experiment must always be able to withdraw from or adapt the experiment [53]. As mentioned in section **??**, the impact of AR on individual users and society is largely unknown. For that reason, the guidelines incorporate van de Poel's recommendations for experimental technology. This means that all viewers of the advertisement, from the initial test group to a large scale audience, should be able to opt out. Moreover, since the advertisements could either partially or entirely block the users view, using false affordances that make it harder for the user to close the pop-ups should be considered unethical. This is emphasised in G16.

---

**G15** Viewers of the advertisement must always be able to opt out of being targeted for a specific advertisement.

**G16** Viewers of the advertisement must always be able to close the advertisement from their field of view.

---

### 6.4 Privacy & Surveillance

Collection and retention of data should be done with great caution and with respect to the advertised audience [47,25,20],[99,92,91]. All subjects of a new technology must be made aware of the privacy concerns and risks [53]. Whenever personal information about a user is sent to a third party, this must be closely scrutinised for privacy concerns [5].

Current privacy laws, like the EU's GDPR, already require data collectors to clearly disclose what data is collected, why it is collected, how long it will be retained and for what reasons. For ARA however, the possibility of data collection greatly expands. Sensors in the device could determine if the user has seen the advertisement and even what emotional state the user had before and after seeing the advertisement [85]. This makes it more likely that not only applications will gather data, but also individual ads will be collecting data from their viewers.

---

**G17** No personal data should be collected until the viewer gives explicit and informed consent.

**G18** Privacy statements should be expanded with more information on the collection of novel data types, like eye-movement, facial expression or 3D scans of the physical surroundings of the user.

---

### 6.5 Review Intentions & Determine Risks

New technologies tend to enforce or even amplify existing social biases and inequality [26]. Especially due to the immersive nature of AR, the technology will be more than capable of bringing such negative impacts [26]. Therefore, creators and developers should critically examine the abilities, intention and desired outcome of their persuasive applications [51]. The risks should be contained as far as reasonably possible [53] and the creators must hold themselves responsible for all reasonably predictable outcomes of using the technology [5].

---

**G19** Evaluate risks to all potential viewers of the advertisement: Determine and review the intention and desired consequences of the advertisement. Determine and review all other reasonably predictable consequences, even if unintended.

---

Other guidelines regarding responsibility and accountability are addressed in section 6.3.

Furthermore, any potential hazards and benefits must be fairly distributed [53]. Especially when starting with AR advertisements, there is little knowledge about the consequences. Therefore, it is important that the selected target groups are not focussed on a specific part of society. Minorities are often disproportionately affected by privacy issues [26]. Moreover, the current advertising already tends to amplify inequality [112]. To reduce this disproportionate harm, it is important advertisements are not targeted directly based on race, sexual orientation or religion.

---

**G20** Advertisements should never be targeted based on race, ethnicity, sexual orientation or religion.

---

### 6.6 Vulnerable Audiences

Some individuals are particularly vulnerable and are more likely to experience harm from advertisements [7]. Van de Poel states that when applying experimental technology, vulnerable subjects should be excluded from experiments, provided additional protection or stand to benefit substantially from the experimental technology [53]. In the case of advertising, one can argue that vulnerable audiences are not the ones that stand to benefit substantially. Especially given the before mentioned tendency to enforce inequality [26]. As mentioned in section 5.7, exploiting the vulnerability should be avoided at all times and work to compensate the vulnerability [62]. This leads to the following guidelines:

---

**G21** Avoid targeting vulnerable audiences. When this is unavoidable, ensure to compensate for this vulnerability: provide all the information about the product or service, not just the selling points and state the legal rights the customer has.

---

AR experiences could be so realistic, that they could inflict psychological trauma [45]. In the case of games and other applications, it is advised to warn the audience of this risk beforehand [45,72,71]. Yet in the case of advertising, it is impractical to present a disclaimer, ask the user for consent and then show the advertisement. This would require too much time and would likely lead to very low effectiveness. Therefore, it is advised to avoid this completely:

---

**G22** Thoroughly test advertisements to determine any potential shock reaction or trauma.

**G23** Refrain completely from using any content that could inflict psychological trauma.

---

Other ways to limit this have already been addressed by guidelines given in 6.3 concerning small-scale tests and detailed reviews.

### 6.7 Additional guidelines

Section 5.3 discussed intelligent advertising, where the content of each advertisement can be optimised per individual viewer. This makes testing an advertisement on a small group of individuals an ineffective measure. As each ad can be completely different from the other, testing the ad on a small group does not yield any useful results, as the ad might show completely different versions to the wider audience. Even though highly personal AI generated AR advertisements do not exist just yet, we advise to refrain from using them until we know more about the effect of ARA on the consumer. By launching, reviewing and testing AR advertisements that are crafted by humans, more data can be gathered about the effect of these advertisements on consumers. This could tell the industry if advertisements can be too realistic, to what extent they can safely use scary elements like tigers and zombies, and they can set up industry-wide standards for indicating what is an advertisement and systems for users to report faulty advertisements. Until the industry and research have become more mature, the following guidelines hold.

---

**G24** Only use automatically generated advertisements whenever each specific variation of the generated advertisement can be tested as prescribed in these guidelines.

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## 7 ARA consumer ethical impact assessment tool

With 24 guidelines, it can be complex to see if an AR advertisement adheres to all of them. To make this easier, an assessment tool has been created. This tool consists of a survey like setup where the advertiser answers a set of simple questions about their advertising idea. To make the test as short as possible, conditional rules are applied that hide questions which do not apply. Initially there are 22 main questions, based on the given answers, a maximum of 21 follow-up questions could appear. After answering all the questions, the advertiser is given an overview of what they should improve on and which guidelines are already being followed. This overview is colour coded, with orange being possible improvements and green being followed guidelines. An export function has been added such that advertisers can print or save their answers, including the final report as a PDF. Ideally, this tool is only necessary in the beginning. After a while, advertisers will know what guidelines to adhere to and will keep these in the back of their mind when creating new advertisements, or incorporate them into their regular process.

## 8 Interview results

Both the guidelines and the tool have been discussed with people active in the advertising industry. After analysis, the interviews have resulted in a set of overarching themes. Those themes are listed and discussed in the following sections.

### 8.1 Overarching themes

Positive remarks:
- All participants value the final overview
- Questions of the tool are easy to comprehend
- The questionnaire-type format is appreciated and familiar
- Likes the ability to export the report: will give the advertising agency a basis to stand on when asking the client for more time or budget to do proper testing.
- The need for guidelines is acknowledged

Tool can be seen as another tedious task:
- Advertisers might start giving the desirable answers just so that the ad can be published. It is good to communicate that the tool is there to help them navigate within the new field of ARA.
- Advertisers are hesitant in using the tool, in general they would rather incorporate some of the guidelines within their already existing processes.

Unclear responsibilities:
- The participants acknowledge that an ad should not be untruthful and misleading, yet rarely see it as their task to ensure the wellbeing of their audience. The out-of-home publisher figured the tool should be used by creatives, the creatives figured that publishing platforms and social media companies should perform advertisement screening.

Regulation will be necessary:
- Scepticism about the harm an AR advertisement could affect on their viewer.
- As long as the advertisement is legal, clients are focussed on selling a product.
- Companies can legally guard themselves with terms and conditions and disclaimers.
- Three out of four participants do not perform standardised screening, the one who does, does so because they are legally required to.
- Advertisers will have a hard time convincing clients to spend more money for proper testing.

Improvements to make on the tool:
- Long list of things to improve can be demotivating: might be good to show what is done right first, and then give the list of things to improve on.
- Does the advertisement contain any buttons or other affordances that are intended to be misinterpreted by the viewer? '*Intended*' needs to be emphasised
- Would the advertisement perform better with people that lack knowledge or experience or skills to judge the offered product or service? Question is too lengthy / vague
- Do these plans ensure involved parties can receive aid to reverse these consequences? Receive aid needs to be explained

- Is it possible to run all the necessary tests on each generated version of the advertisement? All necessary tests needs more explanation.
- The discrepancy between general modifications to the physical world and modifications that are created only for persuading viewers needs more explanation
- The start screen with long text introduction is a little intimidating
- Tool might need to be translated into Dutch to make it easy to comprehend

Improvement to make on the guidelines:
- G11 was not entirely clear, might need more explanation. Could be expanded by letting the consumer decide whom they send the issue report to. Aside from notifying the advertisers, options could be added for notifying regulators or independent supervisors.
- Sees value in G15, but notes that it can be interpreted in various ways.

Other notable comments:
- Guidelines overlap with current guidelines
- Viewers might fake harmful consequences to receive financial compensation.

### 8.2 Modifications to the tool

- Two participants had trouble understanding the discrepancy between general modifications to the physical world and modifications that are created only for persuading viewers. To explain this in more detail, the following note has been added to the question in the tool: *'Note that there is a difference between modifications for aesthetic or informative reasons and modifications that truly try to persuade the viewer. Only answer yes when the modifications themselves aim to persuade the viewer. For example, blocking or blurring competing brands from view, or altering a persons physical appearance when they use a product)*
- It became apparent in most interviews that advertisers might start seeing the tool as 'just another thing they would need to pass'. One participant also noted that advertisers are familiar with similar questionnaire-like formats where they need to answer everything correctly in order to pass a certain certification or participate in tenders. To combat this misconception, there is a note added before starting the tool that explains this tool is on the side of the advertisers, the aim is to help advertisers navigate in the new field of AR Advertising and create a healthy advertising space.
- Advertisers seem hesitant are hesitant in using the tool. In general, they would rather incorporate some of the guidelines within their already existing processes. The participants also noted that it would not be viable to complete the tool for every advertisement. Ideally, the tool will only be necessary in the beginning. As one participant noted, after working with it for a while, the guidelines will become part of the workflow and advertisers will automatically know what the limits are. To emphasise that the tool will be simply an aid to get started, an explanation has been added before starting the tool.

- The start screen of the tool contained an introduction and all the guidelines, this was perceived as somewhat intimidating. Therefore, the first screen has been split up into two pages. One with an introduction and one with the guidelines and explanation of the tool.
- One of the participants had trouble understanding several questions, to accommodate this, several explanations have been added:
  - The question 'Does the advertisement contain any buttons or other affordances that are intended to be misinterpreted by the viewer?' now has an extended explanation on hover saying *'Note that this does not include any accidental misinterpretations. Only answer yes when the advertisement has elements that are intentionally there to be misinterpreted.'*
  - The question 'Would the advertisement perform better with people that lack knowledge or experience or skills to judge the offered product or service?' now has an extended explanation on hover saying *'Answer yes if your advertisement utilises the vulnerability of the viewer in some way.'*
  - The question 'Is it possible to run all the necessary tests on each generated version of the advertisement?' now has an extended explanation on hover saying *'The guidelines advise running several tests on small groups before launching an advertisement. Is it possible to run a dedicated test for each generated version of the advertisement?'*
  - The question 'Do these plans ensure involved parties can receive aid to reverse these consequences?' now has an extended explanation on hover saying *'In the case (some) viewers are harmed by your advertisement, is there a plan in place to help them reverse this harm?'*

### 8.3 Other remarks

The participants noted that the guidelines overlap a bit with currently enforced Dutch regulations. Namely, G6 which concerns clearly defined advertised and sponsored content. This is included in these guidelines because on social media, blending advertisements with organic content is very common and it is still not always mentioned. One participant also noted that this is still a common issue. Furthermore, blending virtual content with the real world is in the very nature of AR. This makes the technology highly capable of blending advertised messages with everyday life. G17 about data collection, overlaps with the GDPR. This is left in because the guidelines are not necessarily focussed on the EU only where the GDPR is enforced. Moreover, current literature states that AR-headsets will likely collect even more data from the user [10], making privacy guidelines even more important. Lastly, it was noted by two participants that G20 about targeting on race or ethnicity overlaps with what is currently enforced on social media platforms. Yet, this is not the most stable way of ensuring ethical advertising practices. Meta only started enforcing this in 2021 [109] and only one network has to choose financial gains over ethics. While platforms can certainly be held responsible, advertisers should not rely completely on external parties to do this screening. Therefore, the guideline has been kept.

It was also noted that G11 was not entirely clear. One participant mentioned that it could be expanded by letting the consumer decide whom they send the issue report to. Aside from notifying the advertising party, options could be added for notifying regulators or independent supervisors. This is a valuable addition and would be desirable in later versions. But in the case of voluntary guidelines, the advertiser that is following these guidelines can be considered responsible enough to respond to certain reports. And as long as there is no regulation enforcing these guidelines yet, reporting it to a governmental body might not be viable just now.

One participant noted that G15 could be interpreted in various ways. Opt out of being targeted could mean for just that one ad, but also completely opting out of all advertised content from that company. G15 is built on the fact that in the beginning of ARA each advertisement will essentially be a scientific experiment, participants should always be able to opt out of a specific test. Legislation will be necessary to determine whether consumers should be able to opt out of all advertisements from a company all together, and also if consumers are allowed to be denied access to certain content if they do so.

A participant noted that giving a large list of things to improve on might be demotivating and swapping positive and negative might solve this. Yet, the choice has been made to keep the list of improvements at the top and the followed guidelines below it. The reasoning behind this is that these are both long lists. If a user sees a list of things that need to be improved, they will notice there is some work to do and scroll further, if a user that sees a screen with guidelines followed might think there is nothing that needs to be done, close the tool and miss the list of things to improve on.

A participant noted that because of G14, viewers might fake harmful consequences to receive financial compensation. G14 has been left in because in the event of harmful consequences this can likely be verified.

One of the participants had trouble understanding various questions because it was in English. While accommodations were made to provide a better explanation to several questions, any misinterpretations could cause advertisers to give wrong answers or stop using the tool. Therefore, if the tool is to be used by Dutch advertisers, a translated version would be helpful.

# 9 Discussion

## 9.1 Guidelines Discussion

Some guidelines will be easier to enforce by AR device makers and platform owners. For G11, device makers could setup a system which allows users to report any issues with an advertisement, ideally users have the choice to report to the platform, the advertising party or even regulating authorities. G16 for example, about advertisements filling the entire view, this might never become a reality as device makers could prevent advertisements from filling the user's view and could ensure that closing an ad always is done with the same interaction. Yet

these are still added to the guidelines because it is uncertain how these platforms and interactions will be shaped and what rules device makers might set in the future. Furthermore, while one platform might do the right thing, others could ignore it. Therefore, even though the device makers are more capable of enforcing this, advertisers still have the responsibility to determine whether the platform they advertise on is enforcing these guidelines and setting up correct systems.

When we look back at the exemplary AR advertisements discussed in section 5.3 it becomes clear that the guidelines have already been crossed by some advertisements. While the Walking Dead and Pepsi advertisements were done on bogus windows and not head-mounted devices, they used shock reactions and went to great lengths to make the experience as realistic as technically possible at the time. If advertisers would continue to use these tactics on head-mounted AR, the consequences to consumers could be harmful.

**Non-applicable guidelines** The reviewed literature made a few recommendations which have been deliberately left out of the guidelines. Each of which is discussed in this section.

Madary [45] stressed that users should be made aware that AR technology can be highly persuasive. This has been left out of the guidelines because it will not be feasible for advertisers to disclose. It will be more relevant to disclose when purchasing an AR device or to spread awareness about this to the general public.

Van de Poel [53] recommends that experiments are only ran when it is reasonable to expect that it has benefit to society. Whether or not society benefits from advertising is hard to determine. For as long as advertising has existed, there has been criticism on its intention and effects [73]. Yet, in the case of ARA it is no question whether AR will be used for advertising. Therefore, one can argue that it is beneficial for society if the advertisers who launch the first ARA campaigns do so in a controlled manner, following the mentioned guidelines and documenting their findings about impact.

Van de poel also mentions to use a flexible set-up to avoid lock-in of the technology [53]. This does not apply to ARA, the avoidance of a lock-in during the experimental phase of a technology is more something that AR device manufacturers should be concerned with.

Fogg [25] mentions concerns about the use of operant conditioning [25]. This recommendation is excluded from the guidelines because it is unlikely and hard to enforce negative punishments in advertisements. This is more often used in applications and games.

**Self-regulation and enforcing guidelines** Some guidelines and preventive measures can best be implemented and enforced by the companies building and designing AR hardware and software. Device makers could for example make sure that popups and advertisements can never block the entire screen, they could create a system to report faulty advertisements and a user's privacy pref-

erences could be much easier to regulate system-wide instead of for each specific advertisement.

The guidelines proposed in this research are ment as voluntary guidelines. It is possible for advertisers to ignore them. Yet it is certainly in their best interest to prevent negative impacts as this could also harm the industry as well. This is the reason why the industry is largely reliant on self-regulation. For AR device makers, the incentive to enforce these guidelines will be even greater. The manufacturers have a clear incentive to ensure that their devices are as safe, easy to use, and harmless as possible. Yet certain voluntary guidelines are far from a perfect solution [19] The industry alone cannot address the complex implications of widespread AR use. Legal intervention may become necessary in areas where guidelines prove insufficient. [19].

### 9.2 Interview Discussion

What became an apparent theme throughout the interviews was that optional guidelines will not be sufficient. Regulation will be essential in order to ensure that all AR advertising practices put effort into limiting consumer harm. In most interviews participants were sceptical about the negative effects AR could have. Three out of four participants felt like most advertisers will mean no harm, thus minimising the issue. The one participant that was highly convinced of the potential harm noted that the clients he is working for would not. As long as the advertisement is legal, the clients are focussed on selling their product or service. This means convincing clients to spend more money on proper testing will be challenging. Moreover, the interviews showed that the responsibilities are often unclear. While all participants acknowledge that an ad should not be untruthful and misleading, they rarely see it as their task to ensure the wellbeing of their audience. The out-of-home publisher figured the tool should be used by creatives, the creatives figured that publishing platforms and social media companies should perform advertisement screening. Thus, regulations will need to define who is responsible.

Every participant saw value in the final overview of the tool. Most participants had no issues comprehending the questions and one participant noted that the questionnaire-type format is appreciated and will be familiar to advertisers. The ability to export the report was valued as well. Aside from the intended ability to save it for internal use, a participant noted it will also give the advertising agency a basis to stand on when asking the client for more time or budget to do proper testing.

## 10 Conclusion

This research outlines the currently established advertising techniques, lists the technological capabilities of augmented reality (AR), and describes currently used AR advertising techniques. This provides insights into the tactics that advertisers can apply to influence consumers with AR technology. These tactics are

combined with existing literature on AR ethics, guidelines for other new technologies, and the ethics of advertising, resulting in an extensive list of guidelines for AR advertising (ARA). These guidelines give insight into the key ethical assessment points for ARA.

From the interviews, it became clear that advertisers are hesitant to use another tool. Furthermore, not all advertisers or their clients will be convinced of the risks that this novel technology can bring. Eventually, regulation will be necessary to ensure ethical use of ARA.

This research faces a novel technology and attempts to provide ethical guidelines before the technology is established. This limits the outcome of this research; how the world of ARA will unfold is yet unknown. More research will be necessary to further define these guidelines so that they can be legally enforced. It is also a call to AR device makers to set up proper platforms, enforce their guidelines, and give users the ability to report issues with an ad. Cooperation with device makers will be necessary to set up industry-wide standards.

Until then, the guidelines and the tool are an aid for pioneering advertisers, those that will be the first to use head-mounted AR for advertisements. As they will face unknown situations and consequences, these guidelines aim to guide them in the right direction and prevent them from accidentally harming consumers.

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# Grey Literature


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