Transparency in Persuasive Technology, Immersive Technology and Online Marketing: A Narrative Review

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Funding Statement

GambleAware is a grant-making charity using best-practice in commissioning, including needs assessment, service-planning, evaluation and outcome-reporting to support effective, evidence-informed, quality-assured prevention of gambling harms. Guided by a public health model, GambleAware commissions integrated prevention services on a national scale and in partnership with expert organisations and agencies, including the UK National Health Service, across three areas of activity: universal promotion of a safer environment (primary); selective intervention for those who may be 'at risk' (secondary); and, direct support for those directly affected by gambling disorder (tertiary).

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Glossary

AI: Artificial Intelligence

AR: Augmented Reality

B2C: Business-to-Consumer

CGA: Consumer-Generated Advertising

DNM: Darknet Marketplace

GDPR: General Data Protection Regulation

HCI: Human Computer Interaction

ICT: Information and Communication Technology

MOOC: Massive Open Online Course

MR: Mixed Reality

OTA: Online Travel Agent

SME: Small and Medium-sized Enterprise

SRI: Socially Responsible Investment

UI: User Interface

UX: User Experience

VR: Virtual Reality

3D: three-dimensional

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1. Executive Summary

In the current age of emerging technologies and big data, transparency has become an important issue in online marketing for not only consumers' online privacy but also their impression of trustworthiness, integrity and good conduct (Seizov and Wulf, 2020; DiStaso and Bortree, 2012; Rawlins, 2008). However, there is a lack of consensus on what constitutes or relates to transparency across domains of research, not to mention clear guidelines to achieve transparency for designers and marketers. The main aim of this review is to examine the transparency-related aspects, either elements and mechanisms or issues and risks, implemented or discussed in the fields of persuasive technology, immersive technology and online marketing. In this multidisciplinary narrative review, we explored the question of what transparency means in current research and practices by reviewing the existing literature in the three fields. Whilst the focus is on the abovementioned fields, the knowledge synthesised from this review is transferrable to a range of contexts relating to communication of information in the digital world.

Literature searches were conducted in Web of Science. Two experienced reviewers independently screened titles and abstracts. For potentially eligible studies, one reviewer read the full texts. To be included, the article had to be relevant to transparency and within the field of persuasive technology, immersive technology or online marketing. Transparency could appear in various forms, given the lack of definition and discussion of transparency in literature. Relevance to transparency was evaluated based on the elements, mechanism or current practices implemented or discussed in the literature regarding the lack or support of transparency.

Through this narrative review, we provide insights into the different aspects of transparency involved in persuasive technology, immersive technology and online marketing. Addressing these aspects will facilitate the users' or consumers' freedom and autonomy and thus contribute to their informed decision making. In summary, transparency in persuasive technology involves transparency of persuasive design and techniques, transparency of potential risks and user autonomy, and informed decision making and dark patterns of design. Similarly, transparency in immersive technology involves transparency of potential risks, transparency of system and user control, and using immersive technology as a tool for enhancing information transparency and informed decision making. Transparency in online marketing comprises organisational transparency, information transparency, transparency of data privacy and informed consent, and transparency of online advertising and social media.

We summarised the recommendations based on this review to guide the design and practice of transparency. In future, more efforts should be focused on ensuring users' awareness and understanding regarding the persuasive nature and intention in persuasive technology, and the computing process where possible, and these efforts involves improving related regulation and policy, raising awareness of the relationship between transparency and trustworthiness, and improving the design of information disclosure. Transparency also involves the notion that new technologies should be designed and developed to support human-computer collaboration and reciprocity. Also, visualisation could support transparency of recommendations by providing users with the rationale behind suggested items. User consent should be achieved prior to a data collection process, including the purpose of data collection, what data is collected, and how the data is stored, anonymised and removed. Information should also be made transparent regarding the potential impact or risks of the technology, including how it may interfere with users' activities and restrict their autonomy. Benefits and risks of the technology should be given equal value in consent forms to be presented to users. the potential solution to improving transparency involves a human-centred, personalised approach to the design of new technologies. The good practices for transparency of persuasive and immersive

technologies also apply to contexts where they are employed for marketing purpose, as these technologies have been extensively applied to online marketing. The implementation of information obligations involves 4 broad aspects: content, presentation, comprehensibility, and the human element in these areas (Seizov et al. 2019). These aspects are essential to consumer protection in terms of lowering consumer burden and improving information transparency. Multiple disciplines such as communication science and information design, critical linguistics, eye-tracking research and neuroscience should be employed to improve online information design (Seizov et al. 2019). From the perspective of companies trying to design selling mechanisms to maximise profit, providing product information has been found to lessen price pressures resulting from Internet-enabled price comparisons (Granados et al. 2012). In terms of information in social media, the inclusion of hashtags, photographs, and videos in messages positively affected citizens' engagement with posts; conversely, the use of URL, mentions, and photos in posts was found to negatively affect engagement (Lappas et al. 2018). Our review also highlights the need for more research focusing on transparency issues and practical guidelines. Future research and guidelines of transparency need to consider different applications and contexts including social, economic, cultural and environmental factors, and thus it may be challenging to achieve an adequate trade-off. For example, in the gambling industry, questions remain on how to strike a balance between maximising transparency for customers and avoiding unintended harm the transparency may cause.

2. Introduction

Digital technologies, devices and services have increased accessibility of information and created considerable opportunities for consumers to receive personalised services and for marketers to send targeted advertisement and promotion. The Internet and related technologies have made online consumption, interaction and activities become part of daily lives where user experiences and journeys and profiles can be continuously tracked and traced. In the current age of emerging technologies and big data, transparency has become an important issue in online marketing for not only consumers' online privacy but also their impression of trustworthiness, integrity and good conduct (Seizov and Wulf 2020; DiStaso and Bortree 2012; Rawlins 2008). In general, transparency can be described as "the perceived quality of intentionally shared information from a sender" (Esterhuyse 2019). However, there is a lack of consensus on what constitutes or relates to transparency across domains of research, not to mention clear guidelines to achieve transparency for designers and marketers.

With the uptake of persuasive technology and immersive technology in research and in the commercial world, researchers have increasingly noted the importance of transparency. Lack of transparency can cause various issues such as lack of sustained user engagement and failure of persuasion or personalisation. Further, persuasive technology and immersive technology have the potential to be used to promote outcomes for profit that may cause harm or facilitate addiction-like behaviour to users in some settings including online gaming and shopping. Persuasive technology can take on diverse forms including the websites, mobile phones or tablets, smart devices integrated into everyday life to persuade or affect users to change their perception, attitudes and behaviour. Immersive technology imitates a physical world and creates a sense of immersion in the form of Virtual Reality (VR), Augmented Reality (AR) or Mixed Reality (MR). Online marketing refers to any effort to spread the corporate name using the Internet to reach the public, and it can take different forms such as search engine marketing and social media marketing. We are not making distinctions between the different forms of these technologies and the online marketing efforts in this review; instead, we

attempt to establish a better understanding of transparency as a concept by reviewing literature and synthesising knowledge and evidence on transparency in the three fields mentioned.

The main aim of this review is to examine the transparency-related aspects, either elements and mechanisms or issues and risks, implemented or discussed in the fields of persuasive technology, immersive technology and online marketing. In this multidisciplinary narrative review, we aim to explore the question of what transparency means in current research and practices by reviewing the existing literature in the three fields. Each field approaches the aim from a different perspective, but the insights and inspirations from them can be combined towards a consensus on the conceptualisation of transparency that has been lacking to date.

In relation to this review, transparency is a concept related to interpretability and explainability. Specifically, it refers to the explainability of any decision in online systems or technologies that may affect consumers or end users. Different aspects related to transparency will be outlined based on the review of previous research studies in persuasive technology (Section 3), immersive technology (Section 4) and online marketing (Section 5). A summary of recommendations based on the review (Section 6) and discussions about the debates on transparency (Section 7) are also presented, followed by conclusions to inspire future research directions (Section 8). Although the review is non-systematic and not designed to meet the standards of a scientific meta-analysis or quantitative review, it is sufficient to demonstrate the main aspects and characteristics of transparency.

3. Transparency in Persuasive Technology

3.1 Literature Search and Selection

A literature search was conducted in Web of Science. It is a multidisciplinary scholarly database covering mostly peer-reviewed literature in all scientific areas, selected for inclusion based on scholarly criteria by literature review committees (Cornell University Library 2020). Two experienced reviewers independently screened titles and abstracts. For potentially eligible studies, one reviewer read the full texts.

To be included, the article had to be relevant to transparency and within the field of persuasive technology, immersive technology or online marketing. Transparency could appear in various forms, given the lack of definition and discussion of transparency in literature. Relevance to transparency was evaluated based on the elements, mechanism or current practices implemented or discussed in the literature regarding the lack or support of transparency.

“Persuasive technology” was searched jointly with the following terms. In addition to “transparency” which only generated 3 results, the terms “explainab*”, “interpretab*”, “informed decision”, “human factors”, “ethics”, were also searched.

Of a total of 98 records from the literature search, 25 were excluded based on title and abstract screening, and 2 were removed due to repetition. Thus, 71 full-text articles were further assessed for eligibility to be included. Overall, 23 articles were classified as relevant and eligible. They are from different subject areas which mainly include computer science and information technology, psychology, healthcare and human computer interaction.

3.2 Findings

From the review for transparency in persuasive technology, we categorised the findings into 4 groups: transparency of persuasive design and techniques, informed decision making and dark

patterns of design, transparency of potential risks and user autonomy, and potential solutions discussed in the articles reviewed to improving transparency (i.e., personalisation and user-centred design). For an overview of the findings below, see Figure 1.

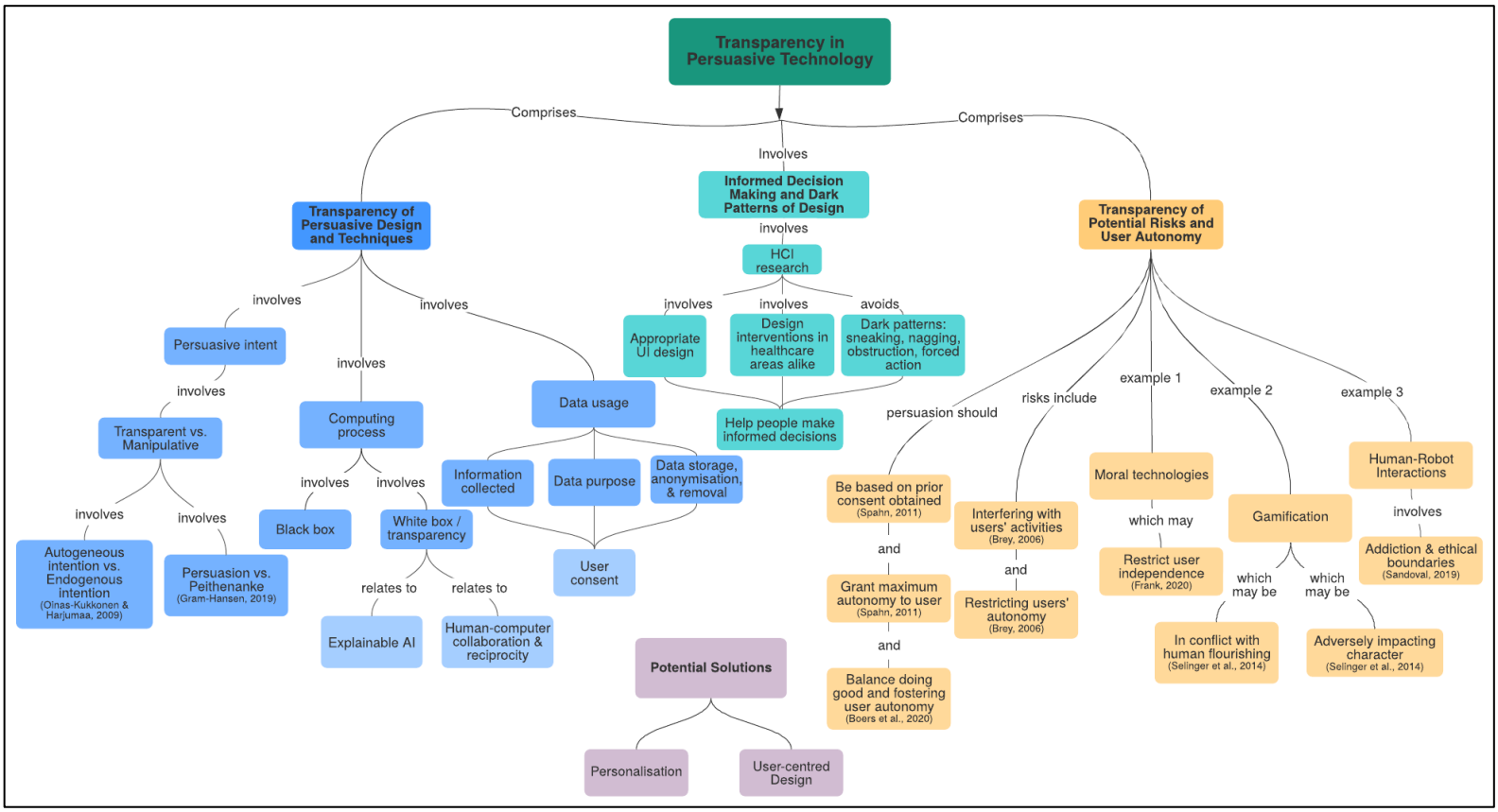

Figure 1. Transparency in Persuasive Technology Mind-Map

a. Transparency of Persuasive Design and Techniques

Transparency in persuasive technology can be understood in the sense that the persuadee is fully aware of the intention and means of the attempt to persuade that is changing his or her attitude or behaviour (Gram-Hansen 2019).

Persuasive technology in this review is viewed more broadly as the technology involving any design approach that may change users' perception, attitude or behaviour. As mentioned in Section 2, our focus is on transparency rather than distinguishing different forms of persuasion. However, different approaches to behaviour changes in persuasive systems may differ in transparency. The concept of "peithenanke" was introduced as an alternative approach of behaviour design to persuasion (Gram-Hansen 2019). It has been argued that transparency and ethics are fundamental qualities of persuasion (Gram-Hansen 2019; Benedikt 2002). Peithenanke, however, implies "the use of less transparent methods and potential manipulation" (Ehninger 1972; Fafner 1997). In contrast to Peithenanke, persuasive design, compared to other approaches, has been argued to adopt a more transparent and ethical approach (Gram-Hansen 2019) and have significant potential towards digital behaviour design in domains such as health and sustainability (Gram-Hansen and Gram-Hansen 2013; Miller 2002; Spahn 2011). Caraban and colleagues (Caraban et al. 2019) identified 23 mechanisms of technology-mediated nudging, clustered in 6 overall categories: facilitate, confront, deceive, social influence, fear, and reinforce. They also provided examples of nudging that work through

manipulating behaviour. Such nudges raise ethical concerns as users may not be able to recognise their intentions and effects. For example, users may be automatically enrolled in a procedure while unaware of the enrolment process and opt-out policies. The invisibility of the automatic enrolment and the difficulty of opt-out used by this nudge is similar to the Peithenanke mentioned above.

Ensuring system transparency and the user's understanding of persuasive principles is fundamental for the user to appropriately use persuasive technologies and maintain control of such technologies rather than the technology controlling the user. At least some transparency is required for persuasive technologies to be ethical (Atkinson 2006). True persuasion does not mislead the user, and ethical evaluations should involve not only the consequences but also the persuasive intent of the technology (Berdichevsky and Neuenschwander 1999). One primary consideration involves analysing the types of intentions. Oinas-Kukkonen and Harjumaa (Oinas-Kukkonen and Harjumaa 2009) discussed the different types of intentions in persuasive environments, i.e., autogenous intentions, exogenous intentions and endogenous intentions. Autogenous intentions are driven by people who adopt and use the technology. Persuasive technology with autogenous intentions comprises a natural transparency towards the system intentions as the technology is used as a tool to facilitate a change of attitudes or behaviour that are already intended by the user, e.g., to reduce the use of alcohol. Exogenous intentions are from people who distribute or grant users access to the system, e.g., personal learning website, where personalisation is important as the effect of persuasion may be influenced by users' individual differences including self-set goals and professional levels. Endogenous intentions are from people who created the system, e.g., promoting purchases of a product. The interpretation of the intent is dependent on the user's experience, and systems with this intent should be designed to fit with the overall goal of respecting that changes of attitudes or behaviour are voluntary for users. It is when considering this nuance of intentions that transparency becomes essential to the discussion of persuasive systems. In addition to the intent of the persuasive technology, questions about how the persuasive consequence is computed or inferred are usually not transparent to users for persuasive systems where the persuasive consequence is generated by Artificial Intelligence (AI). Transparency in explaining the AI decision making process to users to generate "white /transparent box" models for AI to be confidently rolled out by industries and governments can be termed explainable AI. Explainable AI or transparent AI is an AI whose actions can be easily understood and analysed by humans (Hagras 2018). Explanations include transparency in terms, format and language we can understand about the decisions, causality (not only the model inferences but also the underlying phenomena), potential bias based on shortcomings of the training data or objective function, fairness in the AI-based decisions and safety/confidence in the AI reliability (Wierzynski 2020). Naiseh and colleagues (Naiseh et al. 2020) have also reviewed the literature on delivery methods (e.g., autonomous, on-demand) and modalities (e.g. dialogue) of explainable AI recommendations, and also created models to interpret the prediction of any machine learning model (e.g., features, confidence, example-based, counterfactuals). Furthermore, if the users themselves could participate in the process of optimising machine learning algorithms, the accuracy of AI-based decisions in persuasive systems could be improved, and the users' understandings and trust of the systems could also improve. This can be achieved through rich interactions between users and systems involving a system's explanation of the reasoning process, a user's critiques and adjustments and the reasoning correction based on user feedback (Stumpf et al. 2007). However, ensuring full explainability may compromise the complexity of algorithms and decrease the possibility of optimising algorithms for the possibly highest accuracy. Jacucci and colleagues (Jacucci et al. 2014) proposed the concept of "symbiotic interaction" that can be realised by combining computation, sensing technology, and interaction design for deep perception, awareness, and understanding between humans and computers. Important aspects for achieving symbiotic interaction are transparency, reciprocity, and

collaborative use of resources for both computers and humans. Transparency, as a dimension of symbiotic interaction, makes computing accountable and helps answer questions such as: is the system a black box? What is it doing? Is it configurable? Is it reciprocal so that the user can use system resources (computational constructs) and the system can use user resources (physiology, subliminal processes, history, etc.)?

Transparency of data usage within persuasive technology should be considered along with the intent of persuasive technology and usage context. For example, if users' information is used in an attempt to (probabilistically) control the user's mental state, individuals may likely view the lack of consent as problematic due to overlooking or not respecting their autonomy (Burr and Cristianini 2019). Furthermore, it is not always clear how much understanding a user may have about (a) the information being collected about their online activities, (b) what the data collected is used for (i.e., diagnosis, prediction, persuasion, or control), and (c) whether and how the data collected is stored, anonymised and removed.

There are also disputes in relation to transparency for users of persuasive technology. An example of disputable transparency is the Vivofit Jr (Gram-Hansen 2019). This is an activity tracker designed for children with a mobile application controlled by parents to provide the child with virtual rewards and progress in an app-based adventure game if they complete chores including homework, cleaning their room, walking the dog, etc. The system is beneficial to the user in terms of incentives and transparency as it facilitates communication about physical activity within the family. However, the device itself outputs very little feedback to the child. Also, as the mobile application is controlled by parents, meaning the actual persuadee, i.e., the child, is provided with very little system transparency. The majority of persuasive principles do not necessarily reach the actual user. While recognising the safety-concerns leading to this particular element of the design, the limited ability to process the system intentions and the lack of autonomy (which will be discussed more in the next subsection) gives reason to reflect on whether actually children can ever be persuadees, before they are able to recognise the persuasive intent of the system with which they are interacting (Gram-Hansen 2019).

b. Transparency of Potential Risks and User Autonomy

The use of technology to facilitate changes in user attitudes or behaviour can bring potential risks, i.e., the negative effect of persuasive technology on the user, and these risks need to be investigated further and made transparent to the user. Behaviour-steering or persuasive technology may be perceived as threats to individual freedom and rights; as it is designers, rather than democratically elected representatives who influence users' behaviour when they create persuasive technology (Pettersen and Boks 2008; Verbeek 2006). It may negatively affect users' freedom in two ways (Brey 2006): by interfering with users' activities, or by restricting users' autonomy, influencing plans and goals. Examples for the former include speed bumps to slow down drivers, and the latter can be cars restricting swerves and driving speed (Brey 2006). If the aim of persuasive technology is to make individuals behave based on someone else's intentions or to convince users into accepting their goals and values, the information provided can be used to manipulate individuals into action or inaction or changing certain beliefs and attitudes (Pettersen and Boks 2008). This also supports the previously mentioned importance of distinguishing persuasion from Peithenanke or distinguishing autogenous intention from endogenous intentions (Gram-Hansen 2019).

Spahn (Spahn 2011) stated that persuasion should be based on prior consent obtained from the user and grant as much autonomy as possible to the user. Boers and colleagues (Boers et al. 2020) argued that an adequate balance should be struck between using persuasive technology to do good for the user and fostering user autonomy, especially in the healthcare domain. Algorithms used for persuasive

technologies have also raised concerns about uncertainty and subjectivity. Users have the right to access this information about the algorithms and reasoning process as mentioned for explainable AI in the above subsection. For example, in machine learning based clinical decision support systems that provide personalised outcomes, the decision-making process and algorithms can be invalid, biased, or even discriminatory. Though professionals have a duty to do good, paternalistic medicine should be avoided where possible (Boers et al. 2020).

Another interesting area is the application of persuasive technologies to promoting moral progress, which caused much debate regarding its potentially negative effect. Moral technologies refer to those with diverse interventions for the purpose of aiding people to behave more morally with less effort., e.g., sensors with biofeedback as a reminder of an employee's rising stress level, social robots acting as an adviser for moral coaching. Frank (Frank 2020) has argued that a world saturated with moral technologies will have a decrease in moral struggle, as it becomes increasingly easier to do the morally right and good. Although moral struggle may not be necessary for moral progress, the user will lose the independent value of moral struggle, if there is any, in that world. Gamification has much potential to facilitate users' adoption and sustained use of persuasive technologies that promote their positive behaviour change, especially with regards to youth, mental health (D'Alfonso et al. 2019); for example, (Fleming et al. 2016; Brown et al. 2016). However, there are also certain potential risks and ethical concerns to consider, such as the argument that gamification is in conflict with human flourishing and that it could be "morally corrosive by adversely impacting character" (Selinger et al. 2014). Specifically, users' characters can be weakened by technology-mediated assistance when they develop gamified habits and become dependent on digital willpower. For example, replying on Apple's Siri as a reminder of daily activities and weather may negatively impact a user's mental ability and sensibilities. Similarly, if a person relied on a gamified wellness app for healthy eating, what would happen to this person if the app crashed?

Human robot interaction also lacks transparency about the potential impact of interacting with an engaging or persuasive robot on user and working rationales, leading to issues and risks to be addressed. For example, once social robots are widely available, more transparency is required to answer questions such as whether these robots are beneficial for users in the long term, how robot addiction, like other digital addiction, to entertainment and social activities can be prevented, and whether robotics companies will prioritise ethical boundaries over short-term financial benefits, etc. (Sandoval 2019). In addition, robots' realism in physical appearance can have an impact on a person's feelings. For example, the "uncanny valley" hypothesis suggested that robots made imperfectly similar to real humans may provoke feelings of revulsion (Mori et al. 2012); however, it has been criticised by other researchers, e.g., (Hanson et al. 2005). These examples also imply that lack of transparency of the potential risks of some persuasive technologies is due to the lack of knowledge and research rather than the intent of designers and developers.

c. Informed Decision Making and Dark Patterns of Design

Work on persuasive technology (Fogg 2002) has also influenced Human Computer Interaction (HCI) research studying how technology can change behaviour (Gunaratne and Nov 2015). In this regard, persuasive technology can facilitate communicating more effective information to the user to help with informed decision making or behaviour change. Prior HCI research explored how to motivate individuals to change their behaviour through design interventions in areas such as healthcare informatics and environmental sustainability. HCI researchers and designers can provide interventions to help people make informed and effective decisions, such as decision about their retirement savings. Prior research (Froehlich et al. 2012; Lee, Kiesler and Forlizzi 2011) has applied the behavioural economic theories of endowment effect and loss aversion to the design of novel retirement saving

user interfaces. This research found that designs which communicated to savers the long-term implications of their decision about retirement savings, led users to adjust their behaviour more frequently to achieve their retirement saving goals more effectively.

It is evident that appropriate User Interface (UI) design in HCI application areas with more effective information and forms of communicating this information is good practice to help users make informed decisions, though questions remain open about what information is included and how the information is delivered to users, as this may have an effect on users' information processing and decision making. In this way, transparency of the information used by users to make informed and effective decisions is facilitated by appropriate HCI design.

On the other hand, in HCI research, Gray and colleagues (Gray et al. 2018) looked at the "dark patterns" of User Experience (UX) design, where user value is supplanted in favour of shareholder value. UX designers could easily be involved in facilitating manipulation or unethical persuasion. 5 dark pattern strategies used in UX design have been summarised, including Nagging, Obstruction, Sneaking, Interface interference, and Forced action. Likewise, using subliminal techniques to influence consumer behaviour is highly controversial (Dijksterhuis et al. 2005), and subliminal priming can be used as a "dark design pattern" to attempt to manipulate users (Caraban et al. 2018; Brignull 2011; Greenberg et al. 2014). For example, designers might use subliminal priming to make it easier for users to prefer a particular product over others without their consent (Pinder 2017). Caraban and colleagues (Caraban et al. 2018) suggested that any application using dark patterns should ensure they address user fears and misunderstandings in the first place, and it is the responsibility of researchers and designers to ensure that interventions in persuasive systems are delivered in an ethical, transparent fashion. The relevant issues are not only lack of transparency to users, but also designers that may not be aware of the potential dark side and negative social impact of these design strategies due to lack of formal ethics education in UX and HCI education.

d. Potential Solutions: Personalisation and User-Centred Design

The transparency of persuasive systems remains in the hands of designers; therefore, to address lack of transparency, questions that need to be answered relate to design consideration. For example, who bear the ethical responsibility when an inappropriate default is presented and unwanted consequences arise, for instance, in the case of algorithmic decisions? Should the default be tailored to individual users' needs and preferences (Caraban et al. 2019)?

The need for personalisation of system transparency has also been raised and can potentially become the solution to the lack of system transparency. Shahri and colleagues (Shahri et al. 2016) conceptualised software-based motivation within enterprises and argued that a personalised and human-centred engineering method is required to give users' profiles and preferences equal importance to their business roles. Transparency in relation to data usage also means the data collection process in systems should be made intelligible to the users and modifiable or interruptible at their will (Jacucci et al. 2014), as for the data processing and storage following data collection.

To ensure the transparency and user awareness of ongoing data collection processes, the potential solutions also involve ensuring transparency in the criteria used by persuasive systems to create profiles, which again remains in the hands of designers (Jacucci et al. 2014). User-centred and participatory tools and processes of design disciplines such as interaction design and participatory design can be beneficial to ensure transparency and optimal user experience and facilitate deeper mutual understanding, cooperation, and independent agency in human computer relationship (Pettersen and Boks 2008). There are still challenges remaining unanswered. On one hand, prior research indicates that participatory design results in better accommodation of social needs and

requirements through debates, expectation management and acceptance (Pettersen and Boks 2008; Sanoff 1985). On the other hand, research also suggests that high degrees of user involvement can cause a decrease in the flexibility, effectiveness and chance of success and innovations of a project (Preece et al. 2002). Additionally, Pettersen and Boks (Pettersen and Boks 2008) argued that when designers translate abstract concepts and complex information into visualised representations and physical shape, simplify jargon, technical schemes or political structures to fit the knowledge and experience of lay co-designers like most users, there is a chance that the lay co-designers' understanding of the concepts is biased by the intention of designers and facilitators.

4. Transparency in Immersive Technology

4.1 Literature Search and Selection

A literature search was conducted in Web of Science and articles were screened by two experienced reviewers independently based on titles and abstracts. The selection process and inclusion criteria are the same as described in Section 3.1.

"Immersive technology" was searched jointly with the following terms. In addition to "transparency" which generated only 7 results, the terms "explainab*", "interpretab*", "informed decision", "human factors", and "ethics", were also searched.

For a total of 157 records from the literature search, 95 were excluded based on title and abstract screening, and 2 were removed due to repetition. Thus, 60 full-text articles were further assessed for eligibility to be included. A total of 13 articles were classified as relevant and eligible. Same as the results described above for transparency in persuasive technology, the articles are from multiple subject areas, i.e., mostly computer science and information technology, psychology, healthcare and human computer interaction.

4.2 Findings

From the review for transparency in immersive technology, we categorised the findings into the following groups: transparency of potential risks, transparency of system and user autonomy and immersive technology as a tool for enhancing information transparency and informed decision making. For an overview of the findings below, see Figure 2. Transparency in immersive technology comprises similar aspects to those in persuasive technology, however, with different emphases and implications in terms of each aspect.

a. Transparency of Potential Risks

Immersive technology provides unprecedented immersive experiences for users that they can rarely experience in the real world. On the other hand, as the world of immersive technology becomes deeper and more intense, the applications and problems that come with the developing industry will bring about increasing concerns. For example, legal systems have arguments about virtual crime, i.e., whether it is ethical to permit illegal behaviour in a simulated environment, which relates to the adult industry, art, entertainment and video games industries.

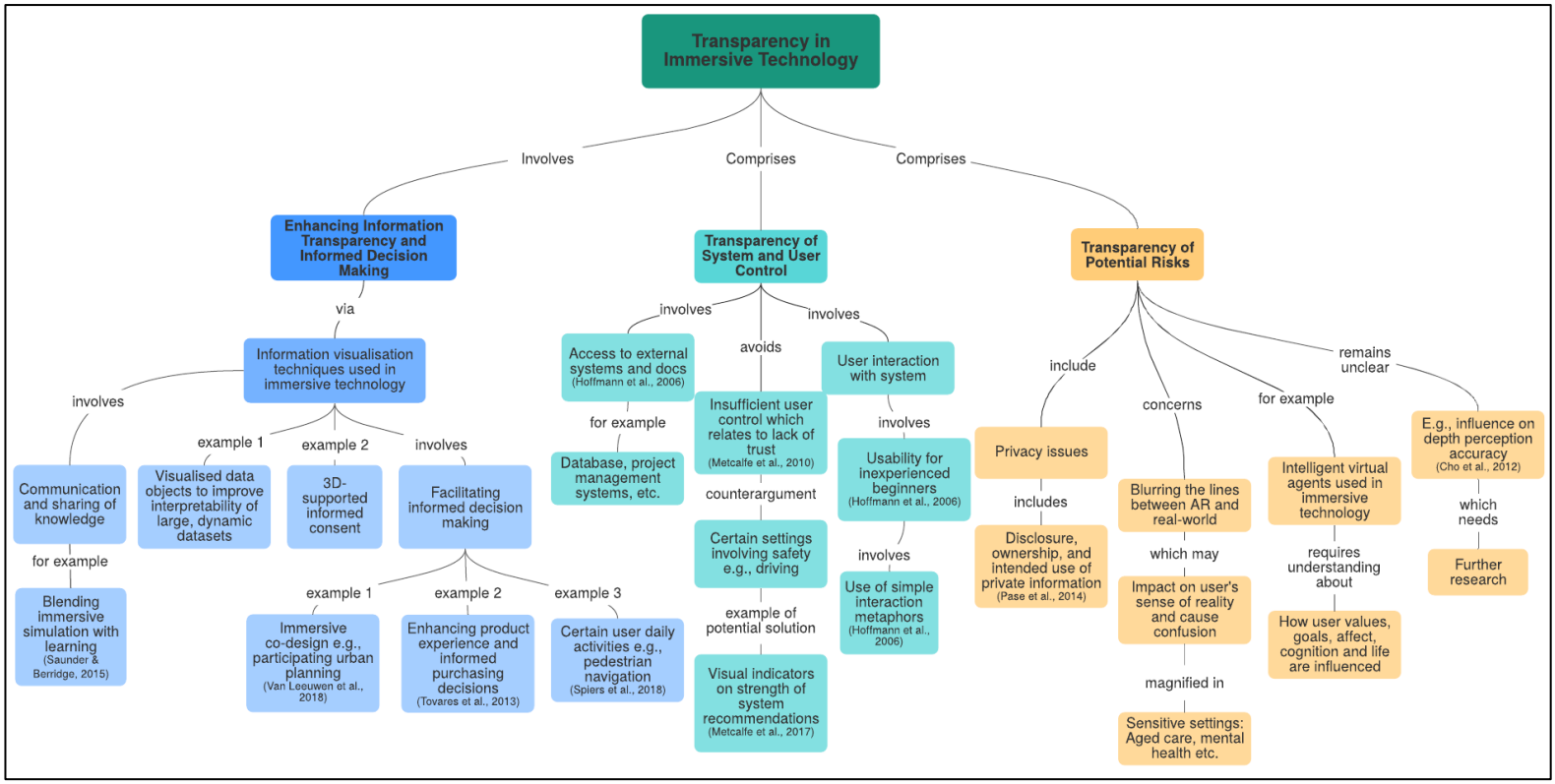

Figure 2. Transparency in Immersive Technology Mind-Map

One of the leading ethical concerns regarding immersive technology is the issue of privacy. Previously there were no clear laws on privacy, and research has suggested that users of AR technology should be concerned about their privacy and security in terms of issues such as disclosure, ownership, and intended use of private information (Pase et al. 2014). The European Union's new data privacy law, the General Data Protection Regulation (GDPR) has established compliance guidelines for companies to provide strong protection for individual rights on data privacy (GDPR.EU 2018). However, there remains a long way to go to make immersive technologies coordinate with the regulations. For example, privacy needs to be incorporated into design, and users should be given the opportunity to fully understand the data protection issues and relevant privacy risks.

Resulting from its immersive and potentially persuasive nature, AR creates many ethical issues in terms of impact on society and users' perceptions and behaviour, including how they will be affected, informed, manipulated, or persuaded by the technology. This relates to both the physical and psychological safety and wellbeing of end users and those surrounding them (Pase et al. 2014).

Blurring the lines between the real world and the artificial one is necessary for AR to immerse users within a 3D environment and create the immersive experience, but this is another significant concern in the future development of immersive technology. Interaction between human and technology should be considered for individual users in relation to the social and cultural context, and the impact of AR should be considered as both a personal decision of the user and a social responsibility (Pase et al. 2014). Moving forward, significant potential risks and benefits relating to emerging technology should be given equal value and importance for ethical considerations. Given the immersion created from the nature of the VR device covering the visual field and its impact on the user's sense of reality, it can be particularly challenging to ask co-designers of VR to imagine and predict what might go wrong, and this risk is magnified when these technologies are designed for sensitive settings, such as aged

care, mental health, and clinical rehabilitation (Waycott et al. 2018). Ethical challenges in VR listed include the following situations: experiences in virtual realities can potentially cause confusion, which may be especially problematic for users with dementia (Waycott et al. 2018). VR could also worsen users' experience of age-related cognitive decline or impairment and evoke a sense of failure along with the confusion potentially caused by VR. There is also a risk of provoking trauma for people with posttraumatic stress disorder, particularly in immersive VR environments where it is hard for them to "escape". For example, an under-water virtual environment which tries to provide a soothing meditative experience can be dangerous for a person who has had a near-drowning experience in the past. In context of gambling, slot machines are one of the most common type of games played by people with gambling problems (Heidrich et al. 2019). Slot machines powered by VR technology allow players to immerse themselves in the 3D gaming environment and interact with the game features in the environment. Emerging technologies, e.g., immersive VR, increase the possibilities to exploit players' erroneous beliefs. Nonetheless, the risk potential of VR-based gambling has rarely been explored. Heidrich and colleagues (Heidrich et al. 2019), in a study of a slot machine realised as a desktop 3D and as an immersive VR version, revealed significantly greater effects on dissociation, dark flow, and urge to gamble in the VR version compared to the desktop 3D version. These harm-inducing factors worsened by VR should be made more transparent and incorporated into educational materials to people who gamble.

Another example of potential risks involves the debate on intelligent virtual agents that may be used in immersive technologies, e.g., intelligent pedagogic agents in immersive virtual learning environments. An intelligent virtual agent is an AI that can make decisions or perform a service without human guidance to aid ubiquitous communication. However, there are potential issues such as privacy and relinquished authority, and Bostrom (Bostrom 2003) argued that to create moral agents in immersive technology, a deep understanding is required about how our own and others' values and goals are shaped and influenced by the increasingly information-intense world, and how virtual realities can change affect, cognition, and life as people usually know it. Otherwise, informed decision making may be replaced by persuasion without reason. This needs further research to enhance understanding and transparency of the risks and remedies.

Some potentially negative effects of VR display on users are still unknown and further research is needed. For example, Cho and colleagues (Cho et al. 2012) conducted two experiments on how various display conditions influence a participant's depth perception accuracy of a volumetric dataset. It showed familiarity with 3D games and VR type technology affected the users' ability to perceive such data and the accuracy boost, and such effect on volume data has not been explored much by researchers.

b. Transparency of System and User Control

Hoffmann and colleagues (Hoffmann et al. 2006) listed the requirements that users expect more from a VR system than just stereoscopic visualisation of virtual worlds. Transparency has been implied several times, for example, "VR applications must be usable by inexperienced beginners in a few hours" "Use of simple interaction metaphors the users are familiar with" "Access to external systems and documents (Database, project management systems, etc.)", which indicates transparency of the system including user interaction with the system is a requisite of a VR system.

Metcalfe and colleagues (Metcalfe et al. 2017) conducted studies of human interactions with driving automation executed in an immersive, full-motion simulated environment and observed lack of trust in participants when they perceived they had insufficient control (Metcalfe et al. 2010). Encouraging participants to make changes at any time at their will is important to ensure transparency, on one

hand. This raises issues of transparency, however, in terms of safety in certain settings such as driving on the other hand. Even with accurate prediction of the preferred control modes that are most likely to lead to better performance, there is currently no solution to the problem about how to reliably elicit users' selection of that mode, if full transparency and user control is required. This is especially challenging due to individual biases. Though it was suspected to be a weak influence, a visual indicator might be useful to provide transparency to users such that they would be able to understand when system recommendations were particularly strong and when user preferences represented only a weak advantage for one mode over the other (Metcalfe et al. 2017).

c. Immersive Technology as a Tool for Enhancing Information Transparency and Informed Decision Making

Immersive technology itself can be used as a tool to enhance informed consent and trust. For example, immersive 3D-supported informed consent can help patients understand their condition and minimise the risk of increasing their anxiety. In a randomised trial, 3D VR helped surgeons and patients establish a better relationship before surgery and led to improved trust between them to possibly mitigate medical-legal issues (Perin et al. 2020).

Information visualisation techniques used in immersive technology can help convey information to users and enhance transparency. Moere and colleagues (Moere et al. 2004) used a novel exploratory information visualisation technique that allows users to analyse time-varying characteristics of large, dynamic datasets within immersive VR environments, where infoticles standing for information particles, represent data objects, placed inside a 3D context. Infoticles helped visualise time-varying characteristics of the datasets in a cognitively distinguishable and interpretable manner.

Immersive technology can also be used to facilitate informed decision making. For example, the incorporation of immersive environments in landscape architecture lacks research on human-centred data interaction and perception of space (Fricker 2019). MR applications have been used to explore new immersive co-design methodologies and meaningful trajectories for participatory processes. Melenbrink and King (Melenbrink and King 2015) developed an integrated real-time computational workflow for architectural design and used a simulated spatial environment to give designers the illusion of being in a space that was being designed. This allows for iterative design based on experientially informed decision making. The Fulldome Interface provided a collaborative immersive environment which was responsive in real-time through dome-based stereoscopic projection. Using 3D modelling and immersive VR technologies could help engage citizens in participatory urban planning (Van Leeuwen et al. 2018). These developments imply that immersive technologies can be used for informed design decision in participatory design; from the end users' point of view, these design decision processes can also be made available and explainable to user at their choices. As involving a sample of users in the design process can also help the design address users' needs and preferences, this technology can help convey information to lay users in the user-centred or participatory design process.

Immersive technology can also be used to improve the transparency of product experience to facilitate potential consumers' informed purchasing decisions. For example, VR technologies have been used to provide users with an interactive, immersive, and realistic product experience at low cost. The VR experience also leads to greater confidence, information, and realism in consumers' preference judgements compared to traditional 2D forms of product representation or a feature list (Tovares et al. 2013).

Enhancing transparency and users' understanding of an immersive technology product not only helps with informed purchasing decisions, but also has the potential to help with users' daily activities in

certain circumstances. For example, a novel shape-changing handheld haptic navigation device, the "Animotus," was developed within an immersive environment to help with "real-world" pedestrian navigation for both vision-impaired and sighted users (Spiers et al. 2018). The form of the device was modifiable in the user's grasp to convey information about heading and proximity to navigational targets. The study suggested that more structured device familiarisation, especially for users with visual impairment, could help enhance performance and avoid incorrect expectations of technology.

If users of immersive technology are students, such technology can serve or facilitate the purpose of communicating and sharing knowledge. Experiential methods based on ICT such as virtual strategic games are good for enhancing knowledge and filling the gap between theory and practice. For example, immersive simulated reality scenarios for enhancing student nurses' experience of people with learning disabilities have an advantage in blended learning and collaborative teaching (Saunder and Berridge 2015). Holdsworth and Apeh (Holdsworth and Apeh 2017) developed an immersive Cyber Security Awareness learning platform with gamification elements to reduce security breaches that were due to human error by improving employee learners' awareness of threats and potential implications. Gupta and colleagues (Gupta et al. 2019) discussed the adoption of information-centric systems engineering principles to design a cyber-human systems-based simulator framework and demonstrated the effectiveness of using such frameworks to train orthopaedic surgery medical staff in haptic and immersive VR learning platforms.

5. Transparency in Online Marketing

5.1 Literature Search and Selection

Likewise, a literature search was conducted in Web of Science and articles were screened by two experienced reviewers independently based on titles and abstracts. The selection process and inclusion criteria are the same as described in Section 3.1.

"Online marketing" and "transparency" were searched together. For a total of 202 records from the literature search, 124 were excluded based on title and abstract screening. Thus, 78 full-text articles were further assessed for eligibility to be included. Finally, a total of 35 articles were classified as relevant and eligible. The articles included are mainly in the area of marketing, communication, business and management, but they also cover other subjects such as information technology, law and public health.

5.2 Findings

From the review for transparency in online marketing, we categorised the findings into the following groups: organisational transparency, information transparency, transparency of data privacy and informed consent, and transparency in online advertising and social media. For an overview of the findings below, see Figure 3.

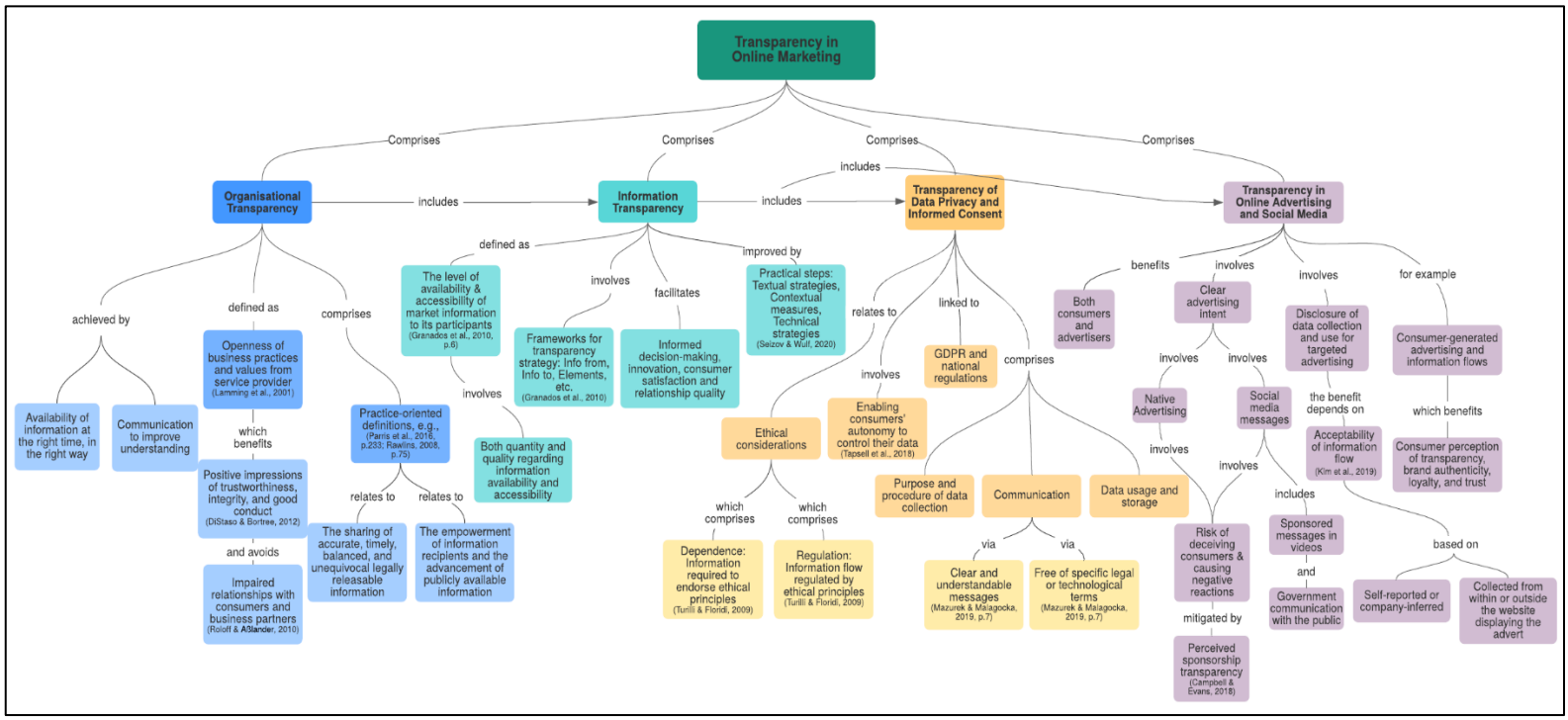

Figure 3. Transparency in Online Marketing Mind-Map

a. Organisational Transparency

Transparency is beneficial to people's positive impressions of trustworthiness, integrity, and good conduct (DiStaso and Bortree 2012). There is an increasing trend of transparency-oriented research in marketing considering consumer trust. However, what is involved in transparency in marketing research has been vaguely defined and the specifics remain elusive. Marketing transparency is part of organisational transparency that concerns communication, interactions, and engagement with external and internal stakeholders. Transparency in communication is an ideal and essential to good relationships with consumers (Seizov and Wulf 2020; Harris and Rae 2009). In contrast, non-transparent communication can sour relationships with consumers and business partners (Roloff and Aßlander 2010). For example, there has been a decrease in public confidence and trust in non-profit sectors, indicating the need for greater transparency for improving donor decision making (Blouin et al. 2018). Organisers of crowdfunding campaigns can use two transparency tools, i.e., updates and certification to attract donors (Mejia et al. 2019). Updates are a form of operational transparency communicating the campaign's work to donors, while certification is a form of conventional transparency to make sure the campaign truly benefits a charitable purpose (Mejia et al. 2019).

Organisational transparency has been defined as the service provider's openness of business practices and values, organisational efforts and relationships (Lamming et al. 2001). Holland and colleagues (Holland et al. 2018) argued that an organisation's strategic decision to be transparent can be passed on to the public at tactical level via decisions about message design. Esterhuyse (Esterhuyse 2019) assessed corporates' transparency intention based on whether there is a link between two types of "messages": communications targeted at investors (financial stakeholders) and those targeted at non-financial stakeholders. Their study revealed that companies satisfying the Socially Responsible Investment (SRI) Index' requirements in the sustainability reporting to the public were more likely to

have better overall transparency in communicating, not only with non-financial stakeholders, but also with investors.

Previously, transparency in marketing has been simply defined as "the availability of information necessary […] at the right time and in the right way" (Beulens et al. 2005, p. 484). This general definition lacks practicalities for achieving actual transparency. "Simply providing information does not guarantee transparency. Rather, an organisation achieves transparency by communicating to improve understanding" (DiStaso and Bortree 2012, p. 513). The advancement of Information and Communication Technology (ICT) has allowed for the two-way exchange of information between corporations and their stakeholders and increasingly empowered both external and internal stakeholders who expect higher levels of transparency and openness. There is a transformation of consumers' roles from passive recipients of information to equal parties with active understanding of information, suggesting a redefinition of the concept of corporate transparency (Seizov and Wulf 2020). It has been proposed that such dynamic information sharing via ICT drives greater openness and accountability, and more transparent operations of organisations, which benefit both the corporations and their constituents; consumers have the right to know especially with regard to corporate strategies and activities that might directly impact their quality of life (Vaccaro and Madsen 2009).

There has been a more practice-oriented definition of transparency in corporate marketing "Transparency is the deliberate attempt to make available all legally releasable information – whether positive or negative in nature – in a manner that is accurate, timely, balanced and unequivocal, for the purpose of enhancing the reasoning ability of publics and holding organisations accountable for their actions, policies, and practices" (Rawlins 2008, p. 75). This rationale empowers consumers with information and contributes to the progress of informed decisions. An alternative and succinct definition of corporate transparency has since been proposed as "the extent to which a stakeholder perceives an organisation provides learning opportunities about itself" (Parris et al. 2016, p.233). This emphasises the empowerment of the recipients of the information and the individual subjectivity of the perception process. Cohen and Hiller (Cohen and Hiller 2009) proposed a two-way collaborative model of corporate transparency and stated that corporate transparency policies should advance the possibility of stakeholders responding to and interacting with companies in order to correct and enrich publicly available information. Another example is the 3T framework of managing online customer complaints (Stevens et al. 2018), where 3Ts are timeliness, transparency, and trust, and transparency involves actions to maintain the public record, promote customer-to-customer interaction, and empower brand advocates to defend the brand reputation.

b. Information Transparency

In short, information transparency has been defined as "the level of availability and accessibility of market information to its participants" (Granados et al. 2010, p. 6). Both the quantity of the information available and the quality of interface in terms of the information accessibility matter to ensure its transparency.

Information transparency is of great importance to facilitate informed decision making and consumer satisfaction. For example, Tsao (Tsao 2019) stated that the information revealed from online reviews for visitors to make purchasing decisions should be accurate, targeting visitors motivated by suggestions in reviews. Transparency of reviews might be improved by more explicit information of reviews (e.g., via like or dislike statements). Malik and Ahsan (Malik and Ahsan 2019) reviewing the banking sector, found that risk assessment, accessibility and transparency of information are

necessary for a co-creation approach that invites customers' opinions to promote innovation in products or services and improve customers' satisfaction. Alnsour (Alnsour 2018) in an investigation of the relationships of Jordanian banks with their Small and Medium-sized Enterprises (SMEs) customers, identified 6 critical constructs of Relationship Quality: trust, commitment, satisfaction, transparency, communication, understanding and cooperation. Transparency regarding information shared with customers was one of the most significant determinants of relationship quality, and communication was identified as the biggest contributor overall.

Granados and colleagues (Granados et al. 2010) proposed a framework based on existing knowledge across multiple disciplines for B2C Transparency Strategy, consisting of Information From (Supplier/Intermediary), Information To (Customers/Competitors), Elements (Product/Price/Inventory/Cost/Process), Actions (Disclose/Distort/Bias/Conceal), Systems & Mechanism Design, Transparency Regime of a market or industry, and Complementary Strategies about other managerial decisions (e.g., product design or pricing strategy).

Seizov and Wulf (Seizov and Wulf 2020) specified the practical steps for online marketers to improve the transparency of legal information posted online, including textual strategies, contextual measures and technical strategies for improving transparency, which synthesised evidence from the disciplines of corporate marketing, communication science, and empirical legal studies. Features that were found to directly impact information transparency in their empirical study include language, text length, information presentation, grammar and syntax, etc. In short, keeping it short, simple, and easy on the eyes is important to transparent information disclosure. Business sectors, consumers' individual traits and medium of information delivery are also associated with the evaluation of transparency of an information notice (Seizov and Wulf 2020).

c. Transparency of Data Privacy and Informed Consent

Information transparency can also be related to ethical considerations. When the disclosed information has an influence on ethical principles, there are two types of relationship between them: dependence and regulation (Turilli and Floridi 2009). The former refers to the fact that certain information is required in order to endorse ethical principles, which overlaps with the transparency in legal information disclosure discussed above. The latter means that ethical principles govern information flow by restricting the access, usage, dissemination and storage of information (Turilli and Floridi 2009).

Personal data about individuals' activities and preferences have been used by companies for providing more targeted and personalised online services. In this context, a consumer authorises companies to collect his or her personal data to receive, in return, more targeted/personalised/context-aware services. However, the security, integrity and accessibility of the personal data to be collected are of fundamental importance (Tapsell et al. 2018). For example, Tutty and colleagues (Tutty et al. 2019) analysed websites offering personal genomic testing for nutrition and wellness to Australians. The content was found to be emotive and lacking transparency for informed consent with regard to the scientific and ethical aspects of information shared with healthcare providers for personal genomic testing. They argued that ethical information along with service information and technical information should be made available to potential clients (Tutty et al. 2019).

Companies' success in acquiring client data relies on 3 Ts: transparency, type of data, and trust (Mazurek and Małagocka 2019). Transparency involves the purpose of collecting client data, procedures of data collection and communication. It is both best practice and the law according to

GDPR and similar national regulations. Companies have the responsibility to share with consumers precisely how their data will be used and clarify how data will be processed and/or transferred to third parties. Transparency in communication can be promoted by "clear and understandable messages, free of specific legal or technological terms" (Mazurek and Małagocka 2019, p. 7). Communication with consumers should be friendly and straightforward with all pertinent information accessible on the platform where consent is seeking from the consumers and avoid references to legal acts and hyperlinks leading to another website (Mazurek and Małagocka 2019).

Although numerous strategies for protecting personal privacy rely on regulatory frameworks, consent, and anonymising data, they are not always effective. For example, Terms and Conditions often fall behind evolution of technology, software, and user behaviours; also, consent to collect and use personal data for various vague purposes may be provided inadvertently (Khalil et al. 2018). Khalil and colleagues (Khalil et al. 2018) reviewed 4 Massive Open Online Course (MOOC) providers from different contexts and investigated how consent was stated to potential users. The study revealed the need for a higher level of transparency for users around the implications of granting consent at the point of registration and emphasised the responsibility of MOOC providers to clarify the potential uses and sharing of users' personal data. The linguistic patterns identified in privacy policies suggested they could not support readers effectively to make an informed decision on their personal data (Pollach 2005). Pollach (Pollach 2005) summarised 4 different strategies in privacy policies, i.e., mitigation & enhancement (e.g., companies' emphasis of qualities when speaking of "carefully selected" third parties), obfuscation of reality (e.g., companies' attempt to avoid responsibility in terms of data misuse via passive voice), relationship building (e.g., companies' attempt to involve consumers emotionally by using first-person pronouns) and persuasive appeals (e.g., companies' attempt to convince consumers of their trustworthiness by stating that certain data usage is standard practice), and suggested that companies redesign their privacy statements in order to improve the transparency of communication of data handling practices, laying the foundation for informed consent.

In addition to concerns about the growing collection, storage, and use of personal data, consumers are worried about the lack of transparency or control over their personal data (Beke et al. 2018). Tapsell and colleagues (Tapsell et al. 2018) proposed a framework aiming to establish a transparent and robust relationship between a consumer and organisation, and to achieve the balance between consumers' privacy and autonomy to control their data and organisations' purpose of delivering targeted services to their customers based on their personal data with high quality and efficiency. The paper advocates that empowering consumers with control over their personal data can not only benefit organisations in ensuring that they conform to GDPR but also in contributing to a positive brand image of transparency and openness.

d. Transparency in Online Advertising and Social Media

Transparency of advertisement is one branch of information transparency. Online platforms and AI techniques have enabled marketers to provide more personalised, targeted advertising. For example, consumers' online behaviour data can be collected and used to generate ads for similar products they have viewed recently or based on their personal profile. In this context, ad transparency involves disclosure of how consumers' personal data is collected and used to generate ads. This is part of transparency in data privacy which is discussed in detail in the above subsection. Kim and colleagues (Kim et al. 2019) demonstrated the benefit of ad transparency depends on whether the marketing practices made transparent violate norms about information flows, i.e., consumers' beliefs on how their information moves between parties. Moreover, the acceptability of information flows is evaluated by consumers based on: 1) where the information

is collected, i.e., within or outside of the website displaying the ad, and 2) whether the information is reported by the consumer versus inferred by the company. Busser and Shulga (Busser and Shulga 2019) found that participating in Consumer-Generated Advertising (CGA) could improve loyalty and trust of both brand customers and noncustomers. The results also identified established CGA contests as a relational marketing tool for hospitality brands.

Information transparency in online advertising is also related to advertisers. As the proxy between advertisers and customers, a mercenary ad broker could arbitrarily make up advertising rates to overcharge advertisers. Huang and colleagues (Huang et al. 2019) proposed a fair online advertising scheme to avoid the collusion attack by generating a unique acknowledgment for downloading the ad, which would then be made publicly available and verifiable to both the advertiser and the ad broker for the fairness and transparency of online advertising.

Native advertising is a relatively new form of online advertising that is displayed surrounding non-advertising content (Campbell and Evans 2018). It has the risk of deceiving consumers because it is mixed with context and the consumers viewing it may not be aware of its advertising nature. For example, consumers may not expect an ad to appear when reading news online, but article-style native advertising imitates the style of online news articles. Campbell and Evans (Campbell and Evans 2018) found that the inclusion of a companion banner in native advertising boosted consumers' ad recognition to the same degree as a traditional disclosure, and the consumers' negative reactions due to ad recognition were mitigated by consumers' perception of sponsorship transparency of a native ad, which made it easy for a consumer to recognise the paid nature of the ad.

Social media influencers often include persuasive sponsored messages in their videos, but potential consumers may not be aware when a video includes advertising (Boerman and van Reijmersdal 2020). An experiment amongst children between 8 and 12 years old showed that advertising disclosure in a YouTuber's videos increased children's brand memory through ad recognition, but there was a decrease in their desire for the advertised product caused by understanding the selling and persuasive intent of the video. They also found a significant interaction between the para-social relationship of children with the influencer and disclosure effects on their brand attitudes. Likewise, an experiment with adults (Boerman 2020) showed that a standardised Instagram disclosure for commercial relationship could enhance ad recognition and have a positive impact on consumers' brand memory and intentions to engage with the post.

Local governments have also been utilising social media to communicate and interact with the public. Lappas and colleagues (Lappas et al. 2018) analysed Facebook communication strategies used by Greek local governments and levels of citizens' engagement. They found that Greek municipalities were taking actions to improve transparency and accountability by sharing critical information, including decisions, operations, objectives, and projects related to local government, information on Facebook was mainly pushed one-way to citizens, and events were promoted in a predominantly top-down way. Evidence based on popularity (likes), commitment (comments), and virality (shares), suggests that effective Facebook communication should increase transparency, provide general information, and include multimedia (Ellison and Hardey 2014). In this regard, transparency as a communication strategy means that governments inform their citizens about the progress of projects and financial information on the projects. Transparency along with other Facebook communication strategies used by the government including marketing the municipality to external public and providing information about services has been found to be effective to improve citizens' online attitude expression (liking) and engagement (commenting) (Lappas et al. 2018).

6. Recommendations from the literature

This section provides recommendations deduced from this review to guide the design and practice of transparency.

From the transparency issues identified from the literature, more efforts should be focused on ensuring users' awareness and understanding regarding the persuasive nature and intention in persuasive technology, and the computing process in AI-based persuasive systems. Barriers to making this information transparent vary from intentional concealment to the challenge of interpreting complex techniques for lay users. Correspondingly, efforts involve improving related regulation and policy, raising awareness of the relationship between transparency and trustworthiness, and improving the design of information disclosure, which is discussed in detail at the end of this section. Moreover, users themselves could be invited to participate in the process of optimising machine learning algorithms for AI-based persuasive systems to improve the accuracy and explainability of the algorithms as well as users' trust. If algorithms are complex and full explainability is not feasible, users can act as a sanity check for the purpose of evaluating algorithms especially ruling out false results instead of achieving full explainability and catching all possible errors. In such cases, user plus system is better than either on their own, as it facilitates users' understanding and trust in the algorithms while it does not compromise the necessary complexity of the algorithms. Furthermore, the accuracy of an algorithm is usually directly linked to the reliability of the decision or recommendation received by a user, and this information can be communicated to users simultaneously with the decision or recommendation per se.

For both persuasive technology and immersive technology, transparency also involves the notion that new technologies should be designed and developed to support human-computer collaboration and reciprocity. For example, users provide computational resources to optimise algorithms and systems provide users with personalised instructions that simplify their interaction process. Also, visualisation could support transparency of recommendations by providing users with the rationale behind suggested items.

As for the usage of users' personal data, user consent should be achieved prior to a data collection process, including the purpose of data collection, what data is collected, and how the data is stored, anonymised and removed. Information should also be made transparent regarding the potential impact or risks of the technology, including how it may interfere with users' activities and restrict their autonomy. This is particularly important to immersive technology as it can impact on users' sense of reality and thus potentially cause physical or psychological harm to the users. Therefore, benefits and risks of the technology, should be given equal value in consent forms to be presented to users. This is closely associated with user autonomy: in addition to granting users autonomy by providing information on the data usage and potential risks, the user should be granted autonomy on the persuasion process they may be involved in. In other words, a persuasive system designed for full transparency provides users with the control and freedom to authorise and opt out of any enrolment of a persuasive process and intervention. This is consistent with Nielsen's heuristic called user control and freedom in UI design (Nielsen 1994). In fact, all heuristics proposed by Nielsen can contribute to transparency regarding the information displayed and the interaction process for users. For example, users should have access to help and documentation when interacting with a system, and designers should make it easy for users to understand with concrete steps to help users perform tasks and without unnecessary information.

Appropriate UI design can improve transparency of information in persuasive or immersive technologies and thus facilitate informed decision making. In addition to the design principles

described above, this can also be achieved via adopting a human-centred engineering method and providing personalised solutions for different individuals instead of a one-size-fits-all solution for all users or asking designers to imagine and predict potential harm.

The good practices for transparency of persuasive and immersive technologies also apply to contexts where they are employed for marketing purpose, as these technologies have been extensively applied to online marketing. For example, HCI research in this context focuses on the UI design for the purpose of persuading a user to make purchases from the Internet. Persuasion is implemented via applying persuasive techniques such as social proof (e.g., linking a product to other consumers' reviews) and authority (e.g., offering expert advice) or utilising a recommendation system through machine learning techniques to provide a user with personalised recommendations of products based on the user' online behaviour and profile in the past or similar users' behaviour and preferences. Likewise, immersive technology has been employed by companies for their brand marketing efforts. For example, Snapchat has launched AR shopping lenses that allow users to interact with the products and brands. YouTube has also created the "AR Beauty Try On" feature with affiliated companies that allows users to virtually try on the makeup while watching makeup tutorials. These ads with AR filter can then be posted in social media platforms to elevate the brand marketing and maximise the exposure by follow-up targeted marketing messaging.

As mentioned before for persuasive and immersive technologies, users should be given access to information and communication should help users understand the information necessary to achieve user autonomy and freedom. However, due to the gaps in technical literacy and the lack of specific guidance on how information disclosures should be designed or formulated, traders are left open to accidental or purposeful obfuscation in communication with consumers, which allows for various amounts and forms of information to be read by consumers.

We have summarised the transparency features in the design of online information in Figure 4.

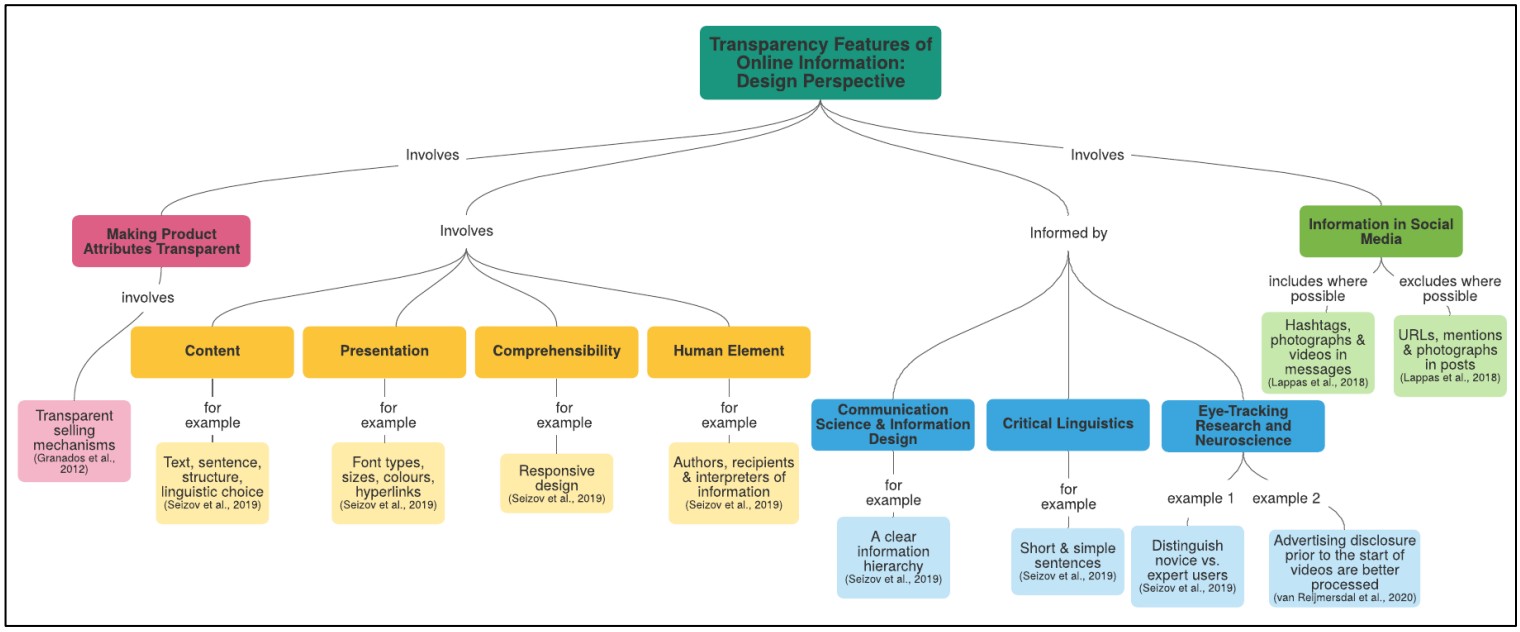

Figure 4. Transparency Features of Online Information: Design Perspective Mind-Map

Regarding technical aspects, the device where information is displayed, and the design of the online information strongly affect its transparency. Seizov and Wulf (Seizov and Wulf 2020)

provided recommendations on the design of text, presentation and webpage. These include responsive web design in terms of clear text structures on mobile screens, setting hard limits to legible font sizes for various screen sizes, avoiding unusual font types, making all vital contractual information no more than “one click away”, general information including privacy policy being accessible from any webpage of the trader, and using hyperlinks for additional content to consumers’ advantage.

The implementation of information obligations involves 4 broad aspects: content (e.g., texts, sentence structures and linguistic choices), presentation (e.g., font types, sizes, colours and hyperlinks), comprehensibility (e.g., adjustment to devices and responsive design), and the human element in these areas (i.e., authors, recipients and interpreters of information) (Seizov et al. 2019). These aspects are essential to consumer protection in terms of lowering consumer burden and improving information transparency. Seizov and colleagues (Seizov et al. 2019) provided recommendations of requirements tested empirically for the design of effective disclosures online including transparency, with a focus on their application in the EU. The paper argued that disciplines such as communication science and information design, critical linguistics, eye-tracking research and neuroscience should be employed to improve online information design. Specifically, eye-tracking and neuroscience research finds that novice users need learning opportunities and should be provided with more detailed guidance and information, while experts should be granted freedom to select their own learning style and pace. Regarding the information layout, communication science and information design implies that complex information should be presented with a clear hierarchy of headings and subheadings, along with varied fonts to highlight important information. The number of highlights should be restricted in a single document or webpage to avoid overwhelming consumers. In terms of the language used, critical linguistics suggests short and simple sentences in information disclosures wherever possible and that obscure terminology, excessive use of modal verbs, unclear frequency adverbs, rhetorical questions, personification, and the passive voice should be avoided.

From the perspective of companies trying to design selling mechanisms to maximise profit, providing product information has been found to lessen price pressures resulting from Internet-enabled price comparisons (Granados et al. 2012). Granados and colleagues (Granados et al. 2012) have stated that offline travel agents and airline representatives do not have the capability or the incentives to execute full transparency, as it is impossible to use phones to deliver all possible information in the same way an Online Travel Agent (OTA) does. Moreover, offline travel agencies and airlines have control of the information and thus have incentives to earn money from consumers by not being fully transparent. For brick-and-mortar companies with online services, a sound multichannel strategy will include the design of online selling mechanisms that make product attributes transparent to consumers. Companies and intermediaries have invested in IT to develop online selling mechanisms that improve the transparency and lessen the uncertainty of products, and even the opaque OTAs have implemented transparent selling mechanisms to increase competitiveness in this dimension.

In terms of information in social media, the inclusion of hashtags, photographs, and videos in messages positively affected citizens’ engagement with posts; conversely, the use of URL, mentions, and photos in posts was found to negatively affect engagement (Lappas et al. 2018). van Reijmersdal and colleagues (van Reijmersdal et al. 2020) in an eye tracking study on the impact of sponsorship disclosure timing on children's ability to understand the sponsoring and advertising information in social influencer videos, found that disclosure prior to the start of videos was better processed and understood with more visual attention. They suggested that policy makers increase transparency of online embedded advertising regarding sponsorship disclosures to minors.

7. Discussions

7.1 Potential Risks of Transparency

Despite the benefits of transparency mentioned before, such as facilitating consumer trust and satisfaction, we should be mindful that transparency can create potential risks if it is implemented without considering the specific application context. Providing consumers or users with full transparency or full autonomy may cause more risks than benefits in certain contexts and platforms.

One such example of context is online gambling. It has been agreed that gambling behaviour is maintained by cognitive distortions regardless of negative outcomes (Jacobsen et al. 2007). Cognitive distortions have been defined as a state wherein "habitual ways of thinking function to support core beliefs and assumptions by generalising, deleting, and/or distorting internal and external stimuli" (Yurica and DiTomasso 2005, p. 118). In terms of gambling, this often refers to gamblers' various erroneous beliefs. One example is gamblers' fallacy: when random events have deviated from the population average in a short run, individuals believe that the opposite deviation is "due" (Tversky and Kahneman 1971). Specifically, when a roulette ball has fallen on a red slot for a certain amount of consecutive times, gamblers may believe that a black winner is more likely to appear. Another example is gamblers' illusion of control, which is a belief of a personal success probability that is unjustifiably higher than the objective probability should warrant (Langer 1975; Goodie 2005), which could involve the principles of sympathetic magic (Wohl and Enzle 2002). In other words, where control over outcomes is important, sympathetic magic allows gamblers to consider causal forces such as personal luck that are unrecognised in the world of physical laws and linear causality and to erroneously believe that their personal luck will lead to a satisfactory outcome (Wohl and Enzle 2002). Therefore, it is possible that transparency offered to gamblers in online gambling websites could create some unintended consequences, where they may use the information in maladaptive ways due to their cognitive distortions.

7.2 Technology: Enhance or Inhibit Transparency

The emergence and advancement of the Internet and technologies result in growing availability and accessibility of information and thus enhanced transparency. For example, internet-enabled price comparison and consumer-generated advertising have improved information transparency in online marketing. Also, as discussed in Section 4, immersive technology has enabled 3D visualisation of information and facilitated information communication and understanding for different purposes such as informed purchase decision making, learning and teaching, participatory design, etc. In addition, new technology can provide opportunities to solve problems regarding lack of transparency. As an example, blockchain has the potential to solve the lack of transparency in copyright ownership of digital content, as it can improve availability and accessibility of information about copyright ownership, transparency and trackability of its subsequent changes (Savelyev 2018). Specifically, blockchain makes it possible for any individual to state a certain event taking place at a certain time in a public, immutable manner. The information about copyright ownership can be provided by the so-called "Trusted Timestamping", which is a way of securely tracking the creation and modification time of a document, thus making it possible for anyone to define the presumption of authorship and resolve disputes (Savelyev 2018).

However, the same digital technologies that enabled ease of access to online information have also increased the possibility of inaccurate information, loss of privacy, identity theft and disinhibited information (Grimani et al. 2020). In addition, the pervasiveness of the Internet and technologies in everyday life has also provided the possibility for people to engage in covert behaviours and activities online such as illicit drugs trade. Using anonymising and encryption software, vendors and customers

can operate relatively secretly in online drug markets via covert electronic communication and encrypted virtual currencies, while the infrastructure of Darknet Marketplaces (DNMs) allows information on drugs such as prices and shipping information to be published in detail (Tzanetakis et al. 2016). This transparency paradox implies both social and technical challenges on the existing system to control purchase and supply of illicit products (Tzanetakis et al. 2016).

8. Conclusions

Through this narrative review, we provide insights into the different aspects of transparency involved in persuasive technology, immersive technology and online marketing. Addressing these aspects will facilitate the users' or consumers' freedom and autonomy and thus contribute to their informed decision making. Transparency is currently more a utopian concept than reality due to lack of consensus and practices. In the digital world, transparency is expected to be realised with stronger regulatory frameworks around user protection and increasingly open conversations around the hidden aspects of technology design, to benefit the production and consumption of online information and new technologies and thus result in satisfactory user experiences and sustainability of industries. The knowledge from the review is synthesised on the practice of incorporating transparency in the design of persuasive technology, immersive technology and online marketing content. In short, the potential solution to improving transparency involves a human-centred, personalised approach to the design of new technologies, which also applies in marketing context of information presentation as well as its communication to multiple stakeholders. Whilst the focus is on the abovementioned fields, it is transferrable to a range of contexts relating to communication of information in the digital world.

The review also highlights the need for more research focusing on transparency issues and practical guidelines in emerging technologies, online marketing and other domains. Research and methodologies from different disciplines such as psychology, HCI, computer science, communication science and information design will be necessary to draw a deep, comprehensive conclusion on the theory and practical guidelines. Also, most research studies in the review are qualitative in nature, implying that well-designed quantitative studies are required in future to address the role of transparency in different contexts. Most findings from this review are related to the transparency of information in different aspects such as clear intent of persuasion or advertising, data usage and potential risks of technology. However, articles tend to talk about transparency as related to information disclosure, i.e., what information is presented and how. Little research has looked at the factors from human elements in the process of human-computer interaction and users' information processing and perceived transparency at the time of interacting with a technology or online platform. Furthermore, the potential risks of a range of new technologies and their applications still remain unclear or debatable to researchers themselves, not to mention the transparency for the users. Much research is required to achieve full understanding of the potential impact of such technologies. This also applies to the uncertainty of marketing innovations, which makes companies tend to avoid the innovations suggested by research, as they fear the innovations may have a negative impact on their profit. Therefore, more large-scale studies and research in applicable contexts are necessary to generate reliable guidelines. Finally, future research and guidelines on transparency need to consider different applications and contexts including social, economic, cultural and environmental factors, and thus it may be challenging to achieve an adequate trade-off. For example, questions remain on how to strike a balance between maximising transparency for customers and avoiding unintended harm the transparency may cause in some settings such as the gambling industry as discussed above. There

is also a trade-off regarding the transparency of AI-based systems between increasing complexity to optimise algorithms and interpretability to foster user autonomy.

9. References

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