May 2019

THE PERSUASION PROCESSES IN VIRTUAL REALITY IN THE CONTEXT OF TECHNOLOGY ACCEPTANCE

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ABSTRACT

This dissertation investigates the extent to which a media audience's degree of technology acceptance (as a mediator) and interactivity of the media influence the user's sense of presence, enjoyment, and message engagement, and finally lead to attitude change (persuasion). The study also explores how the user processes a message and changes the individuals' attitude, guided by the Heuristic-Systematic Model (HSM) of information processing.

To test hypotheses, two different types of media as stimuli sorted by levels of stereoscopic dimension (2D screen versus 3D virtual reality) describing a Syrian Refugee crisis were used for an experiment in the study. Stimuli were randomly assigned to 105 university students to 1) watch (screen) or 2) experience (VR). After the experiment, participants were asked to complete a set of questionnaires, which included items to assess the amount of heuristic and systematic processing; the level of presence; message engagement; enjoyment; message-consistent attitude change; and behavioral intention.

The results showed VR (high interactivity) induced participants' higher level of telepresence, social presence, message engagement, and enjoyment than a screen (low interactivity), and finally led to message-consistent attitude and behavioral intention. Heuristic processing was primarily worked in VR, where Systematic processing was mainly shown in the 2D condition. In addition, it was found that Technological Acceptance significantly worked as a mediator between interactivity and message engagement. Limitations and suggestions for future research were discussed with implications for both academic and business field.

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by

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Dissertation

Submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy in Mass Communications

Syracuse University
May 2019

ACKNOWLEDGEMENTS

It has been a long journey. Life is made up of unexpected events.

Firstly, I would like to express my sincere gratitude and appreciation to my advisor Dr. T. Makana Chock, without whom none of this would have been possible. It is thanks to her unswerving support that I have been able to cope with the unexpected events and experiences that have shaped my doctoral experience. Her endless advice and encouragement have proven invaluable in elevating the standard of my work and challenging my new field of study. Likewise, her generosity of time and effort permeate all aspects of this dissertation.

I would also like to extend my deepest gratitude to Dr. Dennis Kinsey. His ability to listen and consistently identify solutions in areas where I had been lacking was simultaneously inspirational and aspirational. Dr. Qiu Wang provided me with fresh insights into the beauty of numbers and drove me to achieve results, the quality of which I could not have otherwise envisioned. I deeply thank him for providing me with the motivation necessary to complete the work.

I am also grateful to Dr. Leanne Hirshfield, as it was they who imbued in me the notion of exploring the field of cognitive science; while also affording me the opportunity to use her valuable equipment. Although this particular project has ended, I anticipate my research into communication with neuroimaging technology being a lifelong endeavor.

While Dr. Mark Costa provided me a range of practical support in executing various laboratory experiments, of greater importance was his commitment to understanding new technology, which ultimately informed the focus of this dissertation.

I am also deeply indebted to Dr. Jay K. Lee for his efforts as an oral examination chair and for his continued encouragement during my SU life.

I could not hope to have completed this work without the encouragement and support of my family. I would like to extend particular thanks to my wife for her ceaseless patience, and for providing unparalleled support to our sons throughout my studies. Were it not for continued support, I would simply not have survived the unexpected events that formed the backdrop of this project.

Another debt of gratitude is owed to Dr. Frank Biocca for supporting me since commencing my master's, for guiding me with his immense knowledge, and for giving me chance to play such an important role in his laboratory. The experience I gained while running/coordinating the lab facility - working alongside exceptional lab members in doing so - proved to be invaluable in the doctoral work I subsequently undertook.

Last but not least, I would like to express my thanks to all Media, Interface, and Network Design (M.I.N.D.) Lab members with whom I have had the pleasure of working over the past six years. Their ideas, exceptional research designs, and paper reviews have pushed me to become a better researcher and, indeed, person. I would particularly like to acknowledge Tony Yao for his work as a Research Assistant and valued colleague during data collection and the coding of results. Further, Dr. JH Jeon served as an inspiration for their pioneering work in developing new measures and advancing knowledge within the realms of virtual reality.

With all sincerity, I can say that I will not forget the time I have spent with you.

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THE PERSUASION PROCESSES IN VIRTUAL REALITY IN THE CONTEXT OF TECHNOLOGY ACCEPTANCE

CHAPTER 1: INTRODUCTION

Overview

From the roots of rhetoric in ancient Greece to modern-day commercials, the concept of persuasion has long been of extraordinary and critical importance in human society. As persuasion serves to influence changes in individuals' beliefs, opinions, attitudes or behaviors (Petty & Brinol, 2015), it has always been regarded as a pivotal and critical social theme in human life.

With the proliferation of improved computer and digital technology, it has been possible to deliver a large amount of information across various types of media to users, through multiple channels. For instance, a message can be depicted in a true-realistic virtual environment using 3D immersive graphics technology, unlike traditional digital media where pictures or videos are projected onto a traditional flat 2D screen. As McLuhan (1964) famously said, media change pace, form, shape, even content of communication resulting in "psychic and social consequences." Therefore, it is logical to assume that the effects of communication can also be differentiated by each medium.

By providing individuals with a realistic situation/circumstance of information in a message, they have free will to explore/navigate the message (Schwan & Riempp, 2004). In other words, they are allowed to have more chances to get involved with the information in the immersive virtual environment. For instance, compared to a traditional experience of digital

media (e.g., watching television), a user can change his or her viewpoint in the immersive virtual environment to focus on a certain aspect of information in which they are interested. By doing so, they experience and process richer and more detailed information in the virtual reality (VR). With this condition, users can be easily engaged in the message (Oh, & Sundar, 2018), and are more likely to be persuaded (O'Brien & Cairns, 2016).

A key component of this kind of new communication is "interaction": a high level of interaction with a message/information beyond typing, clicking and touching. This type of interaction model of communication strongly alternates the positions of sender and receiver (Schramm, Chaffee, & Rogers, 1997) compared to a linear, one-way process of communication. Also, a medium that brings more engagement has become a key in persuasion in the context of communication perspective (Nabi & Green, 2015; Ophir, Brennan, Maloney, & Cappella, 2017). These concepts require the user's active engagement in communication.

For this reason, a new focus for researchers has become the investigation of the effects of new media technology that provides a true "realistic" experience of information which can maximize user's activity and involvement to interact with a message. In this perspective, the sender is not considered very much (Sundar, Jia, Waddell, & Huang, 2015), and much more importance is attached to the recipient's outcome (e.g., persuasion, attitude/behavioral change) from the use of new technologies as a communication tool. For instance, scholars determined that influencing media receivers' emotion/mood could induce more feelings about the messages (Grigorovici, 2003; Petty, Fabrigar, & Wegener, 2003).

Advanced computer technology (e.g., Virtual Reality, Augmented Reality) has provided users with more realistic and interactive experiences through a message. Virtual Reality especially has a powerful ability to simulate real situations and contexts for users. Therefore, it's

very important to explore how media embedded within this technology affect complex human behaviors and minds, and how these versatile functions are related to the level of persuasion and attitude change compared to traditional digital media.

Development of Interactive Digital Media

Today, there are many types of media, and each medium stimulates the recipient's human senses differently. Text-based information only requires vision, while videos or other interactive medium stimulate both visual and auditory senses. These different characteristics lead to different outcomes in the user's information processing. For instance, providing information on a larger screen induces more attention and arousal in message receivers (Lang, Bolls, Potter, & Kawahara, 1999). Similarly, Kim and Sundar (2016) found that a larger smartphone screen size induces a higher level of trust in the message. Smith and Pyle (2015) discovered that visual information is more likely to influence people in their decision making than less multimodal media formats. In these cases, it has been shown that a "visual cue" has a greater impact on persuasion than the importance of the message sender. Similarly, more realistic sounds incur a higher sense of presence and arousal (Larsson, Västfjäll, & Kleiner, 2002; Serafin & Serafin, 2004). Using a 3D audio (spatial sound) is also important when a visual cue is produced in the virtual environment (Hendrix & Barfield, 1996; Slater & Wilbur, 1997).

From these examples, it is logical to expect that a medium providing more vivid and realistic information, and delivering through multiple sensorial channels (e.g., vision, sound, touch, smell, taste) is a more natural approach to the recipient for persuasion; Therefore, a persuasive message would be delivered more naturally to attract users. For this reason, a feature of "interactivity" which is a key factor in shaping realism in media has become one of the unique

characteristics of today's communication. In other words, by interacting "more" with messages, the recipient can be more active, and engaged in the message. Also, it requires much less effort via this type of media to process the information of the message.

Advanced technological development has led to a "revolution" in the way people communicate. Today, the immersive VR environment, including motion tracking systems with extremely high fidelity graphics, can depict (or replace) a "realistic world (or circumstance)" in the message and allows a user to feel as though they are "actually there" (Biocca & Levy, 1995), and the user feels they are naturally "experiencing" given information. Insofar as this is concerned, media users can actively engage with content, which can encourage them to perceive more information (Xu & Sundar, 2016). In summary, VR's unique features would make the user more focused and engaged in the message by allowing them to be on the spot and requiring less effort to process the information.

However, it's not everyone that enjoys and experiences these features in the context of active users mentioned earlier. Even though VR suggests beneficial features to audiences, they are only benefits to those audiences that prefer VR as their information channel. In other words, the use of new communication technology is decided by the user, and they may have different ideas about the use of new technology as a medium (D'Ambra, Rice, & O'Connor, 1998; O'Brien, Rogers, & Fisk, 2012). For instance, they may choose different types of media or prefer the older, more traditional way of consuming information because they may want to continue to use their familiar media channels. This is because each has a different level of "technology affordance" (Mao, 2014).

For these reasons, exploring the persuasion effects of information or new technology should include the user's technological level and information processing of persuasion.

Outcomes of persuasion in media cannot be accurately measured if the user's level of understanding the media technology is not considered, due to the reasons discussed above. Therefore, in this dissertation, I suggest the model for the research based on the situation discussed above.

Research Model

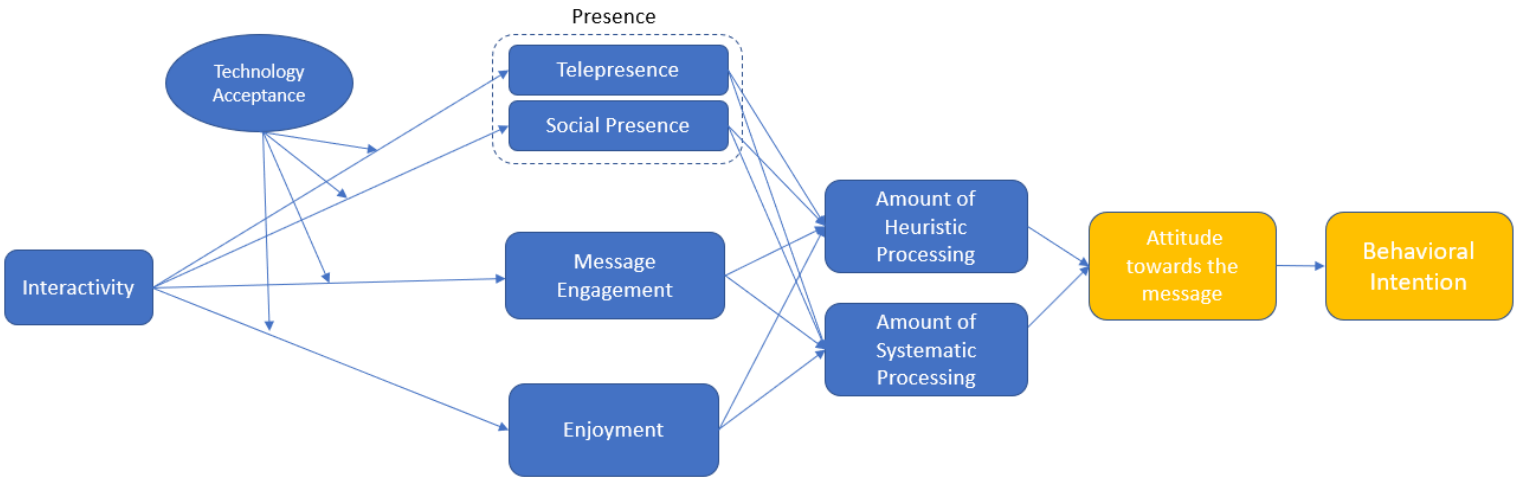

Figure 1. The Theoretical Model - The Model of Persuasion for Interactive Media (Virtual Reality)

First, to ensure a deep understanding of the user's outcomes of the information processing of a persuasive message, the level of technology acceptance is also included in the model. Therefore, we can also see how the user's level of accepting technology is related to their outcomes of the persuasion (e.g., attitude change, behavioral intention) in virtual reality. The study examines the proposed theoretical model of persuasion regarding interactivity, technology

acceptance, presence, enjoyment, message engagement, and types of user's information processing. Details of those elements are discussed below.

CHAPTER 2: LITERATURE REVIEW

Theories and Concepts

Immersive Virtual Environment as a New Medium

Digital media which employs modern technology such as xR (Virtual Reality, Augmented Reality, Mixed Reality) are regarded as the new frontier in digital communication media. Virtual reality (VR) is a unique tool for simulating aspects of the real world, and the use of these new technology tools is rapidly increasing (Ryan, 2015). From a technological viewpoint, the essential elements of a virtual reality system are input and output devices and the simulated scenario (Parsons, Gaggioli, & Riva, 2017). The user's actions (e.g., head, limb, and hand movement) can be captured in virtual reality using advanced input devices, such as data-gloves, eye-tracking, and head-positioning. These can also be substituted for other computing devices, such as a keyboard or a mouse. In addition, output devices convey continuous and vivid information to the user through multiple sensory modalities which are not present through traditional media (e.g., newspaper or television). The underlying concept of virtual reality is to experience a certain unreal environment as real. In other words, it is a "synthetic representation" of a natural or depicted situation (Biocca, 1997; Biocca & Levy, 1995; Kalawsky, 1993).

Figure 2. Stereo Lenses for Binocular (stereoscopic) VR Systems (Oculus Rift)

Because of the technological development in graphics and computer hardware, it is possible to represent a realistic environment as a three-dimensional multisensory environment. When compared to the previous generation of the Head-Mounted Display (HMD) which could produce temporary deficits of binocular vision (Mon-Williams, Warm, & Rushton, 1993), the current version is now presenting a wider angle per pixel (Kress, Saeedi, & Brac-de-la-Perriere, 2014) which provides a clearer vision to users and increases immersion.

By wearing a head-tracked, head-mounted display (HMD), it is possible for a user to experience a virtual world without encountering real objects which may distract when experiencing the immersive virtual environment.

Figure 3. Head-Mounted Display (HMD) with Stereo Headset and Controllers (tracker) for Immersive Virtual environment (Samsung Odyssey)

Other functionalities that increase users' immersion, such as head-tracking or motion-tracking systems, make the virtual environment more realistic, so that users feel "they are actually there" (Biocca, 1997; Heeter, 1992; Reeves & Nass, 1998). Accordingly, in recent years communication researchers and sociologists have carried out studies to determine how the mind works when people interact with other objects or people in virtual reality (McCabe, Houser, Ryan, Smith, & Trouard, 2001; Rilling et al., 2002). They focused on a higher level of interaction: interaction that requires user's less cognitive effort. Beyond using a mouse, keyboard, or controller (consciousness in interaction), information processing can be more natural and requires less effort in the immersive virtual environment (unconsciousness interaction in the user's perspective).

Interactivity in New Media

Interactivity is one of the most distinctive aspects of computer-based media (Kiousis, 2002). Interactivity has been considered a primary reason for a media user's social response to computers (Reeves & Nass, 1998), and VR technology which induces a high level of interactivity can encourage the user to treat the computer as a source of communication, not as a medium (Sundar & Kim, 2005). By doing so, there are more chances to reinforce a stronger psychological affinity to the message (Wu, 2013).

Clearly, it appears to be a persuasive component to the effects of interactivity. For this reason, research in the social psychology of interactivity has focused on the persuasive influence of technologies - allowing a message to be more interactive.

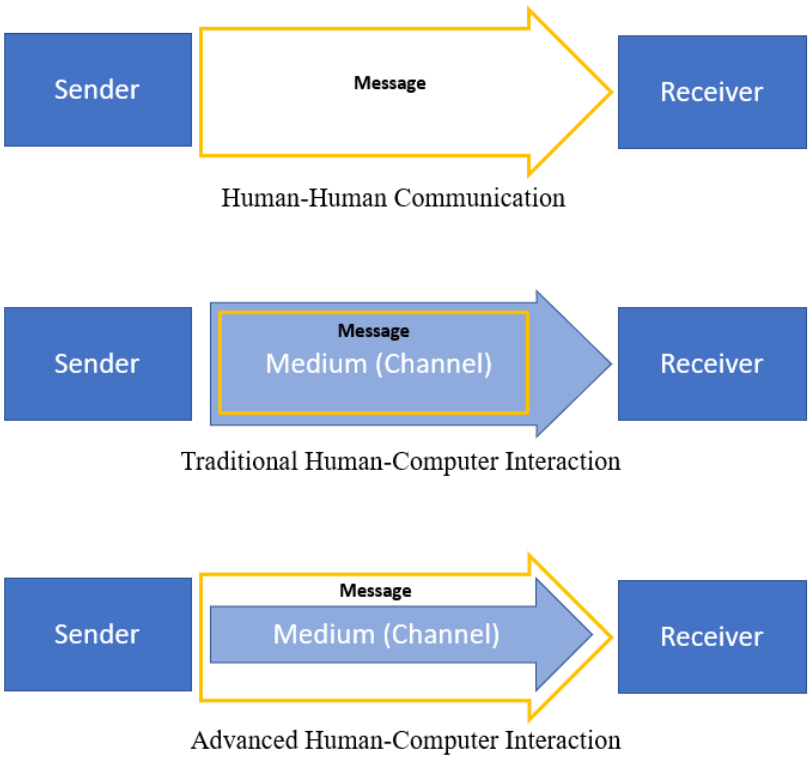

Figure 4. Author's Conceptualization of Various Types of Communication: 1) Human-Human Communication (*upper*), 2) Traditional Human-Computer Interaction (*middle*), and Advanced Human-Computer Interaction with High Level of Interactivity (*bottom*)

Precise accelerometer sensors and a gyroscope embedded into the VR headset provide user's with nearly the same levels of viewpoint and body movement as they experience in the real world. This type of advance in media technology allows us to not just treat the medium of communication as a mere channel simply delivering information between a sender and receiver (Sundar, 2008). For this reason, the user has less of a tendency to recognize a medium as a message (Xu & Sundar, 2016b) because they psychologically bypass the medium and process information as they do in the real world (e.g., human-human communication): for instance, one recognizes a television (object) while watching television. However, one barely sees the VR devices when wearing them. Please see figure 4 for the conceptualized diagram of communication with high and low interactivity.

Many scholars claim that interactivity is often considered to have a "positive influence" on persuasion. For instance, some studies in advertising and marketing found that interactivity improved positive attitudes towards a company and its brand (Arens, 2006; Sicilia, Ruiz, & Munuera, 2005). Similarly, Liu and Shrum (2009) suggest that involvement could play a facilitating role in enhancing central processing in persuasion, leading to more positive attitudes. They also claimed that peripheral cues influence attitudinal heuristic processing. Sundar and Kim (2005) also found that a message that included a higher level of interactivity produced a much greater positive attitude towards products in the message compared to a message with a lower level of interactivity.

At an operational level, interactivity has been defined as the function of "input" (Roussou, 2004) required by the user while responding to the components or the nature of the mediated environment (Sims, 1997). Talin (1998) suggests that the more interactive system

adapts to the user's actions and can allow varying degrees of freedom by distinguishing a computer game and a less interactive system such as a VCR. It appears that the nature of interactivity not only offers deeper involvement for users but also provides stronger retention of a message by the user. It was found that a more interactive story content induces presence which can place users within stories (Sundar, Kang, & Oprean, 2017).

Active Involvement (Engagement) in Media

"Getting immersed within a story"

That might be a sender's desire in communication. As attested by previous research, the paradigm of communication (including interpersonal communication) has shifted from the direct influence of media on passive information-users to active media consumers who freely select and consume various types of media. As a result, the role of the audience has become more important (see uses and gratification:(Becker, 1979; Fisher, 1978; Pornsakulvanich, 2005; Shao, 2009). Moreover, if the user is involved in more interactive media, they are more likely to be persuaded than if they engage with media without interactivity. (Sundar & Kim, 2005). Since we treat interactivity as a function of the medium, engagement will be correlated with interactivity when it's highly active. This study hypothesizes the following.

H1: Higher levels of Interactivity will increase perceived (a) telepresence , (b) social presence , (c) message engagement , and (d) enjoyment.

Technology Acceptance

Technology Acceptance Model (TAM)

Individual acceptance of information technology (Davis, 1985; Davis, Bagozzi, & Warshaw, 1989) has been a central theme in information systems for more than three decades. In information science, understanding an individual's information technology acceptance is important because the expected benefits of IT usage and outcomes cannot be realized if individual users do not accept those systems for their benefits. Prior research in information science has focused on the impact new technologies have on users. However, there has been limited research into how accepting users have been of those technologies and their perception of the usefulness of that new technology. Further, there has been limited research into how an individual formulates positive attitudes towards the message through information technology.

There are similar considerations within the realms of communication. Since most modern day media is developed through advanced information technology, it is important to consider how much users actively accept and utilize information systems (IS). Based on the individual's personality, we can assume the outcome of the message (e.g., learning performance, attitude change, behavioral change) will also be differentiated according to the individual's level of technology acceptance. For instance, Al-Rahmi and Zeki (2017) found that using social media as a new IS tool increased the learner's reading performance. Similarly, it is found that the intention to use Second Life for education can be differentiated by TAM level. (Chow, Herold, Choo, & Chan, 2012). Like this, understanding the dynamics of acceptance-related influence processes are important to understanding the persuasion process in communication.

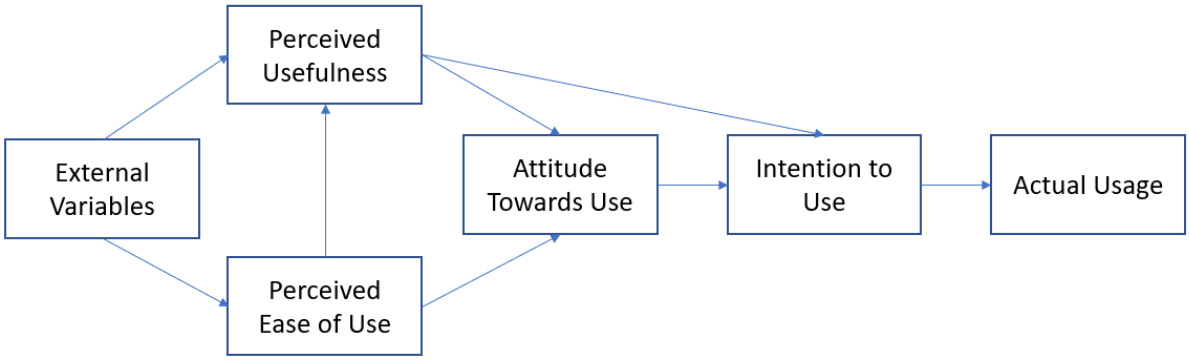

Figure 5. The Basic Model of Technology Acceptance (Davis, 1985)

The Technology Acceptance Model (TAM) explains that an individual's Perceived Usefulness (PU) and Perceived Ease of Use (PEU) affect formulating attitude towards IT use (A). This model explains that the user's perceived psychological processing is important to lead attitude or actual behavioral change. This model is the extension of previous research on attitude measures. Rauschnabel and Ro (2016) claimed that TAM is the most influential extension of the Theory of Reasoned Action.

Prior Research on IT acceptance

Previous research on individual IT acceptance has been informed by two dominant theoretical perspectives. Firstly, the Theory of Reasoned Action (TRA) (Fishbein, M. & Ajzen, 1975) and the Theory of Planned Behavior (TPB) (Ajzen, 1991; Ajzen et al., 1980) focused on individual perceptions as the primary cues of acceptance intention and behavior. After, the technology acceptance model (TAM) (Davis, 1985a), the decomposed theory of planned behavior (DTPB), and the Unified Theory of Acceptance and Use of Technology (UTAUT) were developed for information technology (IT)-specific individual behavior. Collectively, these theories suggest that the user's intention and their behavior of information technology acceptance

can be shaped by the user's cognition towards target information technology (Venkatesh et al., 2003).

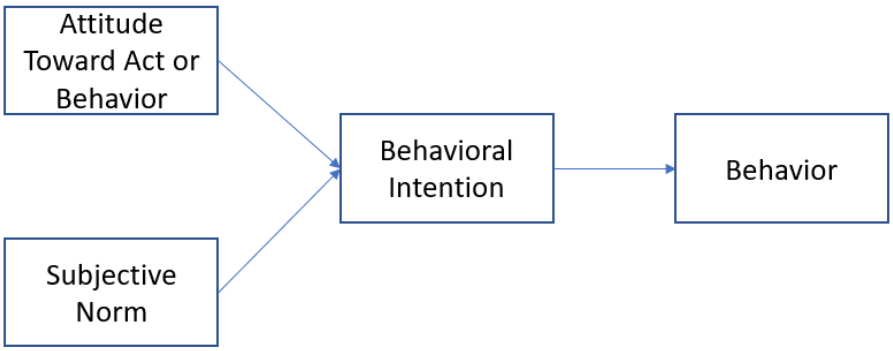

Figure 6. The Basic Model of Theory of Reasoned Action (TRA)

In sum, previous research has shown that an individual's internal influence towards Information Technology plays a significant role in engaging the use of IT for accepting information. Therefore, the usefulness of information technology can be differentiated by a message recipient's internal cognitions and their attitudes towards IT. In addition, this individual acceptance of computer technology is not strongly affected by other external influences such as peers, family members or other referents (Fred D. Davis, Bagozzi, & Warshaw, 1989b).

Similarly, the concept discussed above is also partially addressed by the Innovation Diffusion Theory (IDT) (Rogers, 1995). This model also suggests that IT acceptance patterns within a network of users are formed by the process of social influence: later technology adaptors are informed of the availability and benefits of new IT by earlier adopters within their social network (Rogers, 1995). This theory emphasizes the important role of external influences (e.g., the person who writes a review of new technology).

Collectively, it is possible to infer from the concepts and theories discussed above that there is an emphasis on the individual's psychological perception of "ease of use" and "intention to use" which would then lead to the behavioral intention to use IT. Based on this concept, we can deduce that a medium may engender differential persuasion effects across different user groups divided by TAM. The factor of technology acceptance (TA) was developed for this study, and it measures individuals' tendency to use technology embedded with a medium. This is because psychological behavior might be habituated by individuals (Neal, Wood, Labrecque, & Lally, 2012). Individuals' TA level can't be changed by stimuli in the short term. Therefore, this factor was put as a moderator between interactivity, and presence, message engagement, and enjoyment in the research model.

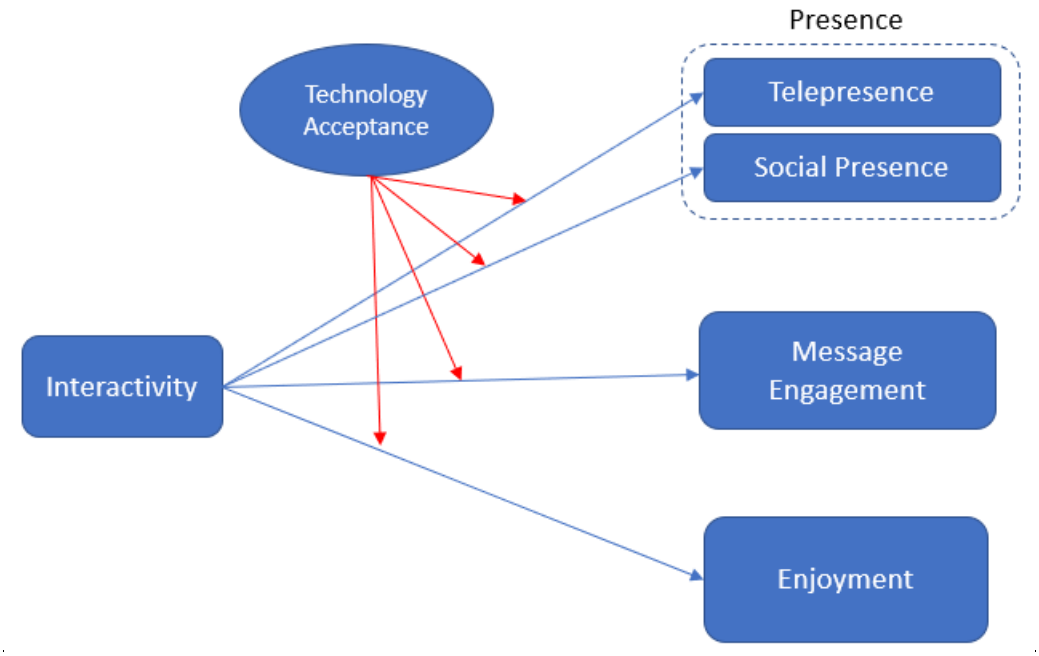

Figure 7. The Factor of Technology Acceptance as a Moderator in the Research Model

RQ1: Will the level of a user's technology acceptance affect the persuasion effect of interactive media using the newest technology?

H2: Higher levels of Technological Acceptance (TA) will moderate the relationship between interactivity and telepresence (a), social presence (b), message engagement (c), and enjoyment (d).

Next, to find the relationship between information technology usage and outcomes of persuasion, a persuasion process at an individual level is addressed below.

Understanding the Persuasion Process

Elaboration Likelihood Model (ELM)

The Elaboration Likelihood Model is a theory predominantly used in communication to understand persuasion and attitude change with a psychological explanation. ELM, as proposed and developed by Petty and Cacioppo (1981, 1983, 1986) is one of the frameworks which explains an individual's understanding, processing, and acceptance of information. For decades, it has been developed and used by various scholars as a mechanism to explain human psychological behaviors, especially in attitude change. This model has played a pivotal role in explaining the persuasion process in social science (Petty & Brinol, 2015).

The Elaboration Likelihood Model can explain why given circumstances or messages for persuasion may lead to differential outcomes in different settings (Bhattacherjee & Sanford,

2017) by proposing two different types of information processing routes: The central route and the peripheral route.

Central Route. The central route of persuasion is used when the message recipient has the motivation and the ability to think about the message and its topic. In other words, the central route requires the message receiver to think critically or carefully about issue-related information. The goal of this cognitive process is to determine whether the central merits of the position advocated have any benefit to the recipient (Petty, R. E., Priester, J. R., & Brinol, 2002) because not every message delivered is important or necessarily interesting to the recipient. Previous research showed that the route of persuasion is not chosen by the types of media because the recipient chooses the route (Petty & Priester, 1994; Petty, Priester, & Briñol, 2002). The reason for this is that every person has their sense of importance (priority) towards products, beliefs, or convictions on a specific issue or information (DeBono & Packer, 2008; Teas & Agarwal, 2000).

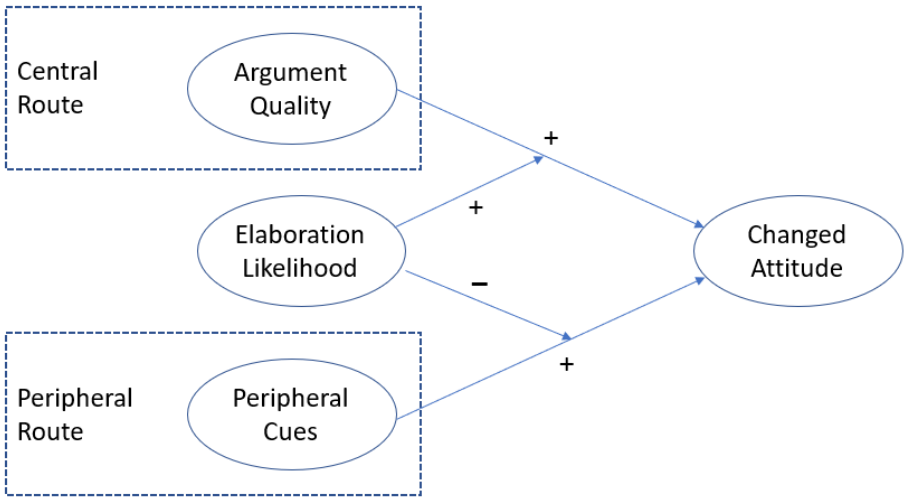

Figure 8. Basic Concept of Elaboration Likelihood Model (ELM)

Peripheral Route. In contrast to central route processing, peripheral route processing is based on the concept that persuasion does not always occur when the media recipient is interested in the topic of the message, or when the information is issue-related. In other words, when elaboration likelihood is low, the information process occurs through the peripheral route. This process requires less effort than the central route of information processing, and attitudes formed by this route are relatively unaffected by argument quality and demands weaker formation than the central route (Petty & Cacioppo, 1983).

However, peripheral approaches may not actually be ineffective (Petty, Brinol, & Priester, 2009). The difference is that the peripheral route of processing requires a more passive acceptance of information and needs a lower involvement from the topic than central route processing.

The elaboration-likelihood (ELM) model has several important implications for understanding the effects of interactivity on persuasive communication. There is a great deal of research which demonstrates that a combination of central and peripheral processes are likely to create attitude change or persuasion (Kitchen, Kerr, Schultz, McColl, & Pals, 2014). For instance, if the topic of persuasive communication is engaging to a recipient, they elaborate the messages through the central route, thereby requiring more effort *(high elaboration)* to enforce their attitude towards the message. In contrast, if the topic of the message is not highly related to the individual's interest, they are more likely to engage with peripheral elements of the message (low elaboration) and rely on general impressions.

Heuristic-Systematic Model of Information Processing

Similar to the elaboration likelihood model (ELM), the Heuristic-Systematic Model of information processing (HSM) is another dual processing model of persuasion. This model was suggested by Chaiken (1980) and is a widely recognized communication concept which aids understanding of persuasion in situations where the users are aware of the persuasive intent. This model posits two processing routes – heuristic and systematic.

Heuristic Processing. Heuristic processing is based on superficial cues and heuristics associated with the persuasive message. It often functions when motivation or the ability to process information is low (Chaiken & Ledgerwood, 2012). Scholars have suggested that source attractiveness would trigger heuristic cues (*mental shortcuts*) – these cues are also termed cognitive shortcuts. For instance, source attractiveness (Liu & Shrum, 2009b) and a realistic representation of the source (Kim & Sundar, 2016) could lead to heuristic processing which involves using mental shortcuts and low elaboration with the message (under low-involvement conditions). In another study, it was found that a "being there heuristic" can work as a cue triggering cognitive heuristics and mental shortcuts about the credibility and quality of the media content (Sundar et al., 2017).

That means that the heuristic approach offers an economic advantage by requiring minimal cognitive effort when processing persuasive information (Chaiken, 1980). In other words, if the information naturally flows to the user, then a user processes that information with a low mental load. In this process, I hypothesized that a user's level of technology acceptance is highly related to judging whether a certain media channel is suitable for them, or not.

H3(a): Higher levels of heuristic processing will lead to higher levels of message-consistent attitude change.

Systematic Processing. In systematic processing, a message recipient actively processes persuasive messages; it involves "detailed analytical consideration of judgment-relevant information" (Sundar, Oeldorf-Hirsch, & Garga, 2008). In contrast to heuristic processing, this processing usually occurs when issue involvement and the level of motivation and ability to process information are high.

In sum, the theoretical models of information processing discussed above share many of the same concepts and ideas. The only conceptual difference is that the Elaboration Likelihood Model (ELM) is looking at persuasion with information "filtering and processing" while the Heuristic-Systematic Model (HSM, also called the Dual Processing Model of Persuasion) explains it with "heuristic and systematic" cognitive processing. However, both the ELM and HSM models suggest that each of the "external elements" of the message along with the user's perception could determine the route of information processing in persuasion. We are going to investigate what factors in media communication affect choosing those processing routes.

H3 (b): higher levels of systematic processing will lead to lower levels of immediate message-consistent attitude change.

As discussed earlier, today's new media consists of numerous factors that could affect one's attitude or behavioral change. The HSM serves as a good model for explaining the various source, message, and context variables. According to HSM, other factors of peripheral route processing, such as the messenger's characteristics, also induce the persuasion effect (Petty & Cacioppo, 1986). Once the user's attitude is shaped through heuristic information processing,

then the formation of immediate (short-term) attitude is stronger than when it is shaped via systematic processing. Therefore, the user is likely to take action (behavioral change) when they have already shaped a strong attitude formation towards the message (Ajzen & Fishbein, 1977; Fishbein, M. & Ajzen, 1975).

H4: Higher levels of message-consistent attitudes will predict higher levels of message-consistent behavioral change.

Presence

The Concept of Telepresence: Being There

The concept of presence is used to describe the user's feeling of "being there" within a virtual environment. Presence has been defined as the "perceptual illusion of non-mediation" (Lombard & Ditton, 2006), "a psychological state in which virtual objects are experienced as actual objects in either sensory or nonsensory ways" (Lee, 2004, p. 37) and a "user's feeling that mediated representations are real" (Ivory & Kalyanaraman, 2007, p. 534). These definitions of presence describe the extent to which users feel "present" in the virtual environment (Botella et al., 1999; Slater & Wilbur, 1997).

Defining presence in terms of structural models (e.g. Witmer & Singer, 1998) means that presence focuses on how a user generates their experiences of presence in the mind and mental representation of the environment (e.g., cognitive process, attention to the VR environment), and those kinds of mental processes are necessary to experience a sense of presence (Schuemie, van der Straaten, Krijn, & van der Mast, 2001; Sheridan, 1992).

According to various scholars' definitions of presence, realism and presence are highly correlated. Within the realms of virtual reality, the concept of presence can be used to assess the realistic environment that is computer generated (Sallnäs, Rassmus-Gröhn, & Sjöström, 2000). Further to this, (Calvert & Tan, 1994) found that greater immersion and realism in an immersive virtual environment influence players' emotional states.

The elements of media which can affect the quality of media may also influence players' level of psychological or physiological states. One feature of modern media that can contribute to presence is interactivity (Lombard & Ditton, 2006; Steuer, 1992). Heeter (1992) suggests that responsiveness is one dimension of interactivity and that a highly responsive virtual environment could induce a higher sense of presence than a less responsive environment.

Social Presence

To discuss the concept of social presence, it's necessary to look at "social interaction" since the behavior of "interaction" is a social activity of human life.

> *"Social interaction is defined as interaction between learners and instructors that occurs when instructors adopt strategies to promote interpersonal encouragement and social integration."*
>
> (Jung et al., 2002, p.153).

The basic concept of social interaction in virtual reality is "being together" or "We are together." However, even though social interaction can be found in many media (e.g., television, radio), the reaction time is differentiated by the level of interactivity, as discussed above. Even though people are not actually present in the same place, the immersive virtual environment

could let people sense that they can perceive others and that others are also able to perceive them immediately (with no delay). Immediacy was conceptualized by Mehrabian and Wiener (1966) and later paraphrased by Cobb (2009), as a measure of psychological distance that a communicator puts between users and the object of their communication.

This cognitive process can be measured. Social presence is a "measure of the feeling of community" (Tu & McIsaac, 2004, p. 131), and two components enhance social presence: intimacy and immediacy (Argyle & Dean, 2006; Mehrabian & Wiener, 1966). In the virtual environment, social interaction is not processed via physical interaction since people are not actually in the same place. However, realistic visual cues and sounds can trigger emotional reactions (Diemer, Alpers, Peperkorn, Shiban, & Mühlberger, 2015) and reinforce intimacy and immediacy with objects in VR. Therefore, users' psychological state of interaction should also be measured in VR research (Blascovich et al., 2002; Lee et al., 2016). Measuring social presence in telecommunication, an approach to see "the subjective quality of the communications medium (Short, Williams, & Christie, 1976, p. 65) has been widely used (Biocca, Harms, & Burgoon, 2003).

Short, Williams, & Christie (1976) defined social presence as "the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships" (p. 65). Recently, Garrison, Anderson, & Archer (2003) defined social presence as "the ability of participants in a community of inquiry to project themselves socially and emotionally, as real people through the medium of communication being used."

Schuemie, van der Straaten, Krijn, & van der Mast (2002) suggested that presence is also deeply related to social richness; "the extent to which the medium is perceived as sociable, warm, sensitive, or personal when it is used to interact with other people" (p. 185).

Presence and Enjoyment

Presence and enjoyment have been found to be highly correlated by many scholars. Sylaiou and his colleagues (2010) found that individuals' presence levels when experiencing both VR and AR, and their feelings of enjoyment were statistically correlated. Similarly, it was found that people were more likely to have a higher level of enjoyment when playing video games in 3D than people who played games in 2D (Williams, 2014). This showed that immersion and the depth of stereoscopic dimension, which are core factors shaping presence, could affect the user's feeling of enjoyment.

Taking all concepts of interactivity and related measurement, we hereby setup more hypotheses below,

RQ2: How will users' report feelings of enjoyment in a serious issue-related message?

H5: Higher levels of telepresence (a), social presence (b), message engagement (c), and enjoyment (d) will elicit higher levels of heuristic processing

H6: Higher levels of interactivity will elicit higher levels of heuristic processing (a) and lower levels of systematic processing (b).

H7: Higher levels of telepresence (a), social presence (b), message engagement (c), and enjoyment (d) will mediate the relationship between interactivity and heuristic processing

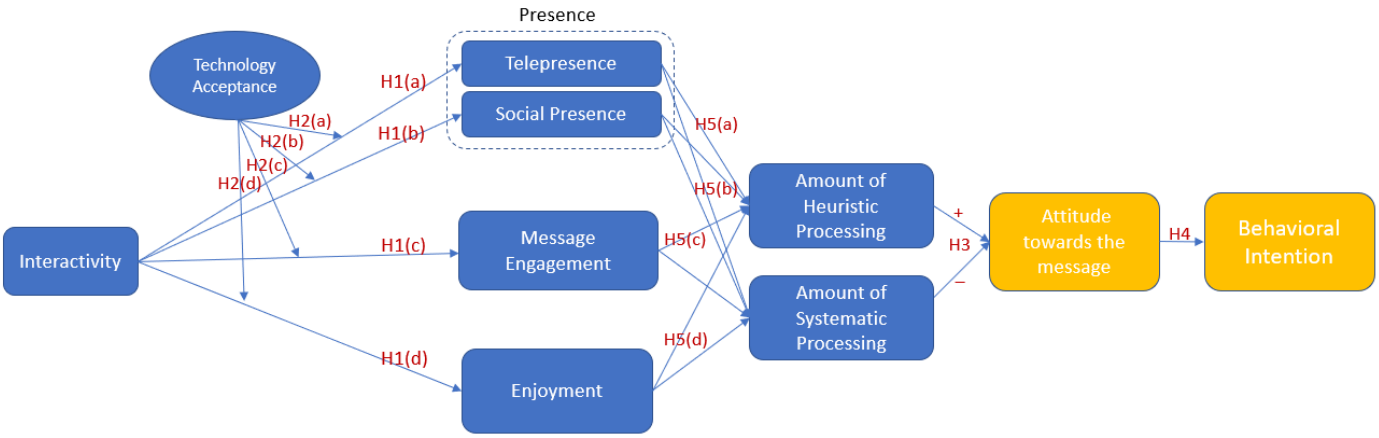

Figure 9. The Theoretical Model with Hypotheses: The Model of Persuasion for Interactive Media in the Context of Technology Acceptance

CHAPTER 3: METHOD

Design

To explore the proposed research questions and hypotheses, we conducted a between-subject experimental pre-test/post-test design with two conditions: two types of representation mode (stereoscopic dimension) configured by levels of interactivity - *Low*: 2D screen, *High*: VR.

Participants were randomly assigned for exposure to a stimulus with identical content prepared in either interactive (VR) or non-interactive (video) format. For the video (2D) version, recordings of VR content were used to eliminate any compounding errors. After either experiencing the message in VR or watching the same content showing on a 2D flat LCD screen, participants completed an online questionnaire, which included items to assess the amount of heuristic and systematic processing; the level of presence; message engagement; enjoyment; attitude towards message; attitude towards the entire surroundings of the medium; eagerness to tell this story to others.

Participants

A total of 105 (50 males, 55 females) college students with no audiovisual impairments were recruited from a large private university in the Northeast of the United States. In particular, only participants who saw objects with two eyes were recruited for this study because the study included the condition to experience VR through stereoscopic lenses. In addition, people who had a history of seizures were excluded to minimize the risk for them during the research. Although a low possibility, interactive media may induce photosensitive seizures (1/40,000,

Fisher, Harding, Erba, Barkley, & Wilkins, 2005). In addition, none of them reported that they had any experience of traveling in Syria.

Selection and Development of Stimuli

Social Issue: Syrian Refugee

Immigration seems to be the most prominent issue in both America and European countries in 2018. President Donald Trump referred to U.S. immigration law as a "broken" system in 2018. In Europe, immigration has appeared near the top of public policy concerns/issues (Welsch, 2019). Some citizens of countries in economic crisis reject either legal immigrants or refugees because they believe supporting them can potentially negatively affect their GDP and increase their growing high unemployment (McMahon, 2018). The refugee crisis has become a very serious social issue today. Therefore, we wanted to see if increased visibility of social issues delivered through new technology can induce users' attention and agreement with the message.

Message in Two Different Levels of Stereoscopic Dimension: 2D versus 3D

To differentiate the level of interactivity, a message was configured with 1) flat 2D screen as a low-interactivity condition or 2) Immersive virtual reality (3D visual & audio with a head tracking feature) as a high-interactivity condition. In the VR condition, a user can "interact" with a message (with a motion tracking system) while they can only "observe" the message in the 2D condition. In addition, the viewpoints are different. In the VR condition, three-dimensional interactive images are provided, while the 2D condition only offers two-dimensional, non-interactive motions.

Figure 10. The VR Story of Syrian Refugee, “We Wait” Developed by British Broadcasting Cooperation (BBC)

With these two conditions, participants were asked to either 1) watch or 2) experience the situation about the Mediterranean refugee crisis. For this study, the film *“We Wait”* developed by The British Broadcasting Cooperation (BBC) was used. This VR story was based on real migrant accounts gathered by BBC News. (see https://www.bbc.co.uk/taster/pilots/we-wait for more details).

Figure 11. A Screenshot of *We Wait*: It Begins on a Beach in Turkey

Figure 12. A Screenshot of *We Wait*: Participants on Board a Boat Crossing the Mediterranean.

The film depicts the harrowing and often perilous journey undertaken by Syrian refugees as they cross the Mediterranean to get to Europe in search of a better life (see Figure 10,11,12 for details of the content). For the two-dimensional (2D) version of the story, this story was captured and converted to a two-dimensional video at 1920x1080 pixels (Full-HD resolution).

Figure 13. A Screenshot of *We Wait*: Participants struggling on Crossing the Mediterranean

For the VR condition, an Oculus Rift and a stereo headset were used. By recognizing participant's head movement with a tracking sensor, they experienced a 360-degree of the interactive VR content, *We Wait* without any delays in their viewpoint in the virtual environment. For the 2D condition, a conventional laptop (Lenovo Thinkpad) with a 13-inch screen was prepared and played to participants as people normally watch videos with a laptop. In this condition, the video was played in 2D, and a viewpoint was fixed. In other words, there was

no interactivity in the point of view and feeling of self-embodiment in the 2D condition compared to the 3D condition.

Self-Embodiment in Virtual Reality

Participants would have a higher level of interactivity in the 3D condition than the 2D condition because of self-embodiment in virtual reality. When participants put on a Head-Mounted Display (HMD), they lose sight of their own bodies, including their arms and legs. It was found that the lack of embodiment can lower the performance on some tasks related to using their self-image (e.g., mental rotation) (Steed, Pan, Zisch, & Steptoe, 2016). In other words, self-identification is necessary for the VR environment to have a deep relationship with the information of a message. This is a reason why there's a difference between omnidirectional (or 360 degree) video/photos and the immersive virtual environment. For this reason, we chose a VR content that a participant can identify with their body in the virtual environment so that they can feel they are experiencing the Syrian Refugee crisis as one of them. We asked participants to check out their body shown in VR (e.g., legs, the bottom part of the body) to give them a feeling of self-embodiment in virtual reality.

Figure 14. Experimental Setup of VR condition: A participant experiencing Syrian Refugee Crisis Content, “We Wait” through Virtual Reality in the laboratory

Measurements

Technology Acceptance towards Interactive Media: Modified Measurement for the Study

The original TAM mainly focused on the use of new technology based on user's attitudes towards it and measured intention or usage as a dependent variable (e.g., Compeau & Higgins, 1995; Davis, 1985a). However, this model does not fully explain the relationship between an individual's use of technology in media and persuasion. This study seeks to expand the model of persuasion processing with TAM so that we can see the level of persuasion by technology acceptance level. For this reason, the model of the dual process of persuasion has been adopted in our research model.

Most TAM studies address the factors of Perceived Usefulness (PU) and Perceived Easy-of-Use (PEU). These factors are essential for seeing media use in this study. However, the original TAM was developed to see an individual user's technology use for their specific purpose (e.g., using technology for work or education). Therefore, a modified version of the TAM questionnaire addressing only these factors was used. The benefits of employing the modified TAM questionnaire are that firstly we can establish the relationship between the level of technology acceptance in their lives and their preferred media as an information channel. Secondly, it allows us to eliminate unnecessary questions (e.g., job relevance).

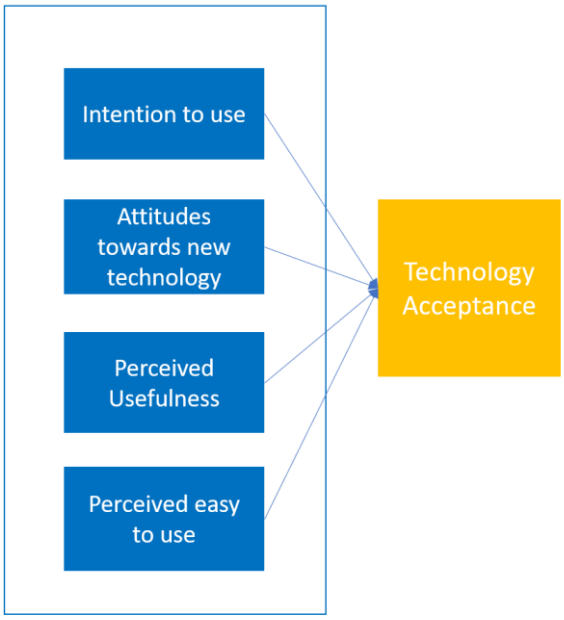

Figure 15. Adaption of the TAM Elements into the Persuasion Process Model for the Study

For this study, only factors (PEU: Perceived Ease of Use, PU: Perceived Usefulness, BI: Behavioral Intention/Intention to Use, and AT: Attitude towards New Technology) directly linked to technological acceptant at the individual's level are selected for this study. In addition, questions were modified to focus on the participants' levels of technology acceptance towards interactive media (e.g., I find interactive media is easy to use). See Appendix A for a list of modified questions.

Table 1. Descriptive Statistics for Measurement Items on Technology Acceptance (12 items)

Item (n = 105)		M	SD	Cronbach α
(PEU1)	I find interactive media is easy to use	5.22	1.29	

(PEU2)	Learning how to use interactive media is easy for me	5.40	1.27	
(PEU3)	It is easy to become skillful at using interactive media	5.06	1.25	
(PU1)	Interactive media (features) would improve comprehension of news/information	5.46	1.21	
(PU2)	Interactive media would increase my understanding of the performance of the information	5.56	1.28	
(PU3)	Interactive media could make it easier to remember information/messages	5.54	1.28	
(BI1)	I intend to use interactive media as an information channel	5.09	1.19	
(BI2)	I intend to be a heavy user of interactive media	4.51	1.38	
(BI3)	When it comes to using technology in your life, would you say you are keeping up?	5.26	1.20	
(AT1)	I like to try out new technology when it's released	5.36	1.32	
(AT2)	I like new technology	5.81	1.18	
(AT3)	I take advantage of using new technology	5.53	1.17	
	Mean	5.31		**0.895**

Note: Response options (from strongly disagree to strongly agree) ranged from 1 to 7

Telepresence (Presence as Immersion)

Presence as immersion was measured by the Temple Presence Inventory developed by Lombard, Ditton, and Weinstein (2009). The factor "Spatial Presence," that consist of seven questions such as "How much did it seem as if the objects and people you saw/heard had come to the place you were?" in a seven-point Likert scale was used to measure the level of presence.

Table 2. Descriptive Statistics for Measurement Items on Presence (7 items)

Item (n = 105)	M	SD	Cronbach α
How much did it seem as if the objects and people you saw/heard had come to the place you were?	3.99	1.97	
How much did it seem as if you could reach out and touch the objects or people you saw/heard?	3.85	2.01	
How often when an object seemed to be headed toward you did you want to move to get out of its way?	3.65	1.86	
To what extent did you experience a sense of being there inside the environment you saw/heard?	4.10	1.99	
To what extent did it seem that sounds came from specific different locations?	4.57	2.02	
How often did you want to or try to touch something you saw/heard?	3.63	1.96	

Did the experience seem more like looking at the events/people on a movie screen or more like looking at the events/people through a window?	3.58	2.04	
Mean	3.91		**0.904**

Note: Response options (from Not at all/Never to Very much/Always) ranged from 1 to 7

Social Presence (Presence as Social Engagement)

Social presence was measured by the factors "Social Presence – Parasocial Interaction" that consisted of a total of seven questions. Sample questions include "To what extent did you feel you could interact with the person or people you saw/heard?", "How often did you want to or did you make eye-contact with someone you saw/heard?" Items were measured in a seven-point Likert scale. For a full list of items, please refer to table 2.

Table 3. Descriptive Statistics for Measurement Items on Social Presence (7 items)

Item (n = 105)	M	SD	Cronbach α
How often did you have the sensation that people you saw/heard could also see/hear you?	3.46	1.91	
To what extent did you feel you could interact with the person or people you saw/heard?	3.61	1.91	
How much did it seem as if you and the people you saw/heard both left the places where you were and went to a new place?	3.95	1.80	

How much did it seem as if you and the people you saw/heard were together in the same place?	4.30	2.0	
How often did it feel as if someone you saw/heard in the environment was talking directly to you?	3.98	1.91	
How often did you want to or did you make eye-contact with someone you saw/heard?	4.07	2.0	
Seeing and hearing a person through a medium constitutes an interaction with him or her. How much control over the interaction with the person or people you saw/heard did you feel you had?	3.60	1.77	
Mean	3.85		**0.941**

Note: Response options (from Never/None to Always/Very Much) ranged from 1 to 7

Message Engagement (user engagement with the message)

Sundar and his colleagues (Sundar, Kalyanaraman, & Brown, 2003; Sundar & Kim, 2005) found that higher message interactivity can induce greater involvement in the message. The user's engagement can be measured by the level of absorption that the participant experienced while interacting with the message (Agarwal & Karahanna, 2006). Presence as immersion was measured by the Temple Presence Inventory developed by Lombard, Ditton, and Weinstein (2009). The factor "Engagement" consisted of six questions in a 7-point Likert scale that was used to measure the participants' levels of Engagement with the message.

Table 4. Descriptive Statistics for Measurement Items on Engagement (6 items)

Item (n = 103)	M	SD	Cronbach α
To what extent did you feel mentally immersed in the experience?	4.46	1.71	
How involving was the experience?	4.43	1.87	
How completely were your senses engaged?	4.42	1.74	
To what extent did you experience a sensation of reality?	4.29	1.82	
How relaxing or exciting was the experience?	3.97	1.65	
How engaging was the story?	4.74	1.75	
Mean	4.39		**0.941**

Note: Response options (from Not at all/Very relaxing to Very much/Very exciting) ranged from 1 to 7

Enjoyment

Ten selected items from the Physical Activity Enjoyment Scale (PACES) developed by Kendzierski & DeCarlo (1991) were used to measure the user's level of enjoyment. The items related to asking about an individual's mental state is only selected to have a strong internal validity for both experimental conditions (i.e., reading a textbook is a very limited physical activity).

As such, many studies have adopted this scale for the VR Study (Cuthbert et al., 2014; Mestre, Dagonneau, & Mercier, 2011; Mestre, Ewald, & Maiano, 2011; Plante, Cage, Clements, & Stover, 2006). Sample questions include "I enjoy it," "I find it pleasurable," and "it's very pleasant." Participants levels of enjoyment were measured in a 7-point Likert scale. For the full ten items used in this study, please see table 4.

Table 5. Descriptive Statistics for Measurement Items on Enjoyment (10 items)

Item (n = 101)	M	SD	Cronbach α
I enjoy it	5.12	1.54	
I feel interested	5.68	1.36	
I like it	5.30	1.47	
I find it pleasurable	4.29	1.75	
It's very unpleasant	3.68	1.58	
It's a lot of fun	4.40	1.72	
I find it energizing	4.22	1.63	
It makes me depressed	4.12	1.55	
It's very pleasant	3.87	1.72	
It's very gratifying	3.86	1.57	
Mean	4.46		**0.789**

Note: Response options (from strongly disagree to strongly agree) ranged from 1 to 7

Attitude

Attitude towards the message was measured with five items with a 9-point Likert scale and asked for participants' attitudes towards Syrian refugees. Pretest and posttest were conducted to see participants' immediate attitude changes. Questions are adapted from the survey "American attitudes on refugees from the middle east" (Telhami, 2014). Sample questions are "Refugee crisis is a serious social issue", "U.S. individuals and community groups (e.g.,

churches) should sponsor more refugees, helping them with funds and assistance to settle in the US." For a full list of questions, please see table 5 and 6.

Table 6. Descriptive Statistics for Pretest Measurement Items on Attitude towards Syrian Refugee

Item (n = 105)	M	SD	Cronbach α
The Syrian refugee crisis is a serious social issue	5.40	1.17	
In general, I support the United States taking in refugees from the conflicts in Syria	4.73	1.31	
The U.S. government should take in more Syrian refugees, allowing them into the U.S.	4.40	1.28	
U.S. individuals and community groups (e.g., churches) should sponsor more Syrian refugees, helping them with funds and assistance to settle in the U.S.	4.49	1.48	
We should welcome Syrian refugees and help absorb them.	4.54	1.41	
Mean	4.71		**0.850**

Note: Response options (from strongly disagree to strongly agree) ranged from 1 to 7

Table 7. Descriptive Statistics for Posttest Measurement Items on Attitude towards Syrian Refugee

Item (n = 105)	M	SD	Cronbach α
The Syrian refugee crisis is a serious social issue	5.75	1.28	

In general, I support the United States taking in refugees from the conflicts in Syria	4.93	1.43	
The U.S. government should take in more Syrian refugees, allowing them into the U.S.	4.78	1.40	
U.S. individuals and community groups (e.g., churches) should sponsor more Syrian refugees, helping them with funds and assistance to settle in the U.S.	4.78	1.51	
We should welcome Syrian refugees and help absorb them.	4.68	1.50	
Mean	4.99		**0.881**

Note: Response options (from strongly disagree to strongly agree) ranged from 1 to 7

A degree of attitude change was measured with a difference between scores of pretest and posttest (i.e., attitude change = posttest – pretest). Please refer to table 7 below for more details.

Table 8. Descriptive Statistics of Attitude Measures

Attitude Measures (n = 105)	Mean	Minimum	Maximum	SD	Skewness
Pretest	4.71	2.0	7.0	1.05	0.09
Posttest	5.19	2.0	7.0	1.04	-0.68
Attitude Change	.47	-1.0	2.40	0.65	0.53

Amount of Systematic and Heuristic Processing

Human cognitive information processing is a set of complicated psychological activities. Measuring the amount of systematic/heuristic processing at the operationalization level is problematic because an individual's decision-making process cannot be directly measured with self-reported measures (Bellur & Sundar, 2014). For instance, Chaiken (1980), potentially sorted the amount of systematic and heuristic processing by examining readers' responses (e.g., seeing opinion change, persistent to the message) to a persuasive message containing several arguments under conditions of high or low involvement. This experiment was a part of the verification of the HSM theory. There was still a remaining limitation that they were unable to measure directly, which was the readers' systematic and heuristic processing.

Next, Chaiken and Maheswaran (1994) operationalized the amount of systematic processing as the number of attribute-related thoughts that represent individuals' cognitive responses pertaining to specific attributes of stimulus information. The degree of systematic processing to which participants engaged with systematic cues during the experiment can be measured by counting the number of attribute-related thoughts (i.e., specific descriptions of the message). On the other hand, the number of non-attribute-related thoughts served to indicate which participants engaged in heuristic processing.

After completing the experimental task, participants were given up to five minutes and asked to list any elements or details of the message they read or experienced (word listing). Words, sentences or phrases that did not describe specific attributes of the message were counted as heuristic processing. For instance, a brand logo (e.g., Apple) on a product can be a cue for heuristic processing (Bellur & Sundar, 2014). Taking this concept, non-direct attributes such as 'VR technology is nice', 'Lenovo (brand name of the laptop used for the 2D condition of the

study)', or 'lighthouse' were counted as a cue for heuristic processing. In other words, we expected that when participants indicated more words or phrases of non-direct attributes, that more heuristic processing was used in information processing than participants who did not listed any evidence of non-direct attributes of the Syrian refugee story on the survey.

Since more importance of heuristic processing is shown in the VR condition, we calculated the ratio of non-attribute-related (heuristic) items to attribute-items (systematic). For instance, if a participant reported 10 items of attribute-related items and 3 items of non-attribute-related items, the ratio is 0.3 (3:10). Please note that there were very few non-attributed components in the VR film "We Wait."

Table 9. Descriptive Statistics of Heuristic-Systematic Items and the Ratio to Heuristic to Systematic cues

Items	Mean	Minimum	Maximum	SD	Skewness
Systematic Cues	8.05	4	11	1.37	-.18
Heuristic Cues	2.22	0	5	1.26	-.07
Ratio (Heuristic to Systematic Cues)	0.28	0	0.8	0.18	.45

Behavioral Intention

Kim and Kang (2017) found that an immersive news story influenced readers perceived source credibility and "story-sharing intentions" more than the same news story in text. They claimed that presence-related outcomes (e.g., sense of being there, interaction and realism) positively affected the level of message-consistent reader's perceptions and cognition.

In addition, there are studies seeing outcomes of behavioral intention (behavioral change) with a degree of 'willingness to donate.' For instance, Kashif and de Run (2015) measured

participants behavior change in their study with the ELM model by asking donation intention to the charity. By taking this approach for this study, the individual's behavioral intention after exposure of stimuli was measured by a question directly asking about their willingness to donate and how much money they would donate to a charity (Syrian Refugee Fund) from their compensation of 15 dollars. A full script is as follows,

> "You will soon receive 15 dollars as compensation because you've completed this survey. How much are you willing to donate to the Syrian Refugee Fund from your compensation?"

Table 10 below shows a mean value of all participants' reported amount of donation to a charity. Since the participant's maximum compensation for this study was $15, they were allowed to donate money up to 15 dollars.

Table 10. Descriptive Statistics of the Report on the Amount of Participants' Donation

Donation (n = 105)	Mean	Minimum	Maximum	SD	Skewness
Amount of Donation from Compensation ($15)	$ 5.54	0	15	3.36	0.5

By looking at participants' responses, a deeper understanding of the relationship between immersive content and the user's attitude/behavioral change is possible, because we were able to see their degree of the behavioral intention of donation right after the experiment.

CHAPTER 4: RESULTS

Results

First, the power analysis calculated with Preacher and Coffman (2006)'s simulator to assessing sample size adequacy and statistical power and it showed a statistical power of 0.7.

As briefly discussed in the previous chapter, we created a new factor of Technology Acceptance towards interactive media by modifying original TAM survey questions to see a moderation effect between interactivity and presence, message engagement, and enjoyment. Therefore, a flow between components shown in the original model may not show the same with the modified questions.

It showed that there was no direct correlations between these components and behavioral intention which is a dependent variable of the study: PEU: $r = .113$, $p = .13$, PU: $r = .06$, $p = .28$, BI: $r = .145$, $p = .07$, AT: $r = .07$, $p = .26$.

Also, there were no major differences in the strength of the correlation coefficients between components (see table 11). For those reasons, the components, measuring individuals' level of technology acceptance towards interactive media, were converted into a single factor "Technology Acceptance" for analysis.

Table 11. Bivariate Correlation Matrix of Factors of Technology Acceptance in Analysis (*n* =105)

Variables	1	2	3	4
1. Perceived ease of use (PEU)	---			
2. Perceived usefulness (PU)	.62**	---		
3. Behavioral intention (BI)	.50**	.40**	---	
4. Attitude towards new tech (AT)	.43**	.42**	.58**	---

* $p < 0.05$, ** $p < 0.001$

Next, we tested if there were significant relationships or differences between participants' demographic variables such as gender, age, and race, and any pre-existing refugee attitudes and levels of technology acceptance.

Table 12. Characteristics of Subjects (n = 105)

Variable	Value	Frequency	Percent
Gender	Male	50	47.6
	Female	55	52.4
	Total	105	100
Age	18-20	20	19.1
(M = 23.46, SD = 3.37)	21-23	37	35.2
	24-26	31	29.4
	27-29	9	8.6
	30-32	8	7.7
	Total	105	100
Race	White	48	45.7
	Black/African American	6	5.7
	Hispanic/Latino/Latina	2	1.9
	Asian/ Pacific Islander	47	44.8
	Prefer not to disclose	2	1.9
	Total	105	100

A chi-square test of independence and correlation analysis were performed to examine the relation between (a) age (b) gender, and (c) race, and Technology Acceptance (TA). The results (N = 105) showed that there was a correlation between (a) age and TA (r = .22, n = 105,

$p < 0.05$) , but no association between (b) gender and TA ($\chi^2 = 25.90$, $df = 22$, $p = .26$), and (c) race and TA ($\chi^2 = 134.75$, $df = 165$, $p = .95$).

Regarding the relation between (d) age (e) gender, and (f) race and a pre-existing attitude towards Syrian refugees, the result showed ($N = 105$) there was no relationship between (d) age ($r = -.06$, $n = 105$, $p = .55$) $df = 308$, $p = .99$) (e) gender ($\chi^2 = 25.91$, $df = 22$, $p = .26$), and (f) race ($\chi^2 = 128.67$, $df = 110$, $p = .11$) and pre-existing attitude towards them.

Next, to test the hypotheses, multiple independent-samples T-tests, linear regressions, and path analysis were conducted. Regarding hypothesis 1, the result showed a significant main effect of interactivity. First, participants experiencing a Syrian Refugee crisis story reported in VR had a higher level of Spatial Presence (M = *4.96,* SD = *1.23*) than those who experienced the story with a computer screen (M = *2.90,* SD=*1.15*), $p < 0.001$.

Table 13. Study 1 Means and Standard Deviation of Interactivity (High: VR, Low: Screen) on Spatial Presence

Interactivity mode	*M*	*SD*	*N*	*t*	*df*	*p*
VR	4.96	1.23	52	8.866***	103	<0.001
Screen	2.90	1.15	53			

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Regarding hypothesis 1(b), participants experiencing a Syrian Refugee crisis story reported in VR a higher level of Social Presence (*M = 4.82, SD = 1.33*) than those experiencing the story with a computer screen (*M = 2.90, SD=1.32*), $p < 0.001$.

Table 14. Study 1 Means and Standard Deviation of Interactivity (High: VR, Low: Screen) on Social Presence

Interactivity mode	*M*	*SD*	*N*	*t*	*df*	*p*
VR	4.82	1.33	52			
				7.398***	103	<0.001
Screen	2.90	1.32	53			

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Regarding the hypothesis 1(c), participants experiencing a Syrian Refugee crisis story in VR reported a higher level of Message Engagement (*M = 5.32, SD = 1.29*) than participants experiencing the story with a computer screen (*M = 3.47, SD=1.19*), $p < 0.001$.

Table 15. Study 1 Means and Standard Deviation of Interactivity (High: VR, Low: Screen) on Message Engagement

Interactivity mode	*M*	*SD*	*N*	*t*	*df*	*p*
VR	5.32	1.29	51			
				7.555***	101	<0.001
Screen	3.47	1.19	52			

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Hypothesis 1(d) was also supported. Participants experiencing a Syrian Refugee crisis story in VR reported a higher level of Enjoyment (*M = 4.52, SD = 0.56*) than those experiencing the story with a computer screen (*M = 4.14, SD=0.52*), $p < 0.05$.

Table 16. Study 1 Means and Standard Deviation of Interactivity (High: VR, Low: Screen) on Enjoyment

Interactivity mode	*M*	*SD*	*N*	*t*	*df*	*p*
VR	4.52	.56	50			
				3.440**	99	<0.01
Screen	4.14	.52	51			

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Secondly, as shown from the results of hypothesis 1 (a), (b), (c), and (d), four factors and interactivity are correlated. We are looking at the individuals' Technology Acceptance level (TA) as a moderator on those paths. For analysis, two TA groups (low and high categorical variables) were categorized by participants' Technology Acceptance (TA) scores, and linear regression analysis was performed with them as it was hypothesized in a previous chapter. Each model with the moderator (model 2) will be compared with models without the moderator (model 1). Regarding hypothesis 2 (a), (b), and (d), the results showed that there was no moderation effect of TA on the relationship between interactivity and other factors (a) telepresence, (b) social presence and (d) enjoyment. From the regression analysis, it was shown that each model including TA as a moderator showed a good fit (e.g., Telepresence F (2, 101) = 39.91, p <.001, Social Presence F (2, 102) = 50.01, p <.001, Message Engagement F (2, 100) = 30.38, p <.001, and Enjoyment F (2, 98) = 6.12, p <.05). However, the moderator variable (coefficient) was not independently significant (p = n.s.).

On the other hand, the results showed that TA worked as a moderator for the relationship between interactivity and (c) message engagement F (2, 100) = 31.40, p < 0.001 and overall model fit was R^2 = .386 with a Durbin-Watson value of 2.04 indicating no autocorrelation (King & King, 2018) .

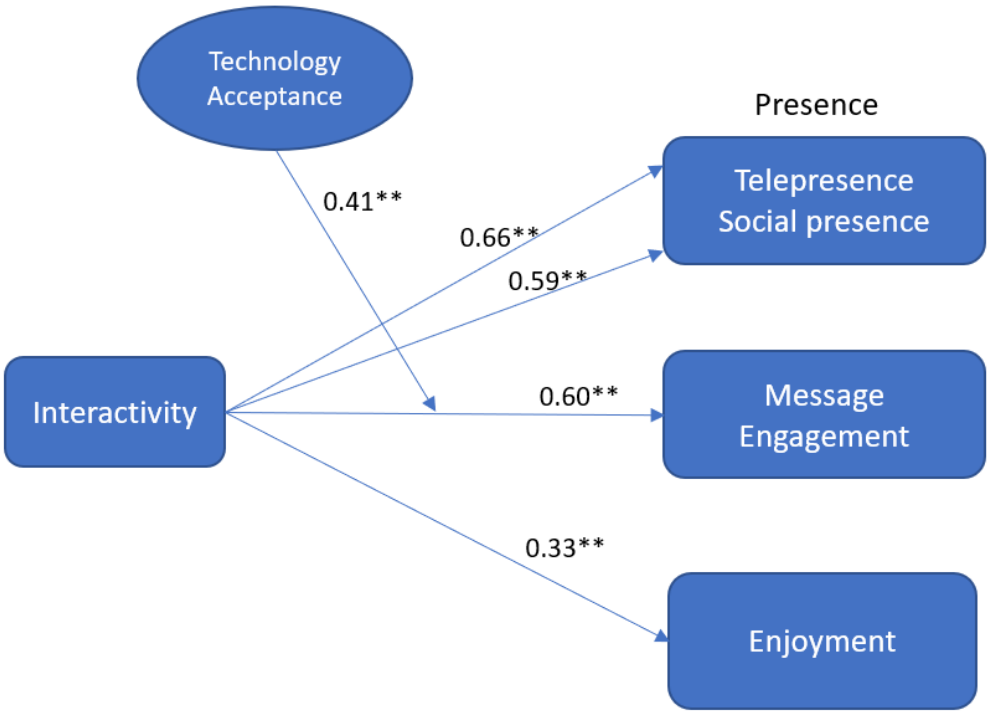

Figure 16. Correlation between Interactivity and (a) Telepresence, (b) Social Presence, (c) Message Engagement, (d) Enjoyment, and Moderation Effect of Technology Acceptance between Interactivity and (c) Message Engagement. (*values shown in standardized regression weights ** P < 0.001*)

Table 17. Standardized Effect of Interactivity on Message Engagement

Independent Variable	Moderator	Effect size (*standard error*)
		SE
Interactivity	NA	.27
	Technology Acceptance	.16

Third, hypothesis 3 was supported. The result showed that participants' heuristic processing of the message led to a higher level of positive message-consistent attitude change (the difference between posttest and pretest) $r = 0.29$, n=105, $p < .05$.

Fourth, hypothesis 4 was also supported. The result showed that there was a positive correlation between levels of message-consistent attitude change (i.e. differences between pretest and posttest of attitude change towards Syrian refugee) (M = 0.47, SD = 0.65)[1] and message-consistent behavioral intention (M = 5.54, SD = 3.36), $r = 0.23$, $n = 105$, $p < .05$.

Fifth, hypothesis 5 was partially supported. The results showed that the higher levels of telepresence (a) $r = 0.33$, $n=105$, $p <.05$, social presence (b) $r = 0.24$, $n=105$, $p <.05$, and message engagement (c) $r = 0.30$, $n=105$, $p <.05$ elicited the higher levels of heuristic processing, but no relationship between enjoyment (d) and heuristic processing (p = n.s.). See table 10 for details.

Table 18. Bivariate Correlation Matrix of Variables in Analysis (n = 105)

Variables	1	2	3	4	5
1. Telepresence	---				
2. Social Presence	.89**	---			
3. Engagement	.80**	.79**	---		
4. Enjoyment	.48**	.43**	.47**	---	
5. HSM (Heuristic processing)	.31*	.22*	.28*	.07	---

* $p < 0.05$, ** $p < 0.001$

Hypothesis 6 was found to be supported. The results showed that the higher level of interactivity elicited higher levels of heuristic processing $r = 0.26$, $n=105$, $p <.001$. Lastly,

[1] *M* represents a mean value of a factor Attitude Change, which was calculated a difference between pretest (pre-existing attitude towards Syrian refugees) and posttest.

hypothesis 7 was not supported. It was found that there was a correlation between some factors (e.g., (a) telepresence, (b) social presence, (c) message engagement and the amount of heuristic processing. However, the results showed that there was no evidence of any of these factors directly working as a mediator (p = n.s.).

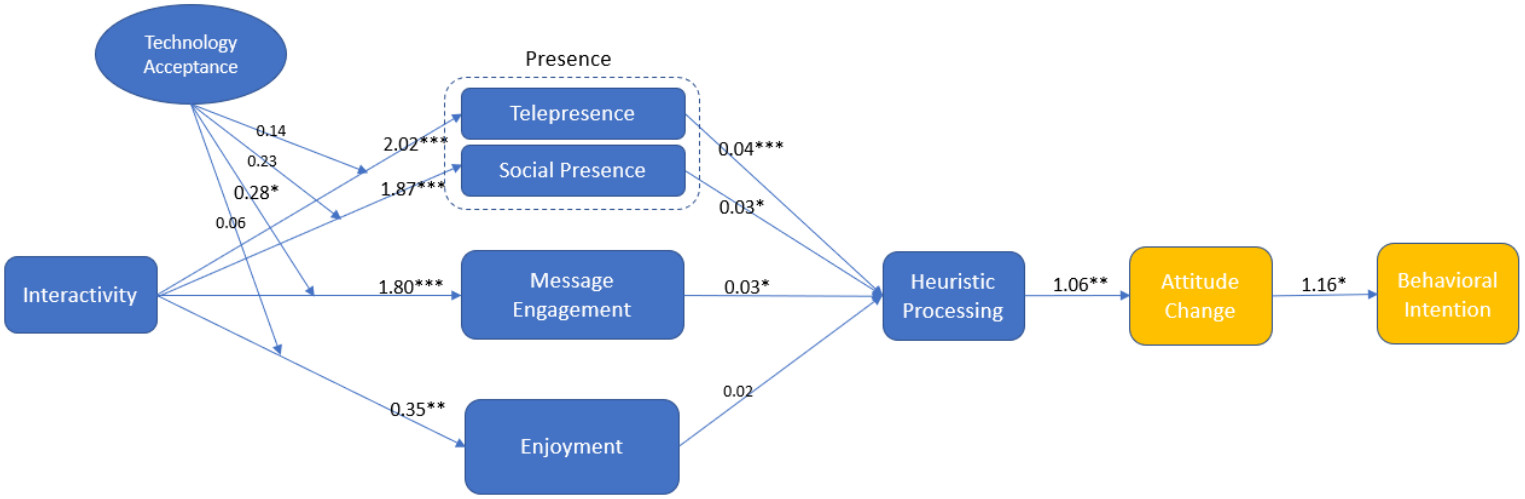

Figure 17. Result of Path Analysis of the Research Model *(values shown in regression weights, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$)*

Table 19. Bivariate Correlation Matrix of All Variables in Analysis (n = 105)

Variables	1	2	3	4	5	6	7	8	9
1. Interactivity	---								
2. Technology Acceptance	.14	---							
3. Telepresence	.66**	.16	---						
4. Social Presence	.59**	.20*	.89**	---					
5. Message Engagement	.60**	.22*	.80**	.79**	---				
6. Enjoyment	.33**	.13	.48**	.43**	.47**	---			
7. Heuristic processing	.36**	.14	.31**	.22*	.29**	.06	---		
8. Attitude Change	.50**	.17	.49**	.48**	.54**	.25*	.29**	---	
9. Behavioral Intention	.38**	.12	.37**	.29**	.30**	.20*	.30**	.23*	---

Notes: 7. Heuristic processing is the ratio to heuristc to systematic-relevant items. * $p < 0.05$, ** $p < 0.001$

Discussion and Limitations

The main effect of the results overwhelmingly shows that interactivity, when attended with a medium, is a strong cue to aiding the persuasive function of digital media indicating a greater natural/realistic way of human-computer interaction (less cognitive effort to understand a medium or think deeply about the issue of messages). In addition, virtual reality includes core components of interactive media (e.g., larger screen, better graphical fidelity, haptic feedback, stereo sound, head tracking (Lombard & Ditton, 2010)). Even though those were not measured as a factor in this study, we assume these characteristics were significant in shaping and reinforcing an individual's feelings of "immersion" in the virtual environment, which can be theoretically explained by the concept of presence (or a sense of *being there*) (Cummings & Bailenson, 2015). By adapting their rich and proven constructs of presence for this study, examining the effects of VR in persuasion has produced solid and statistically valid results.

One of the research questions, "feeling enjoyment in a serious topic of the message" , also showed a significant increment in the VR condition compared to the screen (2D) condition. This shows that individuals not only enjoy "experiencing" the message but also "sympathize" with a refugee crisis. Enjoyment has long been used to shape the positive effect of a message in communication (Wise, Bolls, Kim, Venkataraman, & Meyer, 2008). However, this study did not show strong evidence that enjoyment reinforced message-consistent attitude change even though there was a significant difference in enjoyment between two conditions. And because human cognitive processes are complex, the results even showed these two contrasting feelings might be stirred at the same time, weaking the relationship between enjoyment and attitude change.

It was also found that Technology acceptance (TA), when the information was delivered with a higher level of interactivity, could be used as a moderator to increase message

engagement, indicating a positive effect on message-consistent attitude change/behavioral intention. Understanding virtual reality as a medium for persuasion, the results also implied that a user's technological acceptance level towards interactive media plays an important role in persuasion. Even though VR provides a natural and realistic environment to users, their ability to be persuaded still depends on how much they accept the synthetic representation of the message.

Although virtual reality may seem easy to use compared to other digital devices, there are various reasons why some users reported it difficult to use, such as possible technical difficulties setting up the VR device on a computer, wearing a head-mounted display, or adjusting the focus on the HMD. Therefore, when using new technology for persuasive purposes, "technology affordance" should always be considered. It is important to be able to persuade those individuals with low levels of technology acceptance as much as those with high levels of technology acceptance. This concept should be strongly considered in the industry.

Furthermore, the relationship between one's cognitive process and persuasive outcomes (attitude or behavioral changes) strongly implies heuristic processing plays a significant role in "lowering" mental load. Here, users were more naturally guided to the purpose of the message. Therefore, technology (or a new, innovative interactive media) should be designed and developed to lower users' mental load in the context of Heuristic-Systematic information processing.

This study has its limitations. First, measuring the amount of systematic and heuristic processing remains challenging. As previously mentioned, quantifying complicated human psychological information processes by "word-listing" may not reflect them properly. The results did not show a strong relationship between HSM and message-consistent attitude change, but found statistically significant numbers for a good model fit. According to the model, guiding

heuristic processing can be a cue to attitude change, leading to behavioral intention (donation). At this point, it is important to investigate participants' mental loads with more accurate measures beyond word-listing , which has limitations. For example, a psychophysiological method for VR research in persuasion should be explored for future research.

As briefly discussed in the previous chapter, power analysis showed a power of 0.7 in sample size. Typically, the value of 0.8 is the desired power level. Therefore, a larger sample of participants was needed for stronger statistical power and validation of the paths we hypothesized.

Another limitation was user fatigue in the study (fatigue effect). Participants were asked to watch a seven-minute film and complete a set of questionnaires consisting of a total of 54 questions (including pretest and posttest). Participants took more than twenty minutes to complete the survey. Because of this, user responses may have been affected by fatigue. Shorter survey time would likely produce more accurate results.

Regarding measuring behavioral intention (donation), approximately five participants wanted more information on the charity "Syrian Refugee Fund" while they were taking the survey. For example, they wanted to know whether the charity was a credible, reputable, or trustworthy nonprofit organization (NGO). After the experiment, the participants reported that they would spend more if the charity was highly credible such as the United Nations Children's Fund (UNICEF). For future studies, more detailed information on the fund should be given to participants for more accurate measures of behavioral intention.

CHAPTER 5: CONCLUSION

Technology has become an essential tool in life. In the media, a more immersive and natural way of technological communication has been developed and is widely used today. However, not everybody gets the same "degree" of benefits from this technology.

This study mainly examined how the individual's level of technology acceptance towards interactive media would affect and shape their feelings of telepresence, social presence, message engagement, and enjoyment in the immersive virtual environment. In addition, the consequences of experiencing a persuasive message through an interactive medium, including 1) message-consistent attitude change, 2) behavioral intention were explored. It was found that technology acceptance worked as a moderator between interactivity and message engagement.

The findings of this experiment on cognitive absorption (Saadé & Bahli, 2005) imply that people who are more familiar with accepting/using new technology in their lives are more likely to attach (engage) with the message delivered through new technology (Virtual Reality). One reason for this may be that those who are less accepting of technology do not use as much cognitive effort in recognizing or utilizing new technology.

The results also showed that a higher level of technology acceptance increased the level of message-consistent attitude change and behavioral intention. We attempted to explain this attitude/behavioral intention with the Heuristic-Systematic model of information processing (HSM). As discussed previously, we wanted to quantify participants' cognitive efforts used for information processing in order to see if there was any cue to attitude change or behavioral intention. Adapting the concept of HSM, we assumed that when a user mainly processes information in a heuristic way, he or she is more likely to use less cognitive effort and

sympathize with the persuasive message (Syrian refugee crisis in this study). We found VR (high-interactivity) was leading participants to accept information in the heuristic way, not the systematic way. The Heuristic-Systematic model of information processing (HSM) may seem an abstract concept, yet understanding information processing to lower the cognitive effort of processing a message is a crucial aspect of persuasion.

APPENDIX

Appendix A. Technology Acceptance Questionnaire

Item with 7-point Likert Scale (Strongly disagree – Strongly Agree)

Perceived ease of use (PEU)	I find interactive media is easy to use	(peu1)
	Learning how to use an interactive media is easy for me	(peu2)
	It is easy to become skillful at using interactive media	(peu3)

Perceived usefulness (PU)	Interactive media (features) would improve comprehension of news/information	(pu1)
	Interactive media would increase my understanding performance of the information	(pu2)
	Interactive media could make it easier to remember information/messages	(pu3)

Behavioral Intention /intention to use (BI)	I intend to use interactive media as an information channel	(bi1)
	I intend to be a heavy user of interactive media When it comes to using technology in your life, would you say you are keeping up?	(bi2) (bi3)

Attitude towards new technology	I like to try out new technology when it's released.	(at1)
	I like new technology	(at2)
	I take advantage of using new technology	(at3)

Appendix B. Presence (Spatial Presence) Questionnaire (Temple Presence Questionnaire, TPI)

#	**Item with 7-point Likert Scale**
1	How much did it seem as if the objects and people you saw/heard had come to the place you were? (Not at all – Very much)
2	How much did it seem as if you could reach out and touch the objects or people you saw/heard? (Not at all – Very much)
3	How often when an object seemed to be headed toward you did you want to move to get out of its way? (Never – Always)
4	To what extent did you experience a sense of being there inside the environment you saw/heard? (Never – Always)
5	To what extent did it seem that sounds came from specific different locations? (Never – Always)

6	How often did you want to or try to touch something you saw/heard? (Never – Always)
7	Did the experience seem more like looking at the events/people on a movie screen or more like looking at the events/people through a window? (None – Very much)

Appendix C. Social Presence Questionnaire (Temple Presence Questionnaire, TPI)

#	**Item with 7-point Likert Scale**
1	How often did you have the sensation that people you saw/heard could also see/hear you? (Never – Always)
2	To what extent did you feel you could interact with the person or people you saw/heard? (None – Very much)
3	How much did it seem as if you and the people you saw/heard both left the places where you were and went to a new place? (Not at all – Very much)
4	How much did it seem as if you and the people you saw/heard were together in the same place? (Not at all – Very much)
5	How often did it feel as if someone you saw/heard in the environment was talking directly to you? (Never – Always)

6	How often did you want to or did you make eye-contact with someone you saw/heard? (Never – Always)
7	Seeing and hearing a person through a medium constitutes an interaction with him or her. How much control over the interaction with the person or people you saw/heard did you feel you had? (None – Very much)

Appendix D. Message Engagement Questionnaire

#	**Item with 7-point Likert Scale**
1	To what extent did you feel mentally immersed in the experience? (Never – Always)
2	How involving was the experience? (None – Very much)
3	How completely were your senses engaged? (Not at all – Very much)
4	To what extent did you experience a sensation of reality? (Not at all – Very much)
5	How relaxing or exciting was the experience? (Never – Always)
6	How engaging was the story?

	(Never – Always)

Appendix E. Enjoyment questionnaire

#	**Item with 7-point Likert Scale (**reverse coded)** (Strongly disagree – Strongly Agree)
1	I enjoy it
2	I feel interested
3	I like it
4	I find it pleasurable
5	It's very unpleasant **
6	It's a lot of fun
7	I find it energizing
8	It makes me depressed **
9	It's very pleasant
10	It's very gratifying

Appendix F. Attitude questionnaire (message) before after (pre/post test)

#	**Item with 7-point Likert Scale** (Strongly disagree – Strongly Agree)
1	Refugee crisis is a serious social issue
2	In general, I support the United States taking in refugees from the conflicts in Syria

3	The US government should take in more refugees, allowing them into the US
4	U.S. individuals and community groups (e.g. churches) should sponsor more refugees, helping them with funds and assistance to settle in the US
5	We should welcome Syrian refugees and help absorb them

Appendix G. Behavioral Intention

Script	**(from $0 to $15)** You will soon receive $15 as compensation once you have completed the survey. How much are you willing to donate to the Syrian Refugee Fund from your compensation?	

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