DIVING OR DROWNING?
IMMERSIVE IMAGES AND THEIR EFFECTS
ON THE PARTICIPANT'S EXPERIENCE

By

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Abstract of Thesis Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Master of Arts in Mass Communication

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The purpose of this study is to provide an overview of a sports-related, image-based immersive experience, as compared with the traditional viewing of sports pictures and videos. This investigation was conducted based on data collected though pretest and posttest measures, as well as computer monitoring, in a 2x2 factor design experiment, with interactivity and motion as the main factors. Exposure to, or interaction with, the four ensuing stimuli (interactive pictures, interactive videos, videos, and pictures) constituted the core of the experimental treatment. Borrowing from Steuer's approach to virtual reality, interactivity was conceptualized as the malleability of the medium's form and content.

This study provides the theoretical and empirical rationale supporting the idea that the interactive technology used in this study, whether still or animated, is indeed

immersive. Feeling of telepresence, or feeling of "being there," was substantially increased for participants who were in either of the two interactive settings.

However, beyond the immersive quality of the experience, the main question of this study, metaphorically formulated as two possible alternatives –diving or drowning– revolves around investigating how the participants perceived, and reacted to, this immersive experience. Did the participants feel overwhelmed by such an experience? Were they affected cognitively or emotionally by such conditions? If so, did these changes hinder or improve the mediated experience?

Although the findings of the present study suggest that that interactivity had no effects, positive or negative, on the cognitive process, it seems that the immersive images made the experience more arousing, increased the participants' feeling of being in control, and probably induced a more positive evaluation of the content in terms of perceived interest.

The principal proposition of the study is that the interactive feature, typical of immersive images, may allow the participants to better achieve their goals, which are operationalized using a uses and gratifications approach. Although in immersive conditions arousal increased as the participants' motivation for excitement increased, such proposition was not supported for the other three motivations –cognition, diversion, and parasocial interaction.

CHAPTER 1
INTRODUCTION

In the last three decades, the advent and development of interactivity has played an essential role in the evolution of media channels and content. From video games, to virtual reality, to Web buttons, interactivity has transformed the media landscape and is becoming a major component of future media production and use. Visuals, graphics and images play a fundamental part in this interactive environment because interactivity most often relies on visual stimuli to provoke a reaction from an active audience. In other words, visuals serve as a metaphoric revolving door between the source and the receiver. However, recent developments in new media technology have attempted to go beyond a bi-dimensional approach to visuals by simulating, by means of various technologies, a three dimensional presentation of visuals that puts the viewer in what is referred to as an immersive environment. From being virtual, flat revolving doors, visuals are moving to show off virtual rooms and surroundings. For Reeves and Nass (1996), "the screen is where the action is." We will go even further in this study and see whether the action can be *within* the screen, rather than *on* the screen.

This study aims at understanding the effects of the combination of interactivity and visuals on the viewers' experience in immersive environments. More specifically, the experiment developed in this study is used to investigate the effects that interactions with videos and still pictures have on the emotions and cognitive processing of the

participants. In other words, this study seeks to answer the fundamental question of whether videos and pictures are better enjoyed and more appropriate to convey information when their viewing is a passive activity or when they allow the user to interact with their content. Metaphorically, this question can be thought as the interrogation on whether a participants plunged in an immersive environment ends up diving in an exciting, arousing, and explorative world, or whether he or she drowns, overwhelmed by a confusing surrounding in which he or she loses control and points of reference. Sports provide the common environment for the four different settings of this 2x2 experiment: exposure to video, exposure to photos, exposure to interactive video, and exposure to interactive photos.

Need for Research

Interestingly, little scholarly research has been undertaken on either visual communication or interactivity from a mass communications perspective. The present study attempts to fill this void and to establish a theoretical link between both concepts.

From a theoretical standpoint, this study is important for several reasons. First, it sheds light on the concept of telepresence, which indicates that today's visual materials, such as virtual reality and television news stories, tend to simulate reality so that the audience tends to forget that the experience is mediated (Grabe et al., 1999).

Second, interactivity is often cited as a distinctive characteristic of new media.[1] Research on specific aspects, or definitions of interactivity, then, is likely to increase knowledge and understanding of the emerging and rapidly developing new media.

Third, there is a clear lack of research on the links that may exist between uses and gratifications and the effects of media on the individuals' experience in terms of cognition and emotion. More specifically, it has been shown that the perception and handling of media messages (e.g. recall) can be significantly influenced by the users' motivations, depending on what gratifications (e.g. increased knowledge) he or she seeks through media exposure. This study may help to better understand such process. This approach is also an attempt to advocate for closer ties between the fields of psychology and mass communication.

In addition, studies on mass media effects have traditionally relied on the one-way, sender-receiver model of communication. By integrating the notion of interactivity and active audience, this study seeks to expand the knowledge of mass media effects. More specifically, this study places the notion of active audience, operationalized through the integration of a uses and gratifications approach, as a core variable in mass media effects. In other word, this study investigates the theoretical bridges that exist among mass media effects, audience activity, uses and gratifications, telepresence, and interactivity.

This approach has strong methodological implications and manifests a desire to rely on previous research and theories to find new methods and perspectives that are adapted to the study of new media. Indeed, in view of the limited potential of traditional

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[1] See for instance Williams et al. (1988).

methods for understanding new media, many scholars have argued for the finding of new methods that are suitable to the study of new media. In the context of the present study, such an attempt seeks to answer, or at least brings some elements of answers, to Vorderer's interrogations:

> Are researchers capable of explaining interactive entertainment? Are new hypotheses, theories, and models needed to first conceptualize what interactive media use is? Is it necessary to describe and explain why some forms of interactive exposures are considered to be enjoyable but not others? Is it necessary to answer the question of why some users enjoy interacting with the media while others strive to avoid doing so? (2000: 23)

From a more practical perspective, such an investigation presents important insights for both the entertainment and the news media industries, which make extensive use of the combination of these two communication tools. Online news services are transforming the way information is presented by shifting their story-telling techniques from a linear structure to one that is interactive and better fitted to the audience's particular interests, and by relying on new techniques to present clearly and appealingly the news in an increasingly competitive market. As visuals are an important part of news presentation, online news services strive to incorporate them into their product. However, online news producers are still unaware of how to maximize visual use (Davis, 2000). While visuals, and especially moving images, remain a limited feature of the Internet due to the still insufficient bandwidth and memory available, the advent of broadband technology and other improvements in computer technology promises to present a major challenge for the development of original visual content. The question of the interactive visual, then, will certainly become crucial in the future of new media applications.

Moreover, educational media are now relying heavily on interactive materials (e.g. CD-ROMs teaching children how to count). This study, then, could provide insights

into the effects of such materials on memory, recall, and enjoyment. Similarly, as the Web and Digital Versatile Disc (DVD) grow exponentially while interactive television is at its early stage, this study may find numerous applications in mass communications, from advertising, to movie production, to political communication.

In addition, the issue of the combination of interactivity and visuals is at the core of the current HDTV dilemma. Indeed, broadcasters have to choose among High Definition Television (HDTV), Standard Definition Television (SDTV), and data stream in the allocation of their bandwidth. For instance, they can simultaneously broadcast, in addition to data stream, one of two things: (1) Two, high-resolution television programs, or (2) four to six standard definition programs. The latter would allow for multicasting - or multiplexing- and thus, add interactivity to the program (e.g. change camera or camera angle). The former would increase image's quality, therefore enhancing what could be qualified as passive television viewing. Hence, it could be argued that the HDTV dilemma comes down to a choice between allowing active, interactive experience on one hand, and increased passive viewing relying on high-quality images on the other hand. This critical issue has tremendous business and content-related consequences, and is tightly related to the combination of visuals and interactivity in media content. In this context, although this study will not survey all the possible options available to HDTV (e.g. data stream and e-commerce) it could point to new directions for the development of HDTV programs.

Finally, and most importantly, it is often assumed, among industry professionals in particular, that individuals *long for* interactivity. However, non-academic research has found competing results for such assertion. As Williams (2001) recounts in a recent

newsletter of *The Standard*, a study from the Cable and Television Association for Marketing found that seventy-nine percent of digital cable subscribers reported being interested in interactive TV services. As tThese findings openly contradict a Cyber Dialogue study, which reports that "about 70 percent of adults aren't interested in any kind of tube-based interactivity" (Williams, 2001). The lack of thorough rationales and evidence supporting the assumption that consumers want interactivity has led to dramatic failure of large-scale, expensive projects, such as Time Warner's Full Service Network three-year drama in Orlando, and Bell Atlantic's Tele-TV.

Research Problem

As Vorderer explains, "It is indeed often expected that the audience will accept and even seek out new forms of media use if they can receive entertainment in the process" (2000: 22). According to Vorderer, supporters of interactivity argue for increased interactive features in media systems based on the facts that interactivity empowers the user and that users tend to favor content that fits their personal interests, needs, and desires[2] –a process in which interactivity plays a crucial part.

On the other hand, it has been recurrently found throughout research that watching TV is often qualified as relaxation and is often associated with other activities (Hallenberger, 1995). To convey the passive role of individuals in front of TV screens, scholars have nicknamed television viewers "couch potatoes" and qualified television

[2] See for instance the success of cable television and the trend toward increased fragmentation of the audience.

viewing as “the modern form of idleness” (Vorderer, 1992). Interactivity, which implies users’ active role, would therefore not seem suitable for the TV audience, who “do not want to be mentally challenged” (Vorderer, 1995).

This ambiguity over the need for interactivity has led Vorderer to wonder:

> Does the audience desire interactivity at all? What do TV viewers gain and what do they lose when television goes interactive? Is the interactive user of video games or the Internet entertained, and are the experiences thereby made worthwhile or simply gratifying? Does interactivity overwhelm those who in the past have become accustomed to being passive in front of a screen or a mediated text? (2000: 23)

The present study goes beyond the sole notions of interest and pleasure that interactivity might triggers. It explores the effects of interactivity on immersion, cognition, and emotions. By focusing on these three fundamental components of the individuals’ experience, this study takes on a more in-depth perspective on the nature of the interactive experience than a mere study of interest and preference. The following questions constitute the core of this study’s research problem:

- Is interactivity purposive? That is, does it contribute to make the users better satisfy their needs? For instance, does a user who wants to be entertained by watching sports get more entertainment thanks to interactivity in general, and the increased control over the experience that interactivity offers in particular? Or does a user who watches games to fulfill information-related needs increase his or her information gain by using interactivity?
- Does interactivity facilitate cognitive process?
- What are the effects of interactivity on emotions?
- Does familiarity with interactivity affect emotions in the interactive experience?
- Is the interactive experience more pleasant?

- Does interactivity trigger interest in the content?
- Finally, do immersive images really mean immersive experience? Do they actually increase the feeling of "being there" and the intensity of response?

Scope of the Study

The study uses the recently developed IPIX technology to investigate the effects of interaction on the participant's experience. This technology captures pictures and videos in a 360° x 360° field of view and allows the user to pan around, zoom in and out while the picture is presented or the movie is streamed. However, this study will strive to go beyond the specific technological aspects of IPIX technology and consider the conceptual foundations and implications of interactivity in general and interaction with visuals in particular. Indeed, as Chen notes, "Research that looks beyond the technology of each new medium to its underlying content and symbols will enable theoretical progress that does not stop at the border of each machine" (1984: 284).

It should also be emphasized that, while this study relies on concepts that are traditionally used in behavioral and attitudinal research (e.g. advertising studies and market analysis), the scope of the present research lies within the field of mainstream mass communication theory. Indeed, this study neither focuses on persuasion theories, nor does it undertake a consumer-oriented approach. For this reason, sports, which is at the crossroad of journalism and entertainment, has been chosen as the type of content under investigation.

In addition, as Bryant & Raney (2000) note, “watching sports on television is a prominent contemporary social phenomenon.” Sports programming, and viewership, have increased dramatically in the last three decades and televised sports events, nationally and internationally, make up most of the list of top rated programs. As a matter of fact, “more than one third of all programming on broadcast network television is devoted to sports events, [and] five of the Top 10 rated U.S. television programs of all time are sporting events” (Bryant and Raney, 2000: 157). Hence, the importance of sports in media content makes it a priority “field” for the study of mass media.

CHAPTER 2
THEORETICAL FOUNDATIONS

This study borrows from various concepts and areas of communication research. Indeed, its research problems are based on a blend of interactivity, virtual reality, uses and gratifications, media effects, and entertainment theories.

Literature Review

Interactivity Defined

The issue of defining interactivity

As Jensen (1999) explains, interactivity, like other terms such as multimedia, information superhighway, and digitization, has become a "buzz word" that is frequently used and that has different, often obscure meanings. Indeed, Jensen notes that the term interactivity has not only entered common usage, which has been triggered by the recent development of a plethora of interactive technologies and applications such as the Internet, ATMs, VCR, computers, kiosks and the like, but it has also become a hype word. For instance, the advertising and the entertainment industries frequently use the term "interactivity" as a generic adjective to increase the sales of new products and

services. Such confusion, Jensen notes, clearly is an obstacle for the academic world, which needs to work with clearly and precisely defined terms. As Raphaeli puts it,

> Interactivity is a widely used term with an intuitive appeal, but it is an underdefined concept. As a way of thinking about communication, it has high face validity, but only narrowly based explanation, little consensus on meaning, and only recently emerging empirical verification of actual role. (1988: 110)

In addition, it seems that depending on the approach taken (e.g. from a systemic standpoint or from the "end users" point of view, or from an interface-oriented perspective), different, sometimes conflicting definitions of interactivity are given.

Definitions of interactivity

In the last two decades, several scholars have attempted to define interactivity, but as Massey and Levy (1999) point out, attempts to define interactivity have led to the emergence of differing views. Because interactivity is a complex concept that can have different forms, many of these scholars have also tried to classify the different types of interactivity that can be found in the media and communication technologies. A review of these different views and definitions will help us define interactivity as it should be conceptualized and understood in this study and establish the context, applicability, and limits of the study by clearly indicating to which type of interactivity this study applies. It may also help us place the results and implications of the study in the broader context of interactivity by relating the specific concepts used in the study to similar conceptual definitions of interactivity.

Heeter (1989) defines interactivity as a multidimensional concept and presents its six components. The first dimension of interactivity revolves around the complexity of choice. This dimension, Heeter notes, refers to what Rice (1984) called "amount of

choice available to the user." It can also be related to the notion of selectivity, defined as "the extent to which users are provided with a choice of available information" (Heeter, 1989: 222). The second dimension has to do with the "amount of effort a user of a media system must exert to access information" (Heeter, 1989: 222). This refers to Paisley's idea (1983) that interactivity can be viewed as the ratio of user activity to system activity. Within this dimension, VCRs are more interactive than broadcast media because users have to go to the store or tape the desired program instead of merely switching channels. It is interesting to note, though, that according to this definition, both VCRs and broadcast media are considered interactive. The third dimension concerns the responsiveness to the user, that is, "the degree to which a medium can react responsively to a user" (Heeter, 1989: 223). This definition integrates Rafaeli's (1985) definition of interactivity as "how responsive is a medium to a user." Within this dimension, a high level of interactivity is achieved when the roles are interchangeable (e.g. between end users or between the source and the receiver). Heeter's fourth dimension of interactivity considers the potential to monitor information use as a characteristic of interactivity. Ease of adding information, or "the degree to which users can add information that a mass, undifferentiated audience can access" (Heeter, 1989: 224) is the fifth dimension of interactivity. This refers to the notion of the user adding or creating content. Facilitation of interpersonal communication (e.g. email) constitutes Heeter's sixth dimension of interactivity.

Prior to providing his own definition of interactivity, Jensen (1999) presents a good review of the different definitions communication scholars have given to interactivity. While many, including Jensen, agree that we do not know which medium

will prevail in the realm of interactive programming, Jensen asserts that viewers' interaction in interactive television is "a decisive aspect of the program and a factor for its completion" (Jensen, 1999: 16). This shows that interactivity should be understood as a fundamental aspect of communication content and not just as an additional function of communication technology. According to Jensen (1999), there are three principal ways of defining interactivity: It can be defined as a prototype, as a criterion, or as a continuum. For instance, Jensen explains, Durlak's (1987) notion of interactivity, which states that face-to-face communication is the ideal type of interactive communication, fits into the definition of interactivity as a prototype. According to Jensen, Miller's (1987) and Carey's (1989) definitions of interactivity fit into the criteria approach. Miller defined interactivity as a process "involving the active participation of the user in directing the flow of the computer or video program; a system which exchanges information with the viewer, processing the viewer's input in order to generate the appropriate response within the context of the program." In *International Encyclopedia of Communications*, Carey defined interactive media as "technologies that provide person-to-person communications mediated by a telecommunications channel (e.g. telephone) and person-to-machine interactions that stimulate an interpersonal exchange (e.g. electronic banking transactions)" (1989: 328). As Jensen notes, Miller's and Carey's definitions, while relatively exact, exclude many media that are considered interactive (e.g. videotext, video on demand). Heeter's definition of interactivity would fit in what Jensen called the continuum approach. The continuum approach can be better understood when considering Vorderer's assertion that "interactivity is not something that either exists or does not exist." "Instead," Vorderer adds, "there is a continuum that acknowledges

different degrees of interactivity: continuous interaction with the media being at one extreme and having the potential only to start or stop a reception at the other extreme" (2000: 25). Steuer's bi-dimensional approach to interactivity would also fit into the continuum classification. According to Steuer, vividness, "the ability of a technology to produce a sensorially rich environment," and interactivity, "the degree to which users of a medium can influence the form or content of the mediated environment" (p. 80) are two intertwined concepts. (Steuer's approach is presented in detail in the Virtual Reality section bellow.) Other multidimensional, continuum-based definitions of interactivity include the classifications of Szuprowicz, Laurel, and Goertz. Szuprowicz (1995) characterizes interactivity as depending on the type of information flow: user-to-document (choice of information and time of access), user-to-computer (manipulation of material), or user-to-user (collaborative transaction). Laurel (1990) identified three variables in interactivity: frequency (i.e. how often can the user interact), range (i.e. amount of choice), and significance (i.e. impact of choice). Finally, Goertz (1995) distinguished four dimensions in interactivity: Degree of choice available, degree of modifiability, quantitative number of the selections and modifications available, and degree of linearity or non-linearity. As Jensen notes, many of the typologies presented above include categories that are overlapping.

While Jensen agrees that "there are different forms of interactivity, which cannot readily be compared or covered by the same formula," (1999: 59) he attempted to give a comprehensive definition of interactivity: "A measure of a media's [sic] potential ability to let the user exert an influence on the content and/or form of the mediated communication" (1999: 59). His subsequent typology borrows from the Bordewijk and

Kaam's media typology, which established a 2 x 2 matrix with two dimensions – distribution of information (central provider/consumer) and production of information (central provider/consumer) – resulting in four media categories (transmission, consultation, registration, conversation).

Consensual definition of interactivity

In general, then, it appears that all the definitions scholars have given of interactivity implicitly or explicitly present as a fundamental principle the idea of the viewer having control over the information. The idea of control can range from consumer's actual production of information (e.g. email) to the consumer's influence on how and when the information is presented to him or her. Active audience and users exerting control over information flow (content's access, selection, presentation etc.) seem to be the recurrent themes in the various definitions of interactivity. Khoo and Gopal (1996), for instance, insist on the fact that interactivity, at least in the context of online journalism, empowers the user. Seeing from the other side of a coin, interactivity results in the producers giving control over content to users. Khoo and Gopal call this phenomenon "prosumerism." Massey and Levy (1999) refer to it as "content interactivity."

Certain definitions of interactivity distinguish "content" interactivity from interpersonal interaction. This is the case, for instance, in Morris's and Ogan's (1996) definition of interactivity, which emphasizes the interpersonal potential of interactivity. Similarly, Williams et al. distinguish psychological (i.e. cognitive and perceptual process) from social (i.e. interpersonal) involvement and interaction. This last distinction seems

particularly appropriate in the context of this study, which focuses on cognitive and perceptual interactions, rather than on the interpersonal potential of interactivity.

Similarly, the field of human-computer interaction (HCI), which applies interactivity-related theories to hardware and software and investigates the notion of interaction within the context of computer-based environments, distinguishes interactions with computers from interpersonal communications mediated by computers, referred to as computer-mediated communication (CMC). However, HCI posits that interaction with computers does, or should, mimic interpersonal communication. Indeed, interaction with computers, according to the HCI approach, should be conversational and convivial. Reeves and Nass extend this approach to any communication with any given media. They refer to this principle as "the media equation," which asserts, "individuals' interactions with computers, television, and new media are fundamentally social and natural, just like interactions in real life" (1996: 5). HCI scholars, such as Laurel (1992), use the term "natural language" to designate the ultimate interaction between the user and the computer, in which a computer "carry on a 'natural' conversation with a human user" (p. 345). Therefore, as Jensen (1999) explains, interaction and interactivity seem to be synonymous in informatics. This view differs from the multidimensional conceptualizations of interactivity that are presented above and that consider human-machine interaction as only one of the dimensions of interactivity. For instance, Heeter notes, "person-to-machine interactions are a special form of communication" (1988: 231).

Because this study integrates the notion of interactivity into the notion of immersion, the specific definition of interactivity we will use as a theoretical framework is the definition of Steuer (1992), presented in details later in this chapter.

Interactivity and Communication Models

An active audience

The notion of active audience is not new. Almost forty years ago, McLuhan (1964) coined the terms "cold media" and "hot media." According to McLuhan, the classification of a medium as "hot" or "cold" depends on the involvement, or amount of information processing, required of the user during his or her experience with the medium. In addition, the notion of purposive feedback (e.g. letter to the editor) that Heeter (1988) opposes to non-purposive feedback (e.g. audience research), also demonstrates that the idea of active audience has been in the mass communication realm for decades. However, according to Heeter (1988), a fundamental implication resulting from the notion of interactivity is that the information is always sought or selected, not merely sent. Indeed, he adds, "activity is a user trait as well as a medium trait" (1988: 228). Both the user and the medium can have different activity levels. The user as an active participant is indeed the cornerstone of the notion of interactivity. Vorderer corroborates this view and asserts, "it is the participant who decides how much interactivity he or she wishes to employ in a specific situation" (Vorderer, 2000: 26). The notion of feedback, as conceptualized by Wiener in *The Human Use of Human Beings* (1954), was the first attempt to acknowledge that the receiver was having an active part in the communication model. While Wiener first used the term feedback in the context of

humans' interactions with machines –the "control of a machine on the basis of its actual performance rather than its expected performance" (1954: 24), – the term has been broadened to apply to any mass mediated –and even interpersonal– communications. As such, feedback can be understood as any signal that is sent "from the destination back to the source which help[s] the communicator correct subsequent output" (Severin & Tankard, 1979: 45). However, as Heeter notes, interactivity goes beyond the traditional understanding of feedback because the user is able to become a "full fledged deliverer of messages." Therefore, he or she becomes both a sender and a receiver.

Vorderer brings a critical view on the active audience and interactivity duo. Indeed, while the notion of active audience assumes an intention-based process on the part of the individual (Levy & Windahl, 1984), Vorderer stresses that there is no empirical evidence on whether the audience wants to be active or not. He sums up a point made by Schönbach in 1997, "TV viewers do not really care about being active as much as communication researchers may think" (2000: 28).

A new communication model

Nevertheless, audience activity seems to be cornerstone of interactivity. Consequently, it seems that the pervasiveness of interactivity in modern communications challenges the traditional understanding of the communication process, which has revolved around the model of one-way flow of information developed by Shannon and Weaver (1949). Indeed, while the dominant approach to communications has evolved over time – from the hypodermic needle theory, to the notion of two-step-flow, to the concept of social categories and so forth – the Shannon-and-Weaver model has prevailed implicitly (before 1949) or explicitly in research on communication effects. Only the

uses and gratifications theory has moved away from what Heeter refers to as a "purposive approach" that focuses on the sender of the message. In the context of interactivity, Lasswell's verbal model "who says what to whom in what channel with what effect" (1948) seems indeed an oversimplification of the communication process and can barely integrate the notion of true audience activity. Furthermore, as Heeter noted in reference to interactive services then available on Compuserve –the term Web site was unknown at the time– "the distinction between source and receiver is not present in all media systems" (1988: 232) and there is a blurred line between mass and interpersonal communication. While these distinctions do not apply entirely to some interactive services relying on central content providers (e.g. news services), as it is the case in this study, the empowerment of the user and his or her crucial role in deciding which and when information is accessed are, in any case, present in all interactive communication systems. This is enough to challenge the traditional communication model and make its application for interactivity inappropriate at the three levels – technical, semantic, effectiveness – to which this model may apply. As Rogers and Chaffee (1983) assert, one can wonder whether the term "participant" will eventually replace the notion of source and receiver, and whether "information exchange" will forever replace the word "communication."

New methods

Therefore, as many scholars agree that the traditional conceptualization of communication is inadequate to analyze and investigate new forms of communication and new media, most of which rely on interactivity, many scholars also acknowledge the necessity to adopt new research methods. Heeter (1988) for instance, recognizes that

there are inadequacies in the traditional model of communication and that there is a need to reconceptualize communication. Rafaeli (1988) acknowledges that "interactivity is quintessentially a communication concept . . . its time has come for communication research. . . . Interactivity is a special niche reserved for communication scholars." For Rogers and Chaffee, "scholars are going to have to shift toward models that accommodate the interactivity of most of the new communication technologies. New paradigms are needed, based on new intellectual terminology" (1983: 25). This view is also shared by Rice and Williams, who state, "new media, may, in fact necessitate a considerable reassessment of communication research. Intellectual changes must occur to match the growing changes in communication behavior" (1984: 80). Jensen also advocates radical changes in communication research: "The new media represent a growing challenge to traditional media and communication research that necessitates a thorough rethinking of all central models and concepts" (1999: 31). Finally, Rogers confirms the importance of changing the methods and states: "The Communication Revolution now underway in Information Societies is also a revolution in communication science, involving both models and methods" (1986: 213). Yet, despite these claims and numerous praises for changes in communication studies, no new radically new models or methods have been developed in research in general, and in empirical studies in particular.

Uses and Gratifications

Theory overview

Katz et al. (1974) explicitly stated the concept and assumptions of uses and gratifications: "Audience is conceived of as active, that is, an important part of mass media use is assumed to be goal-directed." This assumption is based on the basic principle that "humans can choose among alternative courses of action in the pursuit of their goal" (Reichenbach, 1951; Miller, 1983: 31). As White points out,

> Initially, communication was conceived in terms of a relatively simple paradigm as a direct transfer of a message from the source to the receiver. It was assumed that the completion of the transfer depends largely on the ability of the source to make the receiver accept and implement the message as the source intends . . . Virtually every attempt to test some version of this paradigm revealed "anomalies" which suggested that the activity of the receiver and the sociocultural conditions of the receiver are far more important in the communication process than the initial paradigm would imply. The anomalies have accumulated to the point that a new "receiver-centered" paradigm, or a paradigm in which interacting individuals together create meaning, is proposed as more adequate than the original source-message-receiver model. (1983: 279)

As a result, "Among communication researchers, a respect for the role of human volition has replaced the law-governed, deterministic paradigm of communication behavior" (Miller, 1983: 21). It is therefore crucial, as Rogers and Chaffee (1983) explain, to understand that audiences are characteristically differentiated. In addition, it should be emphasized that the uses-and-gratification approach is geared toward understanding media use and media effects. More precisely, media effects are at the heart of uses and gratifications. Indeed, according to Blumler (1979), there has been equivalence between uses and gratifications research and effects research since the formulation of the uses and gratifications theory. Therefore, as Schramm argues, "now the audience has as much to do with the effects as the communicator. Information flows

both ways" (1983: 14). The validity of this approach has been substantiated by empirical research, which has shown that gratifications orientation influences effects process, either by supplementing exposure influence or by interacting with them (Blumler, 1979). It should also be noted that uses and gratifications has most often been applied across media, rather than within a given medium.

Finally, according to Blumler, among the many needs that have been developed in uses and gratifications typologies, three orientations "have surfaced … with such regularity and distinctness that they clearly deserve focal attention from the standpoint of their likely effects repercussions" (1979: 17). These three main categories are:

- Cognitive orientation (e.g. surveillance, exploration)
- Diversion (e.g. relief from boredom, excitement)
- Personal identity

Therefore, the present study will use these three main categories to assess the orientations of participants.

Palmgreen et al. (1980) provide a detailed explanation of Blumler's typology of uses and gratifications orientations. The cognition orientation, or surveillance, mainly reveals a desire for information seeking on the part of the individuals and capitalizes on the information potential of a given media, while the diversion orientation relies on the escape, entertainment, and arousal functions of the media.

The personal identity orientation, Palmgreen et al. explain, "helps the individual establish a 'social location' in relation to others through two interactive comparison processes." (1980: 168). These two comparison processes –interaction *with* media characters and interaction *about* media characters and events– are of particular interest in

this study. Interaction about media characters is tightly related to the cognition orientation function: the participant seeks information that he or she will be able to share later. According to Palmgreen et al. this function of the mass media has been identified by several researchers and given different labels: It has been referred to as "interpersonal identity" (Swanson, 1977), "anticipated communication" (McLeod and Becker, 1974), and "communicatory utility" (Atkin, 1972). While the final purpose of this orientation – interaction with others– differs from the one of the cognition orientation –increased knowledge on a topic, character, or event– both orientations seem to be identical in the sense that they both focus on information seeking and both rely on the cognitive orientation of the individuals. The other sub-function of personal identity, interaction with media characters, has also been extensively researched and is referred to as "parasocial interaction" by Palmgreen et al. This orientation is closely related to the notion of immersion and telepresence, developed later in this chapter. The present study will therefore take into account the two aforementioned components of personal identity, parasocial interaction and (information seeking for) interpersonal utility.

Furthermore, according to Blumler (1979), uses and gratifications theory and research lead to several postulates. First, cognitive motivation facilitates information gain. Second, "media consumption for purpose of diversion and escape will favor audience acceptance of perceptions of social situations in line with portrayal frequently found in entertainment materials" (p. 18). Third, "involvement in media material for personal identity reason is likely to promote reinforcement effects" (p. 18).

It should be noted that the uses and gratifications approach has far reaching implications that go beyond the theory level and are particularly appropriate for applied research, such as the study of media consumption pattern. As Ferguson and Perse explain,

> Few media are uniquely capable of fulfilling all goals, so people select from among functional alternatives, or media that can fill similar goals. Cable television and videocassette recorders (VCR), for example, are functional alternative to broadcast television for relaxing entertainment. But both cable and VCRs fulfill that need better (2000: 157).

Uses and gratifications and interactivity

As mentioned previously, there has been some attempts in communication research toward integrating the notion of active audience (e.g. feedback, uses and gratifications), while, at the same time, technologies such as interactivity have actually made the audience active. The notion of active audience is at the core of both interactivity and the uses and gratifications theory. As Chen notes, "We begin to see that passivity and interactivity are qualities of individuals making use of the media, not the media themselves" (1984: 284). This proposition, which corroborates the recent trend toward a user-centered approach to communications, refers to the-uses and gratifications theory by acknowledging that even the individuals' passivity toward a given media is purposive. Indeed, even the lowest level of interactivity (e.g. switching on the TV) calls on the principle of gratifications sought.

Several studies have explored motivations and uses and gratifications differences between media considered as interactive (e.g. the World Wide Web) and traditional media (e.g. television). As Ferguson and Perse explain, "research has consistently found that television is used mainly for relaxing entertainment followed by need to pass time and for information" while the World Wide Web is mainly used for information seeking.

(2000: 157). In a survey investigating World Wide Web use, Ferguson and Perse found that "Entertainment is only modestly endorsed by respondents; passing time and relaxation are rarely mentioned."

However, in their study, which sought to answer the question on whether surfing the World Wide Web is a functional alternative to TV viewing (i.e. whether surfing the Web fulfills the same needs as watching TV), Ferguson and Perse (2000) found that 1) "like TV, the Web is seen as a source of diversion and entertainment," 2) "the Web may also compete with television as a way to pass time," 3) the main functional difference between the Web and television is that relaxation is the second most important reason for watching television while it is not a substantial motive for surfing the Web.

Corroborating these findings, a Papacharissi and Rubin (2000) study, which used factor analysis, found five principal motives for using the Internet: interpersonal utility (18.1% of variance), pass time (7.5% of variance), information seeking (8.3% of variance), convenience (6.2% of variance), and entertainment (4.2% of variance). While interpersonal utility seems to be a major motive for using the Internet, it should be emphasized that it cannot be applied to all interactive technologies or content, as it is the case in the present study.

In addition, it should be noted that while uses and gratifications studies usually are medium-specific (e.g. studies across media), this study focuses on content-related uses and gratifications. Palmgreen and Rayburn (1979) refer to this level of abstraction as the medium component level. This approach appears to make sense in contemporary media research because the increasing convergence of communication channels renders distinctions among media difficult. For instance, it seems trivial to merely distinguish

computer use from television watching considering that today's technologies allow individuals to watch the same news program on television and through streaming video. A redefinition of modern content seems therefore crucial, but is beyond the scope of this study. A tentative definition of content, suitable for the present study, uses a multidimensional approach to content. Two dimensions are identified: style (e.g. news, sports, talk shows), and functioning –or mechanical aspects and structural characteristics– such the presence and/or type of interactivity featured in the content. While the distinction between form and substance has been around for a long time, modern communications in general, and convergence in particular, call for an integration and redefinition of these two concepts.

Familiarity

The notion of the user's familiarity with media technology, characteristics, and functioning applies to all types of media. Vorder (2000) and Grodal (2000) agree in saying that the users' control is "not absolute but relative to their skills." Fredin and Krendl defined a media frame as "a structure of expectations individuals apply to organize and understand their experiences with a particular medium. It is evoked whenever the medium is being thought about or is present" (1984: 2). In addition, they explain that a media frame evolves over time depending on the experience the user has with the medium. Corroborating this view, Rice and Williams cite a theory of Borgman (1982) that says that "Humans, no matter their level of experience, develop images [of a technology] that lead to a conceptual representation of a device which is used in interacting with that device" (1984: 65).

In addition, the notion of familiarity seems to have a crucial importance in interactive media. Indeed, familiarity with interactivity, according to Tafler, can radically change the viewer's experience: "The viewer can choose to navigate these [interactive] paths either at random, much like wandering through a gallery, or with an increased understanding of a new interactive vocabulary" (1995: 252). In other words, familiarity can shape the interactive experience:

> When an individual encounters an interactive system and makes a commitment to cognitively map its cybernetic corridors, the early trials signal the extent to which the program will allow the viewer-participant the latitude to determine the conditions shaping his or her exploration. (1995: 236)

Interactive experience, according to Tafler, recreates the participant's own coming of age. Tafler goes even further and explains that unfamiliarity is a quintessential attribute of interactivity:

> With growing exposure to interactive instruments and tools, the viewer-participant's experience accommodates to that growing familiarity. Older systems motivating predictable response patterns lose their interactive condition. For an interactive condition to reemerge, newer systems must restore the challenge of the unknown. (1995: 262)

These assertions show the importance of taking into account familiarity with specific interactive tools when trying to understand media use and effects. One should be aware, though, that the latest assertion of Tafler is unscientific, almost value-laden, for one cannot rationally conceptualize "interactive conditions" in terms of the "unknowingness of the environment or setting." Indeed, using familiarity as the only criterion defining an interactive condition seems to reflect a simplistic definition of interactivity.

Beyond familiarity with the interactive instrument, the participant's familiarity with elements of the interactive experience seems also crucial. As Tafler notes, "The

linkages that an individual makes with varying elements in his or her history, understanding, and knowledge will determine the vividness of his or her encounter" (1995: 254). This seems to make sense in the context of interaction with sports games. Indeed, habits of attending or watching televised sports games can greatly influence the manipulation of the interactive instrument (e.g. the manipulation can imitate head movements or camera shots).

Uses and gratifications and sports

Several mass communication scholars have investigated motives and uses and gratifications related to viewing sports programming. Gantz's study (1980), for instance, compared uses and gratifications across sports activities, namely baseball, hockey, football, and tennis. His study's findings are consistent with the uses and gratifications approach to television viewing and show that watching sports is "a highly functional activity (…) and multifaceted experience" (p. 12). According to this study, the most important motivations for watching sports are "identification with athletes" and "need for success." Less important motivations include information need, social exchange, and emotional release. Four underlying dimensions were found for these motivations: "to thrill in victory," to "let loose," to learn about the players and the game, and to pass time. Most importantly, a factor analysis of these motivations revealed a similarity of factor loading across sports. This led Gantz to affirm that "motivations may be generalizable across sports rather than unique to each sport" (p. 10). In other words, because motivations that ranked high on one sport also ranked high on other sports, one can safely conclude that gratifications are not sport-specific.

Crabb and Goldstein (1991) reports findings from a study that was conducted by Sloan (1979) and that revealed six functions of sports for fans: 1) Belonging needs, "filled by identifying with a (usually local) team;" 2) "diversion from daily routines of work and family life;" 3) source of stimulation and excitement; 4) relief of tension and aggression; 5) source of entertainment; and 6) providing "a sense of achievement or accomplishment through the victory of their team."

In another study, Melton and Galician (1989) compared uses and functions of broadcast (i.e. mediated communication) sports with in-person attendance of sporting events. They found that the main gratifications obtained from watching sports were helping pass time, helping feel less alone, and giving something to do with family and friends. Other gratifications found in their study included "let off steam," get energized, learning/information gain, and ego-satisfaction (a personal identity function).

The findings of the aforementioned communication studies are consistent with the sociologists' perspectives on sports, which assert that the experience of being a fan is pleasurable and motivated by fantasy and escape, and allows for identification with athletes and fulfillment of the needs for sharing, feeling, and belonging (Gantz, 1980).

Critiques of uses and gratifications

Critics of the uses and gratifications approach argue that it is too micro-level oriented. They also contend that reports of needs and gratifications sought may be inaccurate or biased because the common technique of measurement of the subjects' motivations is based on self-report. Therefore, uses and gratifications critics argue, the veracity of the data collected in uses and gratifications studies, as well as the internal validity of the findings, are questionable. However, the *micro-level orientation* of the

uses and gratifications approach seems justified, for it takes into account the recent trend in media consumption and development that shows the demassification, or fragmentation, of the audience and the recognition of media use as being based on the *individuals' specific areas of interest* (e.g. cable television, thematic channels, and niche programming). In addition, despite the real risks of inaccurate reports that social desirability triggers, self-report can be an efficient measurement technique if it relies on a well-constructed questionnaire (e.g. it is based on specific questions) and if the research topic deals with non-sensitive subject matters. This also shows the importance of using indexes in order to gather accurate uses and gratifications information.

This issue also demonstrates the importance of identifying and defining categories that are relevant to the individuals, that exhaustively represent the individuals' possible uses and gratifications sought, that have consistently appeared as relevant categories (e.g. Blumler's three major categories), and that specifically relate to the content in question. Indeed, scholars have criticized the normative characteristic of the approach and the ensuing possibility that it forces individuals to find rationales explaining their behavior (Dozier & Rice, 1984).

In addition, Carey and Kreiling critique the lack of integration of cultural and instrumental elements in uses and gratifications research: "Uses and gratifications research fails to link the functions of mass media consumption with the symbolic content of the mass-communicated material or with the actual experience of consuming them" (1974). This present study addresses the experience issue as it revolves around the interactive experience. In addition, this study will strive to take into account the symbolic

signification of sports content as a component of the subjects' uses and gratifications related information.

Virtual Reality

Theory

The term virtual reality has been employed extensively in the last two decades, but, as Biocca and Levy (1995) note, it has been used to designate very different elements: From interface hardware, to specific applications (e.g. medical image), to cultural environments (e.g. cyberspace), to a sector or industry ("the VR industry"). The same issue has been found with other communication-related words, such as the term "media," but the vagueness of the term has certainly contributed to confine virtual reality to an arcane domain.

In addition, the term virtual reality (VR) is commonly associated with a set of technological device. Traditionally, Steuer (1992) explains, the focus of virtual reality has been "technological, rather than experiential; the locus of virtual reality is a collection of machines" (p. 73). Typically, the definition of virtual reality includes the following technological device: a computer, a pair of gloves loaded with sensory and tracking instruments, position trackers, and a head-mounted stereoscopic display. This association between virtual reality and hardware is not surprising if we consider that the term virtual reality was coined in 1989 by Jaron Lanier, CEO of VPL Research Inc., a firm specialized in manufacturing gloves and other products used in virtual reality environments (Krueger, 1991).

Steuer's mass communication approach to virtual reality, as well as his attempt to clarify and conceptualize the topic, are insightful and deserve some attention in the context of this study. His presentation and definition of virtual reality authorizes the integration of the iPIX technology to the realm of virtual reality and allows distinguishing the immersive environment used in this study from other virtual environments.

Steuer stresses that this "device-driven" definition is problematic because it is unsuitable to a communication approach to VR. Indeed, "because a technology-based view suggests that the most salient feature in recognizing a VR system is the presence or absence of the requisite complement of technologies" (p. 73), such a definition does not address the process and effects of the use of VR, offers no conceptual framework – necessary for a communication approach of the term– and unit of analysis, and lacks "the theoretical dimensions across which virtual reality can vary." Therefore, Steuer argues for the development of a "theoretically grounded term" and a definition based on "a particular type of experience rather than a collection of hardware" in order to place VR in a mass communication research perspective that allows examining VR "in relation to other types of mediated experience" (p. 74).

To remedy to this issue, Steuer provides a detailed conceptualization of virtual reality, which he defines as "a real or simulated environment in which a perceiver experiences telepresence" (p. 76). Therefore, according to Steuer, telepresence is the key element of the VR experience. The section below gives further explanation on virtual reality and the concept of telepresence. It should be noted that Steuer's definition corroborates Biocca's and Levy's view that "VR is not a technology; it's a destination … a metamedium … an environment [that] surrounds the senses" (1995: 17) and reminds of

McLuahn's (1964) idea of the media as "extensions of the senses." The goal of VR, Biocca and Levy add, is "the full immersion of the human sensorimotor channels into a vivid computer-generated experience" (1995: 17).

Telepresence

Telepresence and perceptions are central concepts in this study, as they are in the notion of virtual reality. When an individual is engaged in a mediated experience, he or she perceives two simultaneous environments: A physical environment and a mediated environment. "Telepresence," Steuer explains, "is the extent to which one feels present in the mediated environment, rather than in the immediate physical environment" (p. 76). Therefore, while "presence is defined as the sense of being in an environment, … telepresence is defined as the experience of presence in an environment by means of a communication medium" (pp. 75-76). It should be noted that both concepts are linked to perception and imply an input from sensory channels.

According to this approach, Steuer adds, the notion of telepresence can apply to any medium –telephone, letter, television, or video games. Indeed, "Newspapers, letters, and magazines place the reader in a space in which the writer is telling a story" (p. 79). Therefore, not only does this approach provide a unit of analysis –the individual– for the study of VR, but it also places other media in the context of virtual reality.

While the term telepresence is relatively recent –it was coined in 1980 by Marvin Minsky to designate the remote manipulation of objects (Steuer, 1992)– the idea of simulated presence has been tackled by communication scholars for a long time. As early as 1956, Horton and Wohl introduced the concept of parasocial interaction. According to this principle, Jensen (1999) explains, mass media create the illusion of intimate face-to-

face communication (e.g. close-up, simulated eye contact, direct address, private conversational style). Grabe et al. (1999) confirm that many scholars have been interested in "whether and to what extent media users experience a sense of presence –the illusion that the experience is not mediated" (p. 4). They also note that this phenomena has been labeled in various ways, such as "a feeling like you are present in the environment generated by the [medium]" (Sheridan, 1992) or a feeling of "being there" (Reeves, 1991).

Finally, Grabe et al. agree with Steuer in saying that the perception of simulated presence is generated by virtual reality systems (e.g. flight simulators), simulation rides (e.g. Star Tours attraction at Disney themes parks), "sophisticated film presentations" (e.g. IMAX), and even TV news (see for instance Auter and Davis, 1991), where the way the anchors "address the audience directly promotes parasocial interactions with viewers."

The present study will seek to answer an important question related to telepresence, that is, how do immersive images, which name directly infers that the technology allow for a "feeling of being there" and parasocial interaction, fit into this approach.

The inclusion of the notion of telepresence into virtual reality helps distinguish VR from other concepts. Indeed, as Steuer observes, VR is different from psychic phenomena (e.g. dreams or hallucinations) because telepresence emanates from a communication medium. It is also different from "real reality" because VR assume the existence of hardware. Finally, VR should also be distinguished from cyberspace –an electronic realm conceived by Gibson (1984) and also using hardware– because

cyberspace bypasses the sensory organs (i.e. the stimuli are directly presented to the perceptual system in the brain). The same reason applies to "simstim" (Gibson, 1984), which is similar to cyberspace but in which participants have a passive experience.

Dimensions of virtual reality

Steuer (1992) identifies three factors influencing telepresence: 1) the specific characteristics of the individuals engaged in the mediated experience; 2) the combination of sensory stimuli involved in the experience; and 3) "the way in which participants are able to interact with the environment" (p. 80). Steuer qualifies the last two factors as technology-related dimensions, and he labels them as vividness (sensory aspects) and interactivity (interaction). In a somewhat similar approach, Sheridan (1992) identified five variables for telepresence –sensory information, control of sensors, ability to modify the physical environment, task difficulty, and degree of automation– but this view seems less concept related and too device oriented. Therefore, we will use Steuer's dimensions, which are more theoretical and rely extensively on the concept of interactivity.

Vividness. "Vividness," Steuer explains, "means the representational richness of a mediated environment as defined by its formal features; that is, the way in which an environment presents information to the senses" (p. 81). In his view, highly vivid media are what McLuhan qualifies as "hot media."

The dimension of vividness can itself be divided into two components, "sensory breadth" (a quantitative dimension, i.e. the number of sensory channels involved) and "sensory depth" (a qualitative dimension, i.e. the resolution of each perceptual channel). Gibson (1966) identified five perceptual channels on which Steuer's vividness dimension

can rely: orienting, auditory, haptic (i.e. tactile), taste and smell, and visuals. The technology used in this study (immersive imaging), only utilizes the orienting and the visual channels. Traditional pictures only involve the visual system. A video game console (e.g. PlayStation) with tactile feedback controllers makes use of all of the channels except the taste-smell system, and can therefore be considered as high in breadth. The sensory depth, Steuer notes, refers to such characteristics as image quality. The physical world offers what can be considered as maximum depth. According to Steuer, in a mediated environment, bandwidth issues are often responsible for limiting sensory depth (see for instance the auditory depth difference between the telephone and a CD player). To illustrate the difference between depth and breadth, Steuer compares silent films (high in depth, low in breadth) with video presentation (high in breadth, low in depth). Finally, Steuer asserts, "it is likely that breadth and depth are multiplicatively related in generating a sense of presence, with each dimension serving to enhance the other" (p. 84).

Interactivity. The second dimension of telepresence, interactivity, is conceptualized as "the extent to which users can participate in modifying the form and content of a mediated environment in real time" (Steuer, 1992: 84). In this view, Steuer explains, "Interactivity, like vividness, is a stimulus-driven variable and is determined by the technological structure of the medium." This definition seems particularly relevant to the present study, for it takes into account immersive technologies and differs from other traditional definitions of interactivity (see sections above), which rely heavily on the transmission model (sender/receiver) of communication. It also places the participant in the center stage of the process (i.e. centrality of the notion of perception and of the

relationship between the individuals and the mediated environment). According to this definition, the characteristics of the medium, or the technology, are also the focus of the interactivity, which Steuer explains, varies with the "malleability of a medium's form and content." As indicated by Steuer, the three factors influencing interactivity are:

- Speed: "The rate at which input can be assimilated into the mediated environment." Real time is the highest possible value.
- Range: "The number of possibilities for action at any given time." This factor includes the number of attributes (temporal ordering, spatial organization, intensity, and frequency) that can be modified and the amount of variation allowed.
- Mapping: "The ability of a system to map its control to change the mediated environment in a natural and predictable manner." Mapping, or the way humans actions are represented in the mediated environment, is highly related to hardware and software. Steuer illustrates mapping by mentioning the Apple Computers' "Desktop" –a metaphoric mapping system that Microsoft took up on its Windows' operating system– and "QWERTY" keyboards, which Steuer qualifies as arbitrary mapping system. He recommends that mapping be as natural as possible if the mediated environment recreates a physical environment. It is interesting to note that this factor in general, and Steuer's observation in particular, constitute the focus of the field of human-computer interaction.

Today, according to Steuer, videogames represent the most vivid and interactive environment. We may add that military flight simulators, although not available on the mass market, could be considered as even more interactive and vivid than videogames.

Interactivity, vividness, and telepresence. Steuer also asserts that "vividness and interactivity are positively related to telepresence." A number of scholars seem to agree with him in saying that interactivity reproduces the notion of "being there." Referring to interactivity with art, Tafler explains that

> The gallery restores all the possibilities of random access and self-determined duration and repetition previously denied by the cinema. The [interactive] installation permits the temporal and spatial freedom of moving at will from image to image, experience to experience, and thus conforms to the historical conditions mediating the act of looking at art. (1995: 264)

However, from a sociological standpoint, this assertion is subject to discussion. As Vorderer (1995) explains, when it comes to feeling part of a common virtual reality, two competing arguments come forward. On one hand, any mass communication content creates a sense of "collective awareness," which makes the viewer feel like he or she belongs to a virtual community. One the other hand, because interactivity gives the viewer the chance to communicate with the media, it may result in making the user realize that the "depicted reality" is an illusion. The question, then, revolves around determining which is the dominant force: feeling of belonging or fulfillment of individual needs.

Immersive images

Immersion. The concept of immersion appears to be often used in lieu of telepresence. For instance, Biocca and Delanay's (1995) definition of immersion reminds of Steuer's conceptualization of telepresence: "Immersive is a term that refers to the degree to which a virtual environment submerges the perceptual system of the user in

computer-generated stimuli. The more the system captivates the senses and blocks out stimuli from the physical world, the more the system is considered immersive" (p. 57). Along the same line, Krueger (1990) identified two forms of immersion, which Shapiro and McDonald (1992) report as being 1) environments where the user's actions are "acted on to accomplish the user's intentions," 2) passive experience where, through various sensory feedbacks, the user *enters* a mediated environment. Both forms of immersions, and the last one in particular, are reminiscent of Steuer's telepresence.

However, Steuer distinguishes immersive systems from virtual reality. Indeed, according to Steuer, immersive environments *move* with the participants (e.g. stereoscopic head-mounted displays). Therefore, he explains, 3D systems, such as hologram and 3D movies, are not immersive despite the fact that they strive to "accurately portray a sense of depth across part of the visual field" (1992: 84). In other words, it seems that for Steuer the orientation perceptual channel, mentioned earlier, has to be included in the medium capabilities for the environment to be qualified as immersive. Accordingly, the technology used in this study could, to a certain extent, fit into Steuer's definition of immersion: Although the technology does not involve the tactile sense of the user and does not use a stereoscopic display, it reproduces a 360° field view that is similar to a natural environment and that is set by the participant.

Other scholars consider the term immersion from a cognitive, rather than perceptual, perspective. For Vorderer, for instance, the term immersion can be used in interactive context to designate involvement, which is traditionally used in non-interactive settings. The only difference, he asserts, is that immersion is stronger because "interactivity adds to the experience" (1995: 29). This view is consistent with Ferguson

and Perse's assertion that "the interactive component of the Web as well as the need to "click" to move around might demand greater attention and involvement from the Web audience" (2000: 170). Csikszentmihalyi (1995) and Turkle (1985), Vorderer also reports, associate the notion of immersion –and involvement– with familiarity: "The more using the media gets to the users' optimal mental model and motor capacity, the higher their experience of involvement, immersion, or flow" (1995: 31).

Immersive images. Therefore, it seems that the term immersion should not be thought as absolute. In this study, we use the term immersion to distinguish interactive and 360º images and videos, from traditional photos and videos. We expect the findings of this study (see hypothesis 10 in Chapter 3) to tell whether navigating these images actually results in giving the participants a feeling of immersion. It is interesting to note that the technology used in the present study somewhat fits into what Biocca and Levy (1995) call a mass telepresence system, which they define as real-time camera with full 360° capabilities digital model capable of transmitting to millions. While the present experiment does not use real-time action, the real-time immersive (e.g. iPIX) technology is already available on the Internet.

Finally, Steuer insists on the fact that virtual reality environments do not have to be fictional: "This environment can be either a temporally or spatially distant environment (…) or an animated but non-existent virtual world synthesized by a computer" (p. 76). As a result, according to Steuer's definition, any vivid and interactive environment, whether it is a fictional on-screen environment (such as Doom, Myst or Quest), or an actual environment reproduced on screen (as it is the case in this study), can

be qualified as virtual reality. In addition, it should be emphasized that computer games and iPIX pictures use similar interfaces and hardware.

Immersive images and human-computer interactions. As Wærn (1989) explains, communication with computers can be done through menu selection, form fill-in, command language, natural language, and direct manipulation. However, since her book was published, in 1989, we may add that hypertext has appeared as a new form of communication that has spread rapidly in computer environments (e.g. World Wide Web) and programs (e.g. "help applications" and tutorials). This would make of hypertext the sixth form of communication in computer environments, although some might consider it as another form of direct manipulation.

The technology used in this study, immersive imaging, uses direct manipulation. The term direct manipulation was introduced by Shneiderman in 1974 and signifies that "the user can move and transform objects on the screen as if they were real objects" (Wærn, 1989: 246). As Wærn notes, "this manipulation of objects hardly merits the term "communication" since it is so direct. The user gives no instructions, he simply acts." Because direct manipulation is an achievement in terms of interface transparency, which is considered as the clearest for of human-computer interaction, numerous HCI scholars have focused their research on the representation of objects, mentioned earlier as mapping (e.g. WYSIWYG, What You See Is What You Get software, such as Macromedia Dreamweaver and Microsoft Windows). Since immersive images not only use direct manipulation but also display images of real objects, rather than (computer-generated) *representation* of objects, it seems that few human-computer interaction theories can be applied to this study –except maybe for hardware-related (e.g. the mouse)

considerations, but this is beyond the scope of our research. An interesting point that Wærn makes, though, is that "Direct manipulation suffers less risk than any other communication style of appearing meaningless and demanding to the user" (p. 246).

To conclude with this section, it should be noted that while virtual reality is sometimes considered as meaningless, too experimental or entertainment-oriented, the possibilities for useful applications in the professional world in general, and in the communication field in particular, are endless. According to Biocca and Levy

> As a mass medium, virtual reality could fulfill the oldest dream of the journalist, to conquer time and space. Virtual news environments would invest journalists with the ability to create a sense on the part audiences of being present at distant newsworthy locations and events. For over a century news has struggled to find ways to bring its audiences close to dramatic and historic moments. The very language of journalism suggests the goal of telepresence. Think of (…) Walter Cronkite's dramatized history with the prophetically cyberspatial title, "You are there." (1995: 139)

Media Effects

Uses and gratifications and effects

Levy and Windahl, borrowing from Lin (1977), report that the uses and gratifications theory postulates that "The decision to enter into communication is motivated by goals and uses that are self-defined, and that active participation in the communication process enhances, limits, and influences the effects of exposure" (1984: 52). This postulate emphasizes the fundamental association that exists between uses and gratifications and media effects. This association constitutes a central assumption in the present study. It should be emphasized that this postulate has been demonstrated in several studies focusing on traditional media, as well as new media, uses and effects. For

instance, in a study investigating Internet use, Papacharissi and Rubin (2000) have shown that Internet motives appeared to be significant predictors of outcomes such as length of Internet use, web browsing, and email use. In their study, for example, they show that information seeking and entertainment were the most important predictors of email and Internet use. This is not surprising, even for email use, considering the importance of email-based jokes and listservs among college students. This postulate is also consistent with the widespread belief among communication scholars that "meanings are in people, not in messages," as Bryant (1989) puts it.

However, as mentioned earlier –and as Bryant (1989) notes– uses and gratifications research has traditionally focused on the nature of media (i.e. media channels), rather than on the specific nature of the message (i.e. media content). This tradition seems to conflict with media effects theory, which asserts that media effects are not only dependent on content, but are even influenced by specific media content –rather than "mere exposure to general programming types like entertainment" (Gantz, 1980: 3). The fact that this study focuses on specific content, sports programming, demonstrates that such flaws, or at least critiques, are taken into account.

Entertainment and effects

Four different approaches, or "traditions," have dominated in research on entertainment and message effects: Uses and gratifications, critical analysis, applied audience research (e.g. Nielsen), and entertainment theory (Bryant, 1989). However, as Bryant and Zillmann (1986) note, "Although many scholars have examined the side effects of entertainment . . . few have examined its intended, primary effect: entertainment" (p. xxi). Furthermore, Bryant (1989) remarks, the entertainment industry

perspective on content (i.e. programming) focuses on audience, ratings, marketing –and notions such as programs ratings, placement, TV season, program life span– rather than on specific characteristics of content. “It is highly unlikely,” Bryant points out, “that these elements are as important in creating and sustaining audience enjoyment as specific message attributes” (p. 242). In short, it seems that the two principal areas of research on entertainment fail to analyze effectively the specific aspects of content: Industry-led research is based on exposure, a narrow definition of media effects that that misses the whole process and even the industry’s goal of increasing audience, while most of academic research has narrowed message analysis to few (social) issues (violence, pornography, stereotypes, an so forth) characterized by pros and cons investigations. This study attempts to focus on specific message characteristics, such as motion and interactivity.

Entertainment effects are most often measured in terms of exposure, attention, affective display, enjoyment, and gratifications sought and obtained (Bryant, 1989). This study will examine almost all of these variables, but, again, the latest measures –uses and gratifications– seem crucial in assessing media effects. As Bryant and Zillmann (1986) explain, “Entertaining messages are capable of gratifying respondents because of unique intrinsic properties, along with the respondents’ idiosyncratic appraisal of these properties” (p. 311). In order to clarify “the relationship between entertainment and gratifications,” Bryant argues for an approach combining the uses and gratifications tradition with behavioral entertainment research. He also recommends that studies seeking to understand entertainment effects consider the cognitive process associated with exposure. Although the present study does not fully investigate behaviors –attitudes

are only one set of variables, among many, influencing behavior– and integrates only a limited set of cognition-related variables, both of Bryant's suggestions have been taken into account.

Finally, it should be emphasized that sports content seems to be particularly suited to the study of entertainment effects. As Gantz (1980) contends, "The mental and behavioral activity involved with being a fan suggests that, except among those for whom watching broadcast sports is a 'last resort,' exposure will be a functional, emotionally and intellectually involving experience," (p. 5). In his study, he also found that participants were more strongly motivated to watch team sports than individual sports.

Sports programming

Indeed, sports programming is unique. It differs from other entertainment content because it is not fictional –entertainment programs are often fictions or are rehearsed– it blends "reality and uncertainty," it is often broadcast live, and it is covered as news (Gantz, 1980). This latest specificity of sports seems particularly crucial, for it may allow researchers to apply findings from sports-related studies to the field of journalism.

On the other hand, as Whannel (1979) argues, the fusion of television and sports, as well as the inclusion of "show business/entertainment values" into the game, have led to the audience's expectation of "spectacle, rather than a contest." Parente (1977) corroborates this view and explain that TV has had a tremendous influence on sports, changing sometimes the very nature and proceeding of games. For instance, television is responsible for changing the drawn-out deuce games into tie-break in tennis, and changing golf competition from match to medal play.

Media forms and effects

Overview of past and current research. It seems that more mass communication studies have been undertaken on media content than on media forms. Nevertheless, form matters. As a matter of fact, form is part of what Reeves and Nass (1996) call the media equation. Through a research project called *Social Response to Communication Technology*, which involved numerous experiments, Reeves and Nass have developed the theory of the media equation, which posits that the "Media equal real life." They claim that "individuals' interactions with computers, television, and new media are fundamentally social and natural, just like interactions in real life" (p. 5). This view is consistent with the principle of telepresence presented earlier, and is clearly tainted of the HCI approach to mass communication.

Traditionally, the media's formal features have been categorized into three groups: producer-controlled factors (e.g. editing pace, shot type and length, camera angle, camera movement), viewer-controlled factors (e.g. volume control, viewing distance, ambient light), and appliance-related variables (e.g. screen size, picture resolution) (Reeves and Nass, 1996; Grabe et al., 1999). However, the advent of interactive media – namely interactive television, the World Wide Web, and immersive images– has somewhat blurred the lines between these two categories. Indeed, through interactivity, users take control of features that have traditionally been handled by producers (e.g. the shots' angle) and editors (e.g. organization and presentation of information). This issue will be addressed in depth in the discussion section.

Several studies have explored the influence of form-related factors on the individuals' cognition, emotions, and evaluation. Grabe et al. (1999) present a good review of such studies. Factors such as image size, viewing distance, and shot length

have been found to influence cognition-related variables such as attention and memory (Reeves et al., 1992; Bruijin et al., 1992; Detender & Reeves, 1996; Kim, 1996; Ditton, 1997). Similarly, numerous studies have found that form influences emotion-related factors. For instance, studies have shown that arousal increases with screen size (Detender and Reeves, 1996; Lombard et al., 1996), and that larger TV screens increase the subjects' positive emotional response to an attractive news anchor (Lombard, 1995). However, other studies (Kim, 1996; Detender and Reeves, 1996; Lombard et al., 1997) have found no support for the widespread assumption that screen size could enhance the enjoyment of the viewing experience. In addition, it has been shown that screen size influences the intensity of the subjects' evaluations, such as reported intensity of light and loudness of crowds (Lombard, 1995; Ditton, 1997). Particularly relevant to the present study is the finding that large screens increase the perception of presence and "sense of reality" (Hatada et al., 1980; Neuman, 1990). However, other studies (Kim, 1996; Ditton, 1997) did not support such assertion.

Many of these findings are consistent with Reeves and Nass's (1996) studies, which showed that closer images (i.e. reduced viewing distance) resulted in more intense evaluations and increased attention and memory. Reeves and Nass also found that larger images increased arousal, memory, and intensity of evaluation.

While this study does not focus on screen size, these findings are of interest, for they show that formal features, which this study's participants will be able to control (e.g. camera angle), do influence the individuals' cognition, emotions, and evaluations of content. It also shows the importance of keeping constant in the different experimental

groups formal features that are not investigated (e.g. screen size, viewing distance, image resolution).

Still images versus animated images. In real life, Reeves and Nass (1996) explain, motion triggers attention. The phrase "visual orienting response" is used to express the fact that "when people are exposed to motion, (…) they focus on the source of the motion and stop all other unnecessary activities" (Reeves and Nass, 1996: 219). Reeves and Nass observe that this reaction affects not only mental processing but also induces "physical changes in the body" (e.g. increased blood flow to the brain). One of Reeves and Nass's experiments, which used electroencephalogram (EEG) to measure brain electrical activity, found that this theory holds true with mediated experiences. Indeed, in their study, attention correlated with motion and "pictures that occurred one second after each motion began were remembered better than pictures that appeared at the exact moment of motion onset" (p. 222). In addition, Reeves and Nass found that motion in peripheral vision is more arousing than motion at "points of visual focus." Nevertheless, they warn that too much motion decreases cognitive capacities. The term "motion" in mediated experience applies to objects in motion, but also to special effects (e.g. dissolve) and camera movements.

Furthermore, according to Schnotz and Boeckheler (1999), static images only provide spatial information, while animated pictures have both a spatial and a temporal structure (i.e. they include the time dimension). Therefore, animated pictures let the viewer envision the dynamic characteristics of the subject matter. Because the time structure is taken over by the medium, the viewer's cognitive load decreases when pictures are animated. While the authors stated these principles in the context of learning

models and diagrams, it seems that they also apply to photographs and video. In the present study, this would mean that the cognition-related potential and general understanding of the game would be superior with video than photographs.

Cognition

Theory overview. The term cognition is usually associated with knowledge and information processing (Green, 1996). It is a fundamental concept of psychology, for it influences learning, attitude, and behavior. Psychology theories of attitudes, for instance, are based on the ABC model, which includes three domains: affect, behavior, and cognition. At the behavioral level, often considered to be one level higher than the attitude level, cognition (e.g. paying attention) is considered as one of the two components –the other being affect (i.e. emotions)– of psychological involvement. Involvement, Roser (1987) explains, leads to increased attention, processing of content, and, eventually, attitude change.

Finally, and most importantly, any tasks preformed by humans induce a cognitive feedback (e.g. learning) and an emotive feedback (Wærn, 1989). Therefore cognition appears as a central concept for the study of the individual's experience.

This study's approach to cognition is the same as the one Wærn, and most of HCI scholars, rely on. It is referred to as the information-processing theory and relies on "mentalistic" concepts and on the idea that tasks performed by individuals are goal-driven. This model seems particularly adapted to the uses and gratifications approach and does not rely on the neural aspects of cognition.

The main cognition-related concept on which this study focuses is memory. As Reeves and Nass 1996) explain, there are several definitions of memory within the field

of psychology alone and an important distinction exists between recall and recognition. This study uses recall as a measurement of cognition. This study also uses a limited, simplified definition of learning, for it equates learning to information gain, which is measured through recall. Reeves and Nass used a similar approach to cognition in their studies. For instance, they say that "motion enhances learning," (p. 222) while the only element they measured is recall.

Attention is another important element of cognition. As Wærn explains, "Effort is a limited resource which can be distributed according to the demands of the situation" (p. 18). Because resources are limited and need to be distributed among different tasks operated at the cognitive level, individuals select to process one stimulus among various stimuli, or cues within a stimulus. This process is referred to as "selective attention" (Wærn, 1989). This issue will be developed later in this section. It should be noted, though, that inferences about attention are often based on recall (Bryant, 1989).

Uses and gratifications and cognition. According to Garramone (1984), the influence of motivations (i.e. gratifications sought) on information processing occurs at two levels:

- The attention level. "Audience motivation may result in differential attention to various aspects of the media presentation, including both channel and content aspects" (p. 80). This assertion is crucial in the context of this study because it highlights the influence of gratifications sought on content (i.e. depending of motivations, participants may seek information directly related to the game or they may focus on details included in the interactive presentation but unrelated to the game) and channels (i.e. differential attention to the manipulation aspects and

the use of the technology among cognition-oriented individuals, entertainment-oriented individuals, and individuals who just want to "play around").

- Mental Encoding. Borrowing for Wyer and Carlton (1979), Garramone explains that "Audience motivation may determine the encoding of media information." Furthermore, "How information is encoded will influence its subsequent effects, such as recall of the information and inferences drawn from that information" (p. 80).

In addition, one of the widely accepted assertions of the uses and gratifications approach is that knowledge gain resulting from media exposure depends on cognitive needs: The higher the information need, the higher the information gain. "Information-seeking mode," Garramone stresses, "is the strongest predictor of attention" (p. 81).

Interactivity and cognition. As Tafler explains, "The viewer-participant's access to multiple areas of selectivity guarantees that other reactions and interactions can take precedence over the designs of the artist producers" (1995: 261). Therefore, in the context of news or sports events, one can foresee that the information or emotion that is conveyed by the photo editor or the video producer through the images may not be felt or understood by participants engaged in an interactive experience.

Indeed, in the context of interactive pictures and video, the role of the photo editor or producer is greatly diminished. One of their job's purposes –filtering information and selecting relevant pictures or scenes that are representative of the situation– seems to become irrelevant because the participant constructs his or her own viewing experience and selects the frames he or she wants. Therefore, the participant may not capture frames considered as important by media professionals. He or she may also spend time looking

at information deemed unimportant by popular standards or images unrelated to the actual game. On the other hand, in such a setting, the participant may capture important information that media professionals would not notice (e.g. the media professionals' routines) or would not consider as important. This poses the problem of defining the editor's/producer's job and defining what can be considered as important or relevant information.

In addition, as Heeter notes (1988), in new technologies, when choices increase, the efforts involved in the experience may also increase. This could hinder the interactive experience, for interactivity may require the mobilization of important cognitive resources, as compared to the passive viewing of videos or images.

As Resnick (1987) and Shuell (1988) explain, learning is an active and constructive process. Construction of knowledge is based on the gathering of new information and on previous experience. It is also oriented toward the future needs and requirements, as envisioned by the subject. This view is consistent with the information processing approach and it shows the importance of relying on uses and gratifications theory in understanding the media's potential for learning and cognitive activities. In addition, as Duffy and Jonassen (1992), Greeno et al. (1993), and Spiro et al. (1991) assert, traditional media put learners in the role of passive recipients, exposed to a single view, while interactive media allow the manipulation of content for exploratory purposes. However, Tafler alleviates this proposition and argues, "A computer-directed experience through a constructed, mediated, and regulated image environment such as high resolution interactive video disc allows but does not necessarily guarantee an exploratory interactive platform" (1995: 243). He mentions MIT's Apsen Movie Map (a simulation

of a trip through the streets of Aspen, Colorado), in which "exploration drove the interaction. Each viewer-participant had the freedom to find his or her own way through the information maze" (1995: 244). Therefore, according to Tafler, the particular features (e.g. design, manipulation) and conditions of the interactive experience seem to be of importance in determining whether an exploratory process occurs during the interactive experience. As Tafler notes, Jauss (1982) provides further explanations on the conditions for a true exploratory experience: "The boundaries between passive reception and active understanding fall within the viewer-participant's horizon of expectation" (1995: 257). In other words, the participants' motivations and goals also play a large part in determining whether the experience will be active (i.e. exploratory) or passive. This, once again, shows that the participant's needs, and gratifications sought, are crucial factors in understanding interactive experiences in general, and learning processes in particular.

Because an exploratory experience allows for active learning, it could be argued that interactive settings allow for more efficient learning and cognitive processes (Schnotz and Boeckheler, 1999). However, Schnotz and Boeckheler also argue that interaction with visuals mobilizes greater cognitive resources because part of the memory is used for the manipulation itself. Therefore, at the cognitive level, fewer resources are available for processing. This could hinder the processing of cognitive information. In their study of static and animated interactive pictures, Schnotz and Boeckheler found that, in an individual learning context, interactive animated pictures resulted in a superior mental encoding of details but did not facilitate performance in mental simulation tasks, which require an important amount of cognitive resources. More generally, Schnotz and

Boeckheler conclude, “interactive animated pictures do have different effects on knowledge acquisition under different aspects” (1995: 256).

Likewise, in a study comparing traditional and interactive advertising, Bezjian et al. (1998) found that visual processing is inhibited by the use of interactive systems. They posit that visual orientation, be it on the part of participants (i.e. a psychographic characteristic) or as an attribute of content (i.e. visual material), involves a more complex process than verbal orientation. They conclude that the verbal task of making choices and selections in an interactive condition may hinder the visual processing of pictures and images. These results contrast with the study of Van Tassel (1987), who found that cognitive processing could be improved through interactive settings. Indeed, in his study, subjects gave better answers on questions about cancer and its treatment when they were exposed to interactive learning systems. Van Tassel also found that interactive systems resulted in higher involvement with the subject matter. His theory is that interaction with choice, pacing, and evaluation of the content will require or induce greater cognition and motivation. In addition, he asserts that involvement has a positive effect on learning (recall, comprehension, and processing) and on attitudes (e.g. mood and emotion).

The field of HCI also tackles this issue, through the notion of selective attention. As Wærn explains, two different tasks are involved in human-computer interactions: A main task –in this study it consists in watching a game– and a subsidiary task –handling the computer. The problem, however, is that “If both of these tasks require attention, performance in one or the other is likely to suffer, compared with the case in which only one of the tasks has to be given full attention” (p. 19). “If the person concerned,” Wærn adds, “ is unable to produce all the effort needed (either because there are other things to

do or because the system itself requires too much effort), performance will probably deteriorate, either because the individual narrows the range of his attention too much so that crucial task-relevant cues are disregarded, or because he devotes his attention to non-task-relevant cues" (p. 20). In short, it seems that there are mitigated results concerning the relationship that exists between interactivity and cognition.

It has also been shown that the participants' expectations of their media experience are crucial in determining the participant's cognitive process. Festinger (1957) introduced the concept of cognitive dissonance, which contends that information is selected on the basis of consistency with attitudes, beliefs, and behavior. Along the same line, Heeter (1988) insists on the notion of selectivity, that is, different individuals seek different uses and gratifications, which result in the selection of different pieces of information. Yet, none of the studies presented above have taken into account the far-reaching consequences of the active attribute of the participants, that is, the idea that the audience has specific gratifications in mind when exposed to media content. In other words, a review of previous studies on effects of interactivity seems to indicate that researchers have looked at a new machine with old research tools. It is crucial to understand and integrate the fact that individuals have different needs and backgrounds in order to design empirical studies that are sensitive to the individuals' differences in information processing. In addition, these mitigated results show that cognition in an interactive setting is a complex issue. For instance, as Tafler notes,

> When any event may evaporate without irrevocably destroying the concept or force of reception, attention no longer means captivation. With the enhanced freedom of distraction, the risk of losing the text disappears. Not motivated by plausible or rational conditions, segmented events do have a different emotional impact. With less causal significance, less anticipation, increasingly less surprise, constant change by itself becomes

> redundant. Constant change, however, sets up its own attracting conditions and threatens to dismember traditional hermeneutic systems. (1995: 253)

Visual communication theories. According to the Gestalt theory, parts of a visual can be analyzed individually, but the experience with the image as a whole is greater than with the sum of its parts. This would suggest that more global views of an event (e.g. different angle) would tend to increase the understanding, or at least the perceived understanding, of this event. On the other hand, focusing on detailed images within this event would hinder the general comprehension of the event.

Scholars have identified four main "Laws of Gestalt" that apply to complex stimuli (Wærn, 1989). The "proximity law" states that "figures which are situated close to one another are perceived as forming a unit, a 'Gestalt.'" The "similarity law" asserts that "figures which are similar to each other are perceived as one Gestalt." The "good continuity law" refers to the fact that "we tend to perceive a picture of an object as continuous, even if part of it is hidden." Finally, the "law of closure" states that "we fill gaps in our perception to get a full Gestalt."

Referring to the contiguity principle (i.e. proximity law), Mayer (1997) notes that, because of our limited cognitive capacities, information has to be presented in physical proximity and simultaneously to be processed efficiently. This assumption could then contradict the assertion that "global view increases understanding" if elements are spread out on the screen. Indeed, the non-proximity of the elements could hinder both the understanding and the visual enjoyment of the event.

Emotions

Theory overview. As mentioned earlier, emotions (i.e. affect) are an essential part of humans' life, experiences, and reactions to stimuli (e.g. emotional responses play a large part in determining attitudes and behavior). In addition, it should be emphasized that mediated experiences have the same emotional capabilities as real-life experiences. This is an important point, for it allows researchers relying on traditional psychology theories and applying them to mass communication theories.

Dimensions. Mehrabian (1980) provides the rational and supporting evidence for the designation of pleasure, arousal, and dominance as the three basic emotional reactions. He asserts that the combination of these three factors can be used in the study of preference and avoidance of various stimuli. These dimensions are unique in the field of psychology because they represent a "parsimonious categorization system that [can be] generally and usefully applied to a wide range of psychological phenomena" (p. 5). Indeed,

> Pleasure, arousal, and dominance constitute a parsimonious description of the common core of human emotional responses to all situations. These affective responses, in turn, account for the phenomenon of synesthesia in that stimuli involving different sense modalities may nevertheless elicit the same emotional response. (p.15)

In short, according to Mehrabian, any other emotional response, or attribute, can be described using these three dimensions. For instance, fatigue can be described as low pleasure, arousal and dominance while excitement can be qualified as high in pleasure, arousal and dominance. Anger is high in arousal and dominance and low in pleasure, while stress is high in arousal and low in dominance and pleasure. It should be noted that Mehrabian mentions several studies –many of them used factor analysis–that found similar dimensions. In addition, Reeves and Nass mention that emotions are made of two

independent dimensions: valence (i.e. pleasure) and arousal. This view, while not taking the dominance dimension into account, corroborates Mehrabian's theory.

Because the "pleasure" dimension is independent of the two other dimensions, it has to be conceptualized as different from "liking" and "preference." Indeed, Mehrabian notes, "pleasure" and "liking" are influenced by arousal and dominance. Dominance "is based on the extent to which [an individuals] feels unrestricted or free to act in a variety of ways" (p. 18). According to Mehrabian, previous studies have identified dominance but they labeled it otherwise (e.g. freedom of choice, territoriality, or crowding).

The arousal dimension is a combination of activity and alertness. Mehrabian illustrates this distinction by presenting two cases of moderate arousal: a jogger who is daydreaming (high activity, low alertness) and an individual solving complex math problems (low activity, high alertness). For arousal to be considered as high, both activity and alertness have to be at a high level. While alertness can be measured through electroencephalogram (EEG), activity is usually measured through measures of blood pressure, pupil dilatation, respiratory activity, pulse rate, oxygen consumption, muscle tension, or skin temperature (Mehrabian, 1980: 16).

The "law of initial value" states that the "magnitude of an excitatory reaction decreases as the level of initial arousal increases" (Zillmann, 1991: 113). In other words, the more the user is relaxed at the beginning of the mediated experience, the more the arousal. This seems to indicate that a posttest-pretest measure of arousal would allow controlling for initial arousal, and would therefore give a more accurate insight on the effects of the mediated experience on the individual's arousal. An even more rigorous analysis would add to this model initial arousal as a control variable.

For Zillmann, arousal is "a unitary force that energizes or intensifies behavior that receives direction by independent means" (1991: 104). The cognitive elements (i.e. independent means) determine the "hedonic valence" produced by the message properties. This is consistent with Hebb's (1955) view that arousal "is an energizer, but not a guide; an engine but not a steering gear" (p. 249). Zillmann distinguishes two types of arousal: 1) cortical arousal, which is related to attention, alertness, vigilance, information processing, information acquisition, and information retrieval and is traditionally measured through EEG; and 2) autonomic arousal (i.e. affective and emotional reactions) measured through "peripheral manifestations," such as blood pressure, heart rate, blood pulse volume, skin conductance and vasoconstriction. This typology clearly reminds of Mehrabian's alertness/activity dichotomy.

Zillmann also notes that extreme arousal decreases pleasure. In the context of moderate arousal, the effects of the message, or experience, on pleasure depend on cognitive elements (i.e. valence). In short, this "two-factor theory" contends that pleasure depends on the kind of affect involved (i.e. cognitive element) and the intensity of the affect (i.e. arousal element). This is consistent with Reeves and Nass's approach to emotions and with Mehrabian's (1980) and Lindsey's (1951) idea that arousal refers to the intensity of emotions, not their quality (or valence).

However, this study will follow Mehrabian's approach, for it is well integrated into the multidimensional approach to emotions on which this study relies. He presents three types of arousal –electrocortical, autonomic, and behavioral– but stipulates that the three usually occur simultaneously. Finally, Mehrabian notes, there is a high correlation between the different aspects of arousal and self-reports. In other words, it seems that

instruments relying on self-reports can safely be substituted to traditional measures of arousal such as respiratory activity, pulse rate, oxygen consumption, or muscle tension. Finally, Mehrabian asserts that semantic differential scales are appropriate to measure the three dimensions of emotion.

Emotions and cognition. As mentioned above, there is a complex, multidirectional relationship between emotions and cognition. First, both arousal and cognition influence emotions: Stimuli induce a physiological arousal, which, added to cognitive- and context-specific elements, results in particular emotions. As Grodal explains, "The situational context cues a dominant action tendency by means of a cognitive analysis of the situation, resulting in a cognitive labeling of the arousal" (2000: 201). Second, arousal and cognition influence each other. On one hand, as Wærn asserts, difficult tasks increase arousal. On the other hand, arousal is often cited as a factor influencing cognitive elements, such as memory and information processing. In one of their experiments, Reeves and Nass found that the higher the arousal triggered by a scene, the higher the memory (i.e. recall) score. However, this finding should be complemented with the "Yerkes-Dodson law," which posits that there is a curvilinear relationship between arousal and performance. Indeed, as Wærn explains, "[cognitive] performance is optimal when the arousal in neither too low, nor too high" (p. 13). It should be mentioned, though, that other studies have found no evidence for such an assertion. In their experiment investigating the effects of emotional arousal on memory, Christianson and Mjörndal (1985) found no influence of arousal on memory performance. They implemented two experiments, one measuring recall and the other measuring recognition, and created emotional arousal by injecting adrenalin into the participants' body.

Interactivity and emotions. Interactivity is often mentioned as an important factor influencing arousal. This assertion will be investigated in the present study. Beyond this postulate, Coffey and Stipp (1997) affirm that computers in general, and the Internet and surfing the Web in particular, are considered as more interesting than other media by individuals because the interactivity they offer triggers a higher mental involvement. This is consistent with Van Tassel's (1987) findings that interactivity breeds involvement.

Sports and emotions. There has been little research on the entertaining aspect of watching sports (Bryant and Raney, 2000). In an article titled *Sports on the Screen*, Bryant and Raney note that while participating in sports has been universally praised, sports spectatorship, mediated or not, has often been decried. As they recount, Howard set the tone in 1912, discussing the evil emotions that sports spectatorship creates on "the mob-mind of the athletic spectator," who succumbs to "the elemental gaming and struggle-instinct of the human animal" (1912: 43). He goes even further and encourages "the apostle of social righteousness [to] break into Satan's monopoly" (p. 41). More generally, it seems that most research on sports spectatorship focus either on the social damages and violent aspects of sports, or on the catharsis potential of violent sports.

In addition, Bryant and Raney explain, mass communication research has explored gender differences in sports spectatorship, and it has consistently found differences in enjoyment of sports, with males enjoying watching televised sports, as well as sports violence, more than women. This study will control for gender differences. However, as Bryant and Raney note, these differences may not be due to intrinsic differences between male and female. Rather, sports culture, formats (e.g.

advertisements), and themes (e.g. commentators and announcers) show the predominance of a "masculine bias of sportscasting in America" (p. 171).

Furthermore, as mentioned earlier, sports programming appears to be a well-suited content for the study of emotions. As Gantz asserts, sports spectatorship, mediated or non-mediated, "provides an acceptable outlet for exhibiting emotions and feelings" (p. 5). Bryant and Zillmann (1977) also have shown the capability of televised sports for increasing arousal.

Model

We consider immersive images as virtual reality environments, for it is high in interactivity and vividness, at least compared to traditional pictures and videos. Indeed, immersive images are relatively high in breadth –they use one more perceptual channel (orientation) than still pictures and videos– and in interactivity –the user's input is assimilated in real time, the user can modify the spatial organization of the content, and mapping is natural since control is based on direct manipulation. Our study will investigate the veracity of this model.

We also establish a uses and gratifications typology that relies on the following orientations: 1) cognition, which merges the established cognition orientation with interpersonal utility –traditionally classified as a subsection of the personal identity orientation; 2) diversion; 3) excitement; and 4) parasocial interaction.

Propositions

The main postulate of this study is that interactivity intensifies the participant's mediated experience depending on the participant's uses of the medium and gratifications sought. More precisely, we expect to see an increase in the magnitude of the measures that assess the different components of this experience –cognition, dominance, arousal, pleasure and telepresence– depending on the participants' motivations and expectations.

The implications and derivations of the results and discussions of the various theories and studies presented above substantiate the following specific propositions.

Cognition

Interactivity facilitates exploration (Schnotz and Boeckheler) and triggers involvement, which results in higher attention and encoding (Ferguson and Perse, Vorderer, Van Tassel). In addition, learning is a goal-oriented, needs-dependent process (Wyer and Carlton, Garramone, Resnick, Shuell, Tafler, Schnotz and Boeckheler). Therefore, interactivity will facilitate cognitive processing and information gain for individuals who seek to increase their knowledge or gather information when watching sports.

However, because the manipulation process mobilizes important cognitive resources and necessitates a substantial effort (Waern, Garramone, Schnotz and Boeckheler), and because traditional image editing is nonexistent in interactive settings, we predict that interactivity will hinder cognitive processing for all other individuals (i.e. those for whom the experience of watching sports has little cognitive interest).

Familiarity and Dominance

Familiarity increases with the experience (i.e. previous exposure to interactivity) of the user (Vorder, Grodal, Fredin and Krendl, Borgman, Tafler). Consistent with Mehrabian view, which explicitly links familiarity and dominance (1980: 18), we expect that familiarity will be positively correlated with feeling of dominance in the interactive settings. This makes sense if we consider that familiarity with interactive technologies will help the participants "feel in control," or feel unrestricted by the technology.

Furthermore, since interactivity may trigger emotions, such as dominance, we postulate that individuals in the interactive settings, provided that they are familiar with interactivity, will have a higher feeling of feeling of dominance than individuals who are in the non-interactive settings. However, interactivity may also confuse those who are unfamiliar with the technology. Therefore, their feeling of dominance will be lower than the one of the participants who are in the non-interactive settings.

Arousal

Because difficult tasks increase arousal (Wærn), and because interactivity presumes an active audience, as compared to the passivity of the TV audience, we anticipate that participants in the interactive settings will be more aroused by their mediated experience than participants in the non-interactive settings.

In addition, since we anticipate that interactivity triggers emotions depending on the specifics motivations of individuals, we predict that, in interactive settings, the higher the participants' motivation for excitement, the higher their arousal.

Pleasure

Consistent with this study's postulate that interactivity triggers the emotions that are sought by the individuals, we expect that, in the interactive settings, the participants' motivation for diversion will be positively correlated with the pleasurability of the experience.

However, we have no element allowing us to anticipate whether participants in the interactive settings will find the experience more pleasurable than participants in the non-interactive settings.

Immersion

Telepresence

Because the immersive images used in this study are more vivid and more interactive than still pictures and videos, we anticipate that telepresence will be higher in the two interactive settings.

Telepresence and sensory evaluation

Because of increased telepresence, and especially vividness of the experience, participants who are in the two interactive settings will provide more intense sensory evaluations of the mediated environment.

Telepresence and uses and gratifications

Because interactivity may result in reinforcing particular elements of the experience according to the uses and gratifications sought, we expect that the

participants' "sense of being there" will be positively correlated with the participants' expectations for parasocial interactions.

Theoretical Assumptions

Finally, it should be noted that theories on sports spectatorship often consider suspense and sportsfanship as important elements of sports-related uses and gratifications. The disposition theory (Zillmann et al., 1989), for instance, posits that the enjoyment of witnessing the success and victory of a team or player is correlated with the spectators' sentiments toward this team or player. Conversely, enjoyment of witnessing the failure and defeat of a team or player is negatively correlated with the spectators' sentiments toward this team or player. Similarly, most, if not all, of sports-related uses and gratifications studies have established the fanship-related elements as major motivations for watching sports. As a matter of fact, Gantz found that "emotional satisfactions associated with winning" (e.g. "to trill in victory") were the most important factors underlying the viewers' decision for watching sports programs. Team support and suspense could not be integrated into our model. This issue is further discussed in Chapter 3.

Finally, as mentioned in Chapter 1, this study is not channel-specific. Indeed, the theoretical framework combines theories, methods, and findings based on television- and computer-related research. The fact that this study is not medium-dependant seems well suited to the current trend toward media convergence. This should increase the external

validity of this study's finding, as well as its applicability for the near future. However, the drawback of such an approach is that it may pose a substantial threat to the internal validity of the study. Indeed, our theoretical framework and propositions rely on measures and models that were developed or demonstrated for specific media (e.g. TV) but that may be unsuitable to other (e.g. Internet). For instance, it has been shown that the characteristics of the web audience and television audience are substantially different. In uses and gratifications measures, for instance, one item can be suitable for one medium or specific type of content, but not for others (Becker, 1979).

CHAPTER 3
METHODOLOGY

This study consists in an experiment with a 2x2 factor design. Pretest and posttest questionnaires, as well as computer monitoring, were used to assess the participants' individual scores for each of the independent and dependent variables. One hundred and twenty eight college students participated in the experiment.

Design

The two principal factors of this 2x2 experiments were control and motion. The four ensuing groups and treatments were:

- Group 1, Immersive Pictures (IP): Interactive images with no motion.
- Group 2, Immersive Videos (IV): Interactive images with motion.
- Group 3, Videos (V): Non-interactive images with motion.
- Group 4, Pictures (P): Non-interactive images with no motion.

Process

The experiment was conducted in two days. A half-day session was held for each of the 4 groups. The rationales for having a different session for each group was that the

experiment took place in a single computer lab and it was necessary to limit threats to internal validity such as compensatory rivalry, diffusion, and imitation. In addition, in order to ensure that the time period was not interfering with treatment, a cross repartition of groups based on the two principal factors (motion and interactivity) was implemented. That is, one animated session was held in the morning, the other in the afternoon, and one interactive session was held in the morning, the other in the afternoon. Indeed, if both "interactive" groups or both "motion" groups had been assigned to two mornings or two afternoons, one could have attributed the observed differences across groups to the time period in which the session was held. The difference in students' attention between morning and afternoon, for instance, is a well-known phenomenon among instructors.

Upon arrival at the facility, students were presented with the informed consent form and pretest questionnaire, and asked, if they agreed, to fill out both forms. They would then sit in front of a computer, listen to the investigator's explanations and clarifications, and follow the onscreen instructions. A training stage preceded the actual treatment. After treatment, participants were invited to fill the posttest questionnaire and were kindly asked not to share any information or feelings concerning this experiment with their fellow students.

Training

The training stage was using non sports-related images. For the two interactive groups, it consisted in immersive images –pictures of the College for group 1, aerial video of Hawaii for group 2– that were displayed along with the navigation instructions and that let the participants familiarize themselves with the technology.

For the two non-interactive groups, the simulated training consisted in recognizing 12 pictures representing various campus buildings and places. Participants had to press hotkeys –"ALT" + first letter of the place or building– to indicate their choice and go to the next screen.

Facilities

The experiment took place in the University of Florida's Interactive Media Lab (IML). The facility's 11 computers are identical, including screen size and processor speed, and are connected to the College's Local Area Network.

The 10 computers that were used for treatment were arranged on tables that were placed along the lab's four walls, with the participants facing the walls when seated in front of their computer. A large table at the center of the room was used for the answering of questionnaires, so that participants had no access to the lab's computers before and after treatment. The researcher also made sure all of the 10 computers had similar settings (e.g. screens definition and color settings).

Pretest

The experiment was pretested one day prior the beginning of the experiment to ensure that the experimental design and questionnaires did not have major flaws, and that the organization, logistics, and timing were set to guarantee a smooth processing. Eight individuals participated in the pretest, so that each of the four groups was pretested with 2 persons.

Various changes, such as the design of the questionnaires (e.g. labels reminding the scales' direction were placed at the top of the itemized scales), were made following the pretest. The clarity of some questions was also improved. In addition, this pretest revealed the importance of affixing numbers on computers to guarantee that no mistakes could be done in the grouping of each individual's pretest and posttest questionnaires. It was also decided to measure the length of exposure to the stimuli in the two non-motions groups (pictures and immersive pictures) with timer software.

Finally, the simulated training for the two non-interactive groups was changed from a 3D maze to a hotkey quiz. Indeed, the timed, java-based 3D labyrinth, while similar to the actual trainings of the interactive groups (training for orientation etc.), had the potential to greatly influence arousal –it was timed– and pleasantness –it was very similar to basic video games.

Participants

A total of 128 college students enrolled in graduate and undergraduate courses at the University of Florida participated in the experiment. Each of the four groups was made of 32 participants. A conservative approach would consider students of the University of Florida as the universe from which this sample is drawn. However, we may generalize our findings to the population comprised of all U.S. college students, for we assume a similarity of the two populations in regards to the independent variables involved in this study.

Recruiting

Participants were recruited in graduate and undergraduate classes in the colleges of Journalism and Communications and Liberal Arts. With the consent of the instructors, the researcher invited the students at the end of each class period to sign up for the study. After randomization (see section below), the researcher sent an email indicating to each participant his or her appointment time and date. A confirmation of participation was required, and the researcher called participants on the eve of each session to remind them of their appointment.

The first participants who answered they could not make their appointment were offered to participate in the pretest, without them knowing of such arrangement.

Participants who actually participated in the experiment, including pretest, received as compensation an extra credit applied toward their final grade in the course in which they had been recruited.

Randomization

Entries of the sign-up sheets were numbered serially. The researcher then used *Research Randomizer v2.1*[1] to assign randomly to each entry a number from one to four corresponding to one of the four groups of the experiment. Students were also assigned a non-mandatory appointment time to limit overcrowding at certain times of the sessions, such as early morning or ends of class periods.

[1] This java-script application is available for free on the Internet at http://www.randomizer.org/.

Stimuli

Description

All the treatment materials were presented linearly on a *Microsoft Internet Explorer* browser. Videos used the *RealAudio Player,* and immersive images –videos and pictures–used the *iPIX* plug-ins. A similar screen started the experiment, followed by the general instructions, the training instructions, and the training itself (stage 1). Participants were asked to raise their hand at the end of the training stage so that the researcher could start the computer monitoring software.

The stimuli (stage 2) displayed the following sequences of images (groups 1 and 4) or scenes (groups 2 and 3): A Florida Gators gymnastics meet (vault, floor or uneven bars, beam, podium), intramural soccer competition, intramural beach volleyball competition, and intramural basketball games. The rational for such diverse sports content was that it could allow controlling for sports preferences. Indeed, since various sports were represented, it was improbable that participants' preference for specific sports would interfere with preference or interest in the experience itself. In contrast, a stimulus containing only football or basketball may have indeed influenced greatly the participant's experience based on his or her involvement in this specific sports activity. Moreover, since Gantz (1980) found that the individual's motivations for watching sports are similar across sports, the inclusion of various sports activities in the stimuli did not represent a threat to uses and gratifications measures.

For the immersive pictures group (Group 1), a total of 11 *iPIX* pictures were successively displayed. The still picture stimulus (Group 2) included a series of 57

pictures, each representing one of the *iPIX* pictures' field of view. As a result, all the views available on the *iPIX* pictures (zoom set at minimum) were represented in the non-immersive condition. Both of the videos stimuli (groups 2 and 3) presented 4 successive videos. Group 2 and Group 3 videos were identical but participants in Group 3 (non immersive) could not use –and did not know about– the interactive features (i.e. pan and zoom). The non-interactive conditions were also ensured through the suppression (i.e. hiding) of the mouse. In these two groups (3 and 4), participants had to use hotkeys to jump to the next screen.

Although the researcher strived to have identical shots and scenes for the motion (i.e. videos) and no motion (i.e. pictures) conditions, production-related issues (see section below) resulted in slight difference between what was shown in the videos and what was represented in the pictures.

Samples of the treatment materials can be accessed through the following links:

- Appendix C (screenshots selected from the interactive pictures treatment)
- Immersive video preview[2] (Html document and RealAudio file, 7.3 MB)
- Immersive picture preview[3] (Html document and iPIX file, 295 KB).

Production

Pictures and videos were shot simultaneously using *Nikon Coolpix 990* (still pictures) and *Sony TRV-900* (video) digital cameras, as well as tripods. The cameras were mounted with *iPIX* fisheye lenses. Although two UF broadcast students helped with

[2] The iPIX Plug-In is required for this presentation. To download this Plug-In, go to http://www.ipix.com/download.html

shooting and post-production, scarcity of camera operators, as well as the 360º field of view –resulting in the impossibility of having both the video and the still cameras next to each other– hindered simultaneous shooting of certain scenes. The *iPIX* technology and material used preventing the use of a zoom and offering limited images resolution, especially for video, the camera operators had to be very close to the action and athletes. This resulted in significant problems for the games' and meet's shooting because of access and safety issues.

The pictures were edited using *Adobe Photoshop*. Immersive pictures were then created using the *iPIX Builder* software. Non-immersive pictures were created by using the freeware program *WinGrab 1.40.11* and making screen captures for each of the *iPIX* pictures field of view. The captured images were then cropped to obtain a single, non-interactive photograph.

The video was edited using *Adobe Premiere*, and built in *iPIX* format and encoded as *RealAudio* files using *iPIX movieBuilder Beta Version 1.0*. Operating system and Codecs issues resulted in several problems, including a lower-than-expected image quality, and the necessity to break the video into four parts. In addition, instead of composing a 360º field of view from two original 180º camera shots, the researcher had to mirror the main 180º camera shot to obtain a simulated 360º field of view. These problems are further discussed in the Methodological Assumptions section.

The instructions were coded directly in HTML and training and stimulus materials were embedded into the web pages. The researcher used *Macromedia*

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[3] The iPIX Plug-In is required for this presentation. To download this Plug-In, go to http://www.ipix.com/download.html

Dreamweaver and *Adobe Photoshop* to create or improve the treatments' structure, design, and images.

The treatment materials and computer-monitoring software were stored on the College's server.

Variables for Analysis

The following variables, some of which the present study may not use or integrate into the models, were measured during the experiment. The unused variables may be used for explanatory and exploratory purposes, as well as further research.

Independent Variables

1. Principal factors: Image Characteristics

- Image motion: Motion / No motion
- Image control: Interactive / Non-interactive

2. Independent variables

- Familiarity with interactivity (video games playing habits, Internet use (frequency and session length, experience with immersive images)[4]
- Gratifications sought from watching sports (Cognition orientation / diversion / excitement / parasocial interaction / interpersonal utility)

3. Control variables

- Demographics: Age, gender, education

- Psychographics: Personality orientation (Indoor vs. Outdoor and Shy vs. Outgoing), Social involvement (i.e. involvement in clubs and organizations)
- Familiarity with sports (game attendance and sports media (television, magazines, Internet, newspapers) exposure)
- Importance of sports in the participant's life
- Length of exposure[5]
- Participants' (mouse) activity[6]

Dependent Variables

1. Cognition: Recall
2. Emotions:
- Pleasantness
- Arousal
- Dominance
3. Immersion
- Telepresence (i.e. sense of being there)
- Sensory evaluation (attendance/crowd, athlete involvement, pace of the game, intensity of light)
4. Interest in the game or event
5. Perceived knowledge

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[4] *Immersive groups only*
[5] *No motion groups only*
[6] *Immersive groups only*

Measurement

Questionnaires

Four questionnaires were created for this experiment. Two pretest questionnaires had to be created, one for the interactive conditions and one for the non-interactive conditions. Indeed, questions about familiarity with interactivity were asked to both "interactive" groups in pretest, and these questions could have provided clues about the purpose of the study to participants in the non-interactive settings. Moreover, as mentioned earlier, there were slight differences in terms of the scenes shown between the motion and no motion stimuli. Therefore, the researcher had to create two different posttest questionnaires (motion / no motion) that asked different recall questions. More specifically, five recall questions out of 13 differed between the motion and the no motion questionnaires. However, the researcher strived to assuage these differences by creating questions that were as similar as possible.

Pretest questionnaires

The pretest questionnaires presented the participants with the following succession of questions: Demographics (question one through four), psychographics (question five through seven), familiarity with sports (question eight through 11), familiarity with interactivity (immersive groups only; question 12 through 16), importance of sports in the participant's life (question 17), gratifications sought from watching sports (question 18: cognition, six items; diversion, six items; excitement, three items; interpersonal utility, six items; parasocial interaction, four items), current feelings/emotions (question 19: AdSAM scale, three items).

Several of these questions were designed to be combined into indexes. Seven indexes were created: Familiarity with sports, familiarity with interactivity, and uses and gratifications (five indexes). However, as explained in Chapter Two, the cognition index and the interpersonal utility index were to be grouped in a single index labeled as "cognition." Each index was constructed by accumulating the score obtained for each ordinal item and dividing the total by the number of items included in the index. For instance, one of the "familiarity with sports" items asked participants how often they watched sports events on TV. Responses ranged from "Never," scored as one, to "everyday," scored as six. The purpose of these indexes was to increase variance as well as the statistical significance of the tests' results.

In the demographics section, respondents were asked to indicate their major. The purpose of this question was to distinguish communication majors from other majors, in case such a variable could interfere with the treatment. As a result, communication majors were coded as "one" and non-communication majors as "zero."

Two of the psychographics, or personality, questions used a 7-point semantic differential scale. The two pairs of opposite terms for these two questions were indoor/outdoor and outgoing/shy.

The uses and gratifications items were shuffled in a single series of questions so that the five indexes (i.e. underlying dimensions) were hidden from the respondent. Responses ranged from "Not important at all," scored as one, to "Very important," scored as four. The sources for, and validity of the uses and gratification items are discussed below.

Emotions, or current feelings, were evaluated last to obtain measures as (temporally) close as possible to the beginning of the treatment. Specific considerations on functioning and validity of the AdSAM scale are presented below.

A pretest questionnaire (interactive groups) is presented in Appendix A.

Posttest questionnaires

The first question of the posttest questionnaires consisted in another AdSAM scale. The following 13 items were specific recall questions. Emotions and recall were placed first in order to gauge the participant's emotions and cognition directly after treatment. Emotions measurement came first because the researcher believes that emotions are more time-sensitive than cognitive tasks such as recall. In addition, and as mentioned in Chapter Two, cognition can greatly influence emotional dimensions. In fact, it has been shown that difficult tasks increase arousal (Wærn, 1989). This justified the precedence of the AdSAM scale over recall questions.

The recall questions featured specific central-action-related questions (e.g. scores, injury, podium) as well as questions about the spectators (e.g. crowd reaction). They also combined general questions (e.g. list of sports viewed, athletes behavior) and more specific questions, such as descriptions of the athletes' outfit and athletes' names (the athlete's name probed in the recall questions appeared on a sign in the foreground of one of the gymnastics scene). All recall questions were open-ended.

Question 15 invited respondents to provide comments and details on their experience. Such an input could provide interesting insights to be used in the discussion section. It could also help the researcher better understand the participants' perceptions of the technology and its implementation in this particular sports-related environment. This

open-ended question was not coded. However, the researcher noted observations deemed as useful or interesting in the context of this study.

The next item (question 16) was a manipulation check. It asked respondent how interactive they thought their experience had been. This measure was created to verify the internal and external validities of the experimental design.

Question 17 probed the participants on their perceived interest of the games. Questions 18 and 19 were combined and consisted in a series of Likert scales that measured the participants' feeling of telepresence and their sensory evaluation of the scenes. The last two questions measured the participants' perceived knowledge and asked them whether they had seen any of these specific games prior to this experiment. This latest item was supposed to control for prior knowledge about these games.

The participants' mouse activity and length of exposure were recorded by the investigator at the end of the questionnaire.

A posttest questionnaire (interactive groups) is presented in Appendix B.

Uses and gratifications measures

As Katz et al. (1974) stress, the main concern in gratifications research lies in the measurement of the gratifications sought by the individuals. This challenge of establishing a list of gratifications is mainly a validity issue encountered at the operationalization stage, for it concerns the deduction process that converts large, conceptual categories into actual measurement of natural observations.

Although parts of this issue have been discussed earlier (Chapter Two), it seems important to further discuss these validity-related problems in order to justify the gratifications measures chosen for this study.

As Becker (1979) explains, the two main operationalization-related challenges concern content validity and construct validity. Content validity determines whether the gratification items "logically measure the underlying gratification desired" (p. 58). Some scholars (see for instance Babbie, 1998) refer to this as face validity. Content validity, they argue examines whether "a measure covers the range of meanings included within the concept" (p. 134). Becker tackles this latest issue by mentioning the fact that the lists of items used may not be exhaustive. Researchers usually deal with this problem by performing factor analysis and verifying that the items used account for an important part of the variance. In this study, consistent with Becker's approach, we combine face validity and content validity under the content validity label.

The researcher addressed the content validity problem by establishing a list of gratifications that is based on several lists of general and sports-related uses and gratifications studies. More specifically, most of the items used in this study's uses and gratifications indexes were borrowed from Palmgreen et al. (1980), Gantz (1980), Levy and Windahl (1984), and Melton and Galician (1989). Therefore, it is safe to assume that our uses and gratifications measures have been validated in previous studies. It should also be noted that some items have been validated across the studies aforementioned (i.e. some items had been used in all of the four studies).

The problem of content validity can also be tackled at the categorical level. In other words, one may wonder whether the categories, or indexes, collectively represent exhaustively the full range of uses and gratifications that individuals may seek from media exposure. As explained in Chapter Two, this issue had been resolved by using the categories that were developed by Blumler and McQuail (1969) and that have been

consistently validated ever since. The only modification made to this typology was to assimilate interpersonal utility and cognition. The rationale for such assimilation in the context of the present study was presented in Chapter Two, and the validity of such a combination is presented below.

The main content validity-related issue remaining in the present study stems from the fact that an important gratification category had to be left over. Indeed, as mentioned earlier, the immediate social aspect of sports (e.g. "the opportunity to do something with family and friends") could not be taken into account.

The second type of operationalization-related validity, construct validity, "is based on the logical relationship among variables" (Babbie, 1998: 134). As Becker (1979) explains, media effects research, such as the present study, is particularly appropriate for such a validation technique. Indeed, construct validity uses hypothesis testing to validate the relationship among variables and therefore substantiate that the "empirical measure(s) adequately reflect the real meaning of the concept under consideration" (Babbie, 1998: 133). This approach was first used in uses and gratifications research by McLeod and Becker (1974).

AdSAM

The Self Assessment Manikin (SAM) technique is based on Mehrabian's three-dimensional approach to emotions. As mentioned in Chapter Two, these bipolar and autonomous dimensions are pleasure, arousal, and dominance (PAD). It should be noted that numerous studies (Russel, 1989; Daly, Lancee, and Polivy, 1983; Mehrabian and Russel, 1977; Havlena and Holbrook, 1986) have corroborated Mehrabian's PAD model

(Morris, 1995). This consistency in the identification of emotional dimensions certainly provides a substantial support for the internal validity of the SAM technique.

The complexity of emotions is a major obstacle for the measurements of emotional responses (Plummer and Leckenby (1985), in Morris, 1995). While emotional responses have traditionally been measured through verbal self-reports, physiological measures, photo decks, and dial turning instruments (Morris, 1995), the SAM technique addresses directly the emotional measurement issue because it visually and graphically represents and operationalizes the dimensions of Mehrabian's PAD model (Fig. 1). As Morris explains, "SAM depicts each PAD dimension with a graphic character arrayed along a continuous nine-point scale" (p. 67).

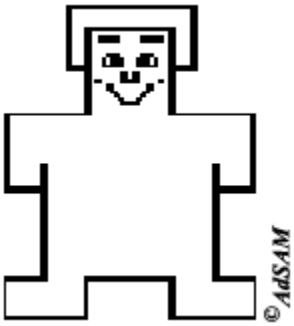


Figure 3-1: Sam

As mentioned in the previous chapter, pleasure, arousal, and dominance have typically been measured using semantic differential scales. The Self-Assessment Manikin is based on a same model but it replaces written phrases and sentences by graphical representations. As Morris et al. (1999) point out, Lang (1985) found high correlations between the SAM measures and Mehrabian's semantic differential scales (0.937 for

pleasure, 0.938 for arousal, and 0.660 for dominance). These high correlations also contribute to the validation of the SAM technique.

In addition, as Morris (2000) notes, the SAM technique offers several advantages:

- It is nonverbal. Indeed, "AdSAM minimizes many of the biases associated with verbal measures of emotion. It enables respondents to more effectively indicate their immediate emotional reactions without the bias of language (…) and to more easily express their feelings."
- Because it is nonverbal, SAM is also cross-cultural.
- SAM is also complementary because it can be used as a supplement in qualitative (e.g. focus groups) and quantitative (e.g. self-administered questionnaires) research.
- "It is easy to use. SAM takes approximately 15 seconds to score per stimulus." It can also be used with children.
- Finally, SAM easily retains the attention of the participants.

Lang developed SAM in 1985 and the technique is now administered by the organization *AdSAM* at the University of Florida. The term AdSAM and SAM are therefore used interchangeably throughout this study.

In addition, AdSAM adds various tools of analysis to the SAM measures. As Morris (1995) explains, there are three methods for reporting SAM results:

- Reports of pleasure-arousal-dominance scores,
- Placing of a stimulus on a four quadrant space (i.e. perceptual map),
- Use of the perceptual map for comparison of the stimulus' pleasure by arousal scores with Mehrabian and Russell's 135 emotions adjectives.

This study favored variations in emotions, rather than absolute AdSAM scores. This strategy seems to be more adapted and accurate for the study of media effects, for it allows controlling for the participants' initial emotional state.

While the AdSAM method is particularly well suited for marketers and well adapted to products and concept testing, it can be a useful tool for measuring emotional response to any types of stimuli. Indeed, as Morris (1995) stresses, "studies by Lang, Bradley, and Morris confirm the reliability of SAM globally, on both the psychological and the communication levels" (p. 67).

Intercoder Agreement

Because the recall questions were open ended, intercoder agreement on these questions' scoring was calculated. However, no tests of intercoder reliability were conducted since the questions were relatively straightforward. Indeed, the coder's own judgment had little importance in the overall scoring of these questions.

Thirteen questionnaires were randomly selected and coded by a third-party investigator. Coders agreed on eight of the 13 questionnaires. This resulted in an observed agreement between the two coders of 0.62. However, it should be emphasized that the score's difference for four of the non-agreed questionnaires was only one point (out of 31). The fifth discordant questionnaire had a three-point difference. This indicates that the relatively low intercoder agreement score reported above had very limited effects on the overall recall score of each participant. Another method of intercoder agreement, more relevant to the scoring method used in this study, would calculate the mean of the agreement on each questionnaire's total score –total agreement being scored as 1 and a one-point difference being scored as 0.968 (1-(1/31)). This method would give a

substantially different coder agreement of 0.982. This method is indeed more adapted to this study, for the recall variable was computed as the participant's overall recall score.

Computer Monitoring

As Rice and Rogers (1984) note, although new media research presents the researchers with many challenges and issues, it also offers several new opportunities and tools for research. Computer monitoring is one of them. As Rice and Rogers add, such a method has the advantage of being unobtrusive, which greatly enhance the validity of the measures.

Both of the programs used for computer monitoring were launched by the investigator after the training stage, and data collected through the software were recorded immediately after the end of the treatment.

TimeIt

The *TimeIt* freeware was used to measure the participant's length of exposure to immersive and non-immersive pictures. Indeed, while the video conditions did not pose any time-related problem because of the fixed length of the stimuli, participants in the "no motion" settings were not limited in the amount of time they could spend on each picture. This issue is further discussed in the Methodological Assumptions section. The software –a script– was downloaded from the Internet.

KeyMeter

The *KeyMeter* software, also downloaded from the Internet, measures the number of clicks and double clicks performed by the user, as well as the number of pixels

traveled by the user-operated pointer (i.e. the mouse). These variables were measured in the interactive settings only.

Statistical Analysis

The data collected during the experiment were analyzed using the SPSS software.

Four different statistical tests were conducted to investigate the 14 hypotheses of this study:

- Independent sample t-tests were used to compare mean for the following hypotheses: H1, H2, H4, H5, H6, H8, H10, H13, and H14
    - Further analyses of these hypotheses and control for other variables were conducted using regression analysis and analysis of variance
- Pearson's correlations were conducted to for H3, H7, H9, H11, and H12.
    - When attempting to control for other variables, the investigator relied on linear regression models.

Descriptive data were computed using frequencies and t-tests.

Design Validity

One of the questionnaire's items functioned as a manipulation check. It asked the participants how interactive they felt their experience had been. It was expected that participants in the interactive settings would actually find the experience more interactive than participants in the non-interactive settings.

The scale ranged from “one” (very interactive), to “five” (not interactive at all). A t-test was conducted to examine each group’s mean on the variable. As expected, users in the interactive groups found the experience more interactive (mean=1.81) than participants in the non-interactive groups (mean=2.65). This difference was significant at the 0.01 level (p= .000). However, when comparing the means to the variable scale, it appears that although the interactive, or immersive, groups found that the experience was between “very interactive” and somewhat interactive,” the non-interactive, or non-immersive, groups found that the experience was between “somewhat interactive” and “neither interactive nor non-interactive.” One could have indeed expected the non-immersive group to find the experience “not very interactive” or “not interactive at all” (i.e. mean ≥ 3). Such results could be explained by the fact that computer-based applications are usually considered as interactive, even when little manipulations is involved. We may have had different results if the non-interactive conditions had been consisted in actual television viewing and printed pictures shows. In addition, participants in the non-interactive settings had to use hotkeys, which may also have contributed to the confusion. Overall, then, these results seem to confirm the vagueness and ambiguity of the term interactivity, as discussed in Chapter 1.

Finally, it is interesting to note that in both the “interactive groups” and the “non-interactive groups,” the video stimuli were found to be less interactive than the picture-stimuli. This corroborates the idea that video screening, like TV viewing, is fundamentally considered as a passive activity.

Hypotheses

Consistent with the theoretical framework and the propositions developed earlier, the following hypotheses were investigated.

Cognition

H_1: Cognition-oriented participants in the interactive settings will recall information better than participants in the non-interactive settings.

H_2: Non cognition-oriented participants in the interactive settings will recall information less than participants in non-interactive settings.

Cognition-oriented participants are individuals who watch sports for cognition purposes and individuals who watch sports for cognition-related personal identity reasons.

Emotions

Dominance

H_3: In interactive settings, the higher the participant's familiarity with interactivity the higher the participant's feeling of dominance.

H_4: Participants who are more familiar with interactivity and who are in the interactive settings will have a higher feeling of dominance than participants in the non-interactive settings.

H_5: Participants who are less familiar with interactivity and who are in the interactive settings will have a lower feeling of dominance than participants in the non-interactive settings.

Arousal

H_6: Participants in the interactive settings will be more aroused than participants in the non-interactive settings.

H_7: In interactive settings, the higher the participant's motivation for excitement, the higher the participant's arousal.

Pleasure

H_{8a}: Participants in the interactive settings will find the experience more pleasurable than participants in the non-interactive settings.

H_{8b}: Participants in the interactive settings will find the experience less pleasurable than participants in the non-interactive settings.

H_{8a} and H_{8b} are mutually exclusive.

H_9: In interactive settings, the higher the participant's motivation for diversion, the higher the participant's feeling of pleasurable experience.

Immersion

Perception of presence / Telepresence

H_{10}: Participants in the interactive settings will have a higher feeling of "being there" than participants in the non-interactive settings.

H_{11}: In interactive settings, the higher the participant's motivation for parasocial interaction, the higher the participant's feeling of "being there."

H_{12}: In interactive settings, the higher the participant's familiarity with interactivity, the higher the participant's feeling of "being there."

Sensory evaluation / Intensity of response

H_{13}: Participants in the interactive settings will have more intense evaluation of the scenes than participants in the non-interactive settings.

Exploratory Hypothesis: Interest in Content

H_{14}: Participants in the interactive settings will find the games more interesting than participants in the non-interactive settings.

Methodological Assumptions

New Media

Rice and Rogers (1984) point out that "quantitative research approaches, particularly manipulated experiments, based on variance research, seldom can provide a satisfactory understanding of the behavioral change process through which a new communication medium has effects" (1984: 87). Monge (1982) also discusses this issue. It seems indeed true that the fact that new media are only in their infancy hinders the thorough analysis of their effects on the users and the clear identification of behavior- and

cognition-related implications of their use. There is little one can do about this issue at this point, and this should not discourage scholars from undertaking research on new media. Rice and Rogers (1984), as well as Monge and Cappella (1980), recommend the use of process research, for instance longitudinal studies (e.g. panels) or time-series analysis, to overcome this issue. These methods are hardly realistic in the context of this study. On the other hand, the study of new media allows for the use of new, efficient methods. The unobtrusive mouse-tracking software used in this study illustrates well this argument.

The challenges of conducting new media research were also apparent in the difficulties the researcher had in measuring the participants' uses and gratifications. Indeed, the researcher had to rely on measures associated with traditional media to investigate a new technology. In other words, participants' were asked questions relating to their *current* motivations for watching sports and the researcher's assumptions were mainly based on current television audience. This dilemma is related to the convergence issue discussed in the Theoretical Assumptions section (Chapter Two) and it features the same pros and cons. As an exploratory study, it can benefit academic research in new media. In addition, because this study takes into account the current television audience, its findings may be useful, at least in the short term, for applied research and the new media industry. Nevertheless, the drawback of such an approach is that, because it is highly likely that in the near future the form and functioning of the media in general, and immersive images in particular, will change, they will fulfill different goals from the ones measured in this study. In addition, the audience is likely to evolve quickly. As a result,

traditional uses and gratifications dimensions, as used and operationalized in this study, may soon become dated.

Design

The drawbacks of artificial settings and the forced exposure that is contingent to experimental designs have been extensively discussed by scholars and researchers. In this study, the artificial conditions have resulted in two intertwined issues. The first one is common to almost all experiments and concerns the high attention that forced exposure might have triggered. However, this hindrance is even more crucial in this study because television viewing is rarely an exclusive activity in natural settings. Indeed viewing sessions usually involve situations where "watching TV" is not the sole activity. Anderson and Field (1991) discussed various audience studies and research methods based on online (e.g. Nielsen Arbitron, "peoplemeter," field and laboratory observations) and offline (e.g. viewing diaries, surveys, focus groups) assessments of the television audience. As they explain, rather vividly,

> In a typical viewing session [Americans] enter a TV viewing area, turn on the TV if it is not already on, look at the television for some period of time, look away, and look back again. They may leave the viewing area and then return. They may engage in a variety of concurrent activities ranging from homework to housework to lovemaking to sleeping. They may change the channel, turn off the TV set, or exit the viewing area. (1991: 199)

Although immersive images necessitate presence and a relatively high attention, their regular use may end up being relatively similar to television viewing. It is not impossible, for instance, that the individual set the desired view, watch for a while, and then engage in a concurrent activity.

The second factor, although also related to the artificiality of the context, has to do with to sports viewing and content. Indeed, sports viewing is most often a collective activity (Gantz, 1980), and the particular characteristics of the content in a natural setting greatly affect the viewer's experience. While, as Bryant (1989) notes, the social context of the viewing of any content influences the message effects and enjoyment, it seems reasonable to assume that this assertion is particularly relevant to sports viewing. Indeed, artificial settings are likely to alter factors that usually influence the viewer's enjoyment of watching sports. Some of these factors, unfortunately, are qualified as critical by Bryant and Raney (2000). Most specifically, these factors are: " 1) The viewers' affective relationships to the players or team involved in the contest; 2) The favorableness of the outcome of the contest to the spectator; 3) The amount of conflict and drama inherent in the contest or added to the sporting event by the sportscasting or production team; 4) The amount of suspense the contest has and how that suspense is resolved" (p. 159).

Because this study involved teams that triggered very limited, almost nonexistent (except maybe for the Gators' gymnastics meet) support on the part of the participants and because only very short sequences of each game were shown, this limitation seems particularly crucial in the present study.

The procedure chosen for this experiment also yielded methodological limitations that ought to be taken into consideration. First, although training was necessary for the immersive groups, the simulated training for the non-immersive groups was not only needless, from a technical standpoint, but it may have biased external validity and measures. Indeed, because such activities –memory game and web surfing– are uncommon in natural settings (i.e. before actual exposure to a game), such a procedure

resulted in lower generalizability of the results. In addition, the simulated training might have influenced the participant's experience, for it might have interfered with the actual treatment. However, scientific thoroughness necessitates such procedure because the experimental conditions, immersives and non-immersives, had to be exactly the same, except for the variation in the factors under investigation. Indeed, it would be plausible that the training resulted in higher maturation –a threat to internal validity– of the participants. Consequently, in order to be completely comparable, all groups had to follow the same procedure.

In addition, since pretest variables were measured at the very beginning of the experiment, the training may have interfered with the posttest measurements for all of the four groups. This issue is especially apparent when considering the measure of emotional responses. It is in fact possible that the posttest measures were influenced not only by the actual treatment, but also by the training. Since pretest measures of emotions were performed before training, the posttest-pretest variations cannot distinguish the influence of training from the variation due to the actual treatment. It should be added, though, that if the pretest had been performed after the training, the problem would have remained, since the training that had occurred right before could have influenced the pretest.

Finally, it should also be mentioned that pretest may have resulted in interaction of testing and treatment. This threat to external validity is due to the fact that "pretest might increase or decrease the respondent's sensitivity or responsiveness to the experimental variable" (Campbell and Stanley, 1963).

Participants

The external validity issues related to the use of college students in academic research are also well documented in the social science literature. Indeed, college students "are not typical of the public at large" (Babbie, 1998: 237). This obstacle to generalizability is especially important when considering media use and familiarity. This issue is perceptible at the geographical and socio economical levels (see the notion of "digital divide") as well as at the demographical level (see the notion of "generation gap"). As Voderer (2000) recounts, Schulz (1997) refers to "cultural fragmentation" and Maletzke (1987) to "two-class societies" to designate the differences that exist between the younger users, who are raised with new media and consider the television boring, and older individuals, who prefer television and often have hard time understanding the functioning and uses of new media devices.

However, as Babbie (1998) explains "this potential defect is less significant in explanatory research than it would be in descriptive research. . . . Social processes and *patterns* of causal relationships appear to be more generalizable and more stable than *specific* characteristics" (p. 237). It could even be argued that college students constitute a population that is particularly adapted to such explanatory study because they are "major consumers of sports events" (Melton and Galician, 1989) and because they are fairly familiar with interactivity and represent an important proportion of all Internet users.

Stimuli

Most of the issues related to the stimuli used in this experiment stem from the difficulties the investigator had in producing these stimuli. As mentioned earlier, encoding and operating system problems resulted in a low image quality for both video-based stimuli, as compared to the quality of both picture-based stimuli, and a simulated (i.e. mirrored) 360º view for the immersive videos. In fact, several participants explicitly observed the low image quality and mirrored view in the "observation" item of the posttest questionnaire. This problem is due to the fact that the researcher used a beta version of software that is not available on the market yet. Therefore, the researcher had to face technical difficulties and deal with them with whatever means were available. While this issue is common to many new media studies, it remains that it poses an important threat to the internal validity of the measures. Indeed, observed differences between the "motion" and "no motion" settings could be attributed to these differences in image quality and presentation, rather than to the "motion" factor.

Another hindrance to the comparison of these two groups is that while the length of exposure was fixed for the "motion" groups, it was variable for the "no-motion" groups. Because such conditions are similar to natural settings, this procedure increased the external validity of the results. On the other hand, it poses a substantial threat to internal validity and comparison between the four groups in regard to the motion variable. To remedy to this issue, a "length of exposure" variable was created.

As mentioned earlier in the Stimuli section, the specific requirements raised by the *iPIX* technology and the immersive images' production –the unavailability of a zoom and/or multiple cameras, and the impossibility to follow the action closely– resulted in

videos that were significantly different from traditional sports broadcasts. These factors should be taken into account when generalizing the findings, as they alleviate the full identification of the non-immersive videos used in this study with sports videos found in natural settings.

Finally, the videos used in this experiment featured no sound or commentaries. In a study dedicated to the importance of commentaries in televised sports, Sullivan (1991) found that level of commentary (dramatic, neutral, or no commentary) had substantial effects on the viewers' perception and enjoyment of the players. However, the investigator believed that the insertion of commentaries in the videos could interfere with the variables studied. Therefore, once again, the investigator had to operate a tradeoff between external and internal validities.

Instruments

Most of the methodological assumptions related to the measuring instruments used in this study have been discussed earlier. However, some clarifications and further considerations are presented below.

Self report

While, as Bryant (1989) asserts, self-reported and scale-based measures of enjoyment and emotions are reliable and show high correlation with unobtrusive measures, the use of self-reported uses and gratifications measures presents a significant threat to internal validity. Indeed, as Becker (1979) explains, such a technique assumes that "the respondent is *capable* of providing answers to the questions posed regarding relevant gratifications" (p. 56). For instance, "items can be rejected prematurely." In

addition to the issue of "capability" of the respondent, investigators of uses and gratifications face the issue of the "willingness" of the respondents. Indeed, "Certain gratifications may well be more socially acceptable than others" (p. 56). While, as mentioned in Chapter Two, the latest issue is not particularly relevant to the present study, the problem of relying on the introspection of the participants deserves to be taken into consideration.

AdSAM

The fact that AdSAM does not rely on any index for the measure of each of the PAD dimensions is somewhat disturbing. However, since the AdSAM measure has been validated since its inception 15 years ago, and since high correlations have been found between SAM measures and semantic differential scales, the researcher assumes that this measure is valid.

CHAPTER 4
FINDINGS

Four hypotheses, out of the 14 that were formulated, were accepted. More specifically, it was found that participants in the interactive settings were more aroused than participants in the non-interactive settings, and that motivation for excitement correlated with variation in arousal for participants who were in the interactive conditions. In addition, participants who were in the interactive settings had a higher feeling of "being there" than participants who were in the non-interactive settings. Finally, participants in the interactive settings found the games more interesting than participants in the non-interactive settings.

Descriptive Analysis

Sample Characteristics

Demographics

Age. The sample was relatively young. More than half of the participants (64%) were between 18 and 22 years old. By regrouping the two lowest age categories, it appears that the age of 91 percent of the participants fell between 18 and 27 years old. These figures are consistent with data on college enrollment from the U.S. census bureau

(March 2001) and show that, at least in terms of age repartition, the present sample is representative of the U.S. student population at large.

Gender. About 71 percent of the participants were female. This is explained by the predominance of women in the student body in general, and especially in communication-related (e.g. advertising) classes, where the participants were recruited. Since this repartition is not representative of the actual sports audience, in which males are by and large the majority, such discrepancy could somewhat limit the generalizability of our findings. However, since female college students also are major consumers of sports events, the accuracy of this study's measurement should not suffer too much from this disparity.

Education. The sample was approximately evenly distributed in terms of highest diploma earned (High School, 36%, Associate 33%, and Bachelor 28%). Only 1.6 percent of the sample had a graduate degree. In addition, two thirds of the participants indicated that their major was communication-related.

Familiarity.

Familiarity with sports. The familiarity of the overall sample with sports events and media was average (mean of 3.12 on a scale from 1 to 6, 1 being labeled as "never," 3 as "less than once a week," and 6 as "everyday"). However, in the context of a sports-oriented college town, this mean could be qualified as relatively low. The same observation comes up when looking at the participants' assessment of the importance of sports in their life. Only a little more than half of the sample considered sports as important ("very important," 26.6%; "somewhat important," 31.3%), and almost 10

percent considered it as "not important at all." These ratings could have hindered the study in that the low involvement in sports of almost half of the sample could have resulted in biased results (e.g. low recall and emotions scores) and low potential for generalizability of the findings to the sports audience at large. Not surprisingly, the "familiarity with sports" index and rated importance of sports in the participant's life were positively correlated (Pearson's correlation of .67, significant at the .01 level).

Familiarity with interactivity. The sample mean for the "familiarity with interactivity" index was 3.6 on a six-point scale, 1 being the lowest familiarity score. While this index's score was certainly brought down by the relatively low videogames playing frequency of the sample (mean = 2.52, between "less than once a month" and "less than once a week"), the participants' high familiarity with the Web, typical of college students, appeared clearly within the index – the aggregate showed that participants surfed the Internet almost every day (mean = 4.83) for a duration of more than 30 minutes.

Familiarity with immersive images. These measures were conducted in the two immersive groups only. A majority of the participants (62%) had never used immersive images, and almost 20 percent had never heard of this technology before. The prevalent participants' unfamiliarity with immersive images is even more pronounced when looking specifically at the *iPIX* technology. About three percent of the sample had used *iPIX* images before, and almost 70 percent had never heard of it. However, it is possible that some individuals in the sample used it without associating the technology with a particular name or brand, such as *iPIX*, or even used technologies very similar to the one

that *iPIX* commercializes (e.g. *RemoteReality*, *QuickTime VR*, *BeHere*, and *iMove*). Moreover, in the heated battle that is currently going on in this sector for market share and leadership, these companies strive to impose different cognomens to designate very similar technologies (e.g. "dynamic" images, "cubic" pictures and video, and "spherical" view).

In any case, the aggregated scores on these items and indexes remain low, and such unfamiliarity may well hurt different aspects of the study. This issue has been mentioned earlier (e.g. uses and gratifications measures) and will be further discussed later (see Chapter Five).

Mouse activity

In average, participants in the interactive settings clicked 168 times, double-clicked 32 times, and traveled 65.3 pixels. Activity was higher in terms of clicks and pixels traveled in the picture setting, but higher in the video setting in terms of double-clicks. This discrepancy is surprising, but it should be mentioned that no specific function required the participant to double-click in the treatment. Such manipulation can therefore be accounted as clicks. As a matter of fact, there was a high correlation (.66, significant at the 0.01 level) between clicks and double clicks.

No significant correlations were found between variation in arousal and mouse activity. At first glance, this finding is somewhat surprising considering that, according to Mehrabian (1980), activity is one of the two dimensions of arousal, the other being alertness. As mentioned earlier, scholars have identified various components of arousal, and the complexity of the concept may explain why the relationship between activity and arousal was not a clear-cut one. In addition, it seems that mouse activity could be more

associated with familiarity-related factors, such as the user's expertise in manipulating the technology, than to the user's arousal. Indeed, a better navigation within the image can be achieved through accurate manipulation of the mouse than through numerous frantic clicks. As a matter of fact, small negative correlations, although not statistically significant, were found between both familiarity with interactivity and familiarity with immersive images, and mouse activity.

Table 4.1: Average Mouse Activity in the Picture and Video Settings

Dependent Variable		**Motion**	
		Picture	Video
Number of clicks	**Mean**	175.800	156.469
	Sig.	.49	
Number of double-clicks	**Mean**	25.100	39.875
	Sig.	0.130	
Number of pixels traveled	**Mean**	69.985	60.898
	Sig.	.331	

Length of Exposure

In average, participants spent seven minutes navigating the immersive pictures, while participants in the "still pictures" setting spent three minutes and 28 seconds looking at the stimuli. This comes down to the participants spending an average of 38 seconds on each immersive picture, and 3.7 seconds on each still picture. However, since the still pictures represented almost every view of the 11 immersive pictures, it could be said that participants in the non-immersive setting spent 19 seconds in average on each scene. Although it could be argued that the novelty of the technology may have greatly influenced such behavior, it remains that participants in the immersive setting spent more

time on each scene, or picture, than participants in the non-immersive setting. This would certainly offer a persuasive argument supporting the use of immersive images on organizations' and products' Web sites.

Sample Scores on the Independent Variables

Recall

Recall scores are reported and analyzed as "x" to 1 ratios. The mean for the recall scores of the 128 participants was .41 (median = .39). Individual means ranged from .03 to .81. Table 4.2 displays the means for the two main factors –interactivity and motion– and table 4.3 displays the means for each of the four groups (i.e. combinations of the two factors).

While it can be observed that recall in the interactive settings is lower than in the non-interactive settings, and higher in motion settings than in no motion settings, these differences are not statistically significant. However, when comparing the mean recall score of each group (i.e. interaction), significant differences surface: In non-interactive settings, recall score is higher for videos than for pictures, while in interactive settings, recall score is higher for pictures than for videos. It seems therefore that there is an interaction between these two factors on the dependant variable.

Table 4.2: Variations in Emotions Between Pretest and Posttest for the Interactivity and for the Motion Factors

Dependent Variable		**Interactivity factor**		**Motion factor**	
		Non interactive	Interactive	Picture	Video
Recall	**Mean**	.429	.390	.399	.421
	Sig.	.127		.388	

Table 4.3: Variations in Emotions Between Pretest and Posttest for Both the Interactivity and the Motion Factors (Interaction)

Dependent Variable	Interactivity	Non interactive		Interactive	
	Motion	Picture (Group 4)	Video (Group 3)	Picture (Group 1)	Video (Group 2)
Recall	Mean	.386	.473	.411	.369
	Sig.	.013			

Interestingly, the recall score decreased as the level of education increased (p = .025). A Pearson correlation confirmed this trend (coefficient = .274, p = 002). Less surprising is the fact that the recall score increased as interest in sports increased ("very important," .45; "somewhat important," .39; "not very important," .38; "not important at all," .30). The Pearson correlation for this last relationship –importance of sports and recall– was 0.194 and was significant at the .05 level (p = .028). Similarly, a .256 Pearson correlation (p = .004) was observed between familiarity with sports and recall.

However, it is important not to draw any quick conclusions or provide tentative explanations at this point, since these scores only are descriptive statistics. The recall means for the two principal factors –interactivity and motion– were conducted without any control for other variables. These scores will be discussed in the next chapter. These findings will also be taken into account for the control variables' selection in hypotheses testing.

Finally, it comes as little surprise that perceived knowledge correlated with recall scores (coefficient = .244, p = .006).

Emotions

The pretest measures of emotions revealed disparate repartitions of means within and across each group before treatment. This was particularly apparent on the pretest perceptual maps. It was therefore crucial to account for these discrepancies in the analyses and the hypotheses' testing. As a result, only *variations* between pretest and posttest within each of the three AdSAM nine-point scales were taken into account. The variations for each aggregate (i.e. motion and interactivity factors) and each of the four groups are presented in tables 4.5 and 4.6, and represented graphically on a perceptual map (figure 4.1).

The only substantial variation in the emotions of the overall sample was a decrease in pleasure. It is likely that this trend resulted from the experiment itself and the fact that participants considered their participation, although voluntary, as a school-related duty necessary to increase their final grade. This phenomenon could be related to the process of experiment-related maturation, through which participants grow more tired or hungrier as time goes on (Campbell and Stanley, 1963).

Interestingly, females felt more in control (i.e. higher variation in dominance) than males after the experiment (mean difference = .706, p = .028).

Table 4.4: Overall Variations in Emotions Between Pretest and Posttest

	Pleasure	Arousal	Dominance
Mean	-.1953	-0.0234	0.0156

Table 4.5: Variations in Emotions Between Pretest and Posttest for the Interactivity and for the Motion Factors

Dependent Variable		Interactivity factor		Motion factor	
		Non interactive	Interactive	Picture	Video
Pleasure	**Mean**	-.313	-0.078	.188	-.578
	Sig.	.300		.001	
Arousal	**Mean**	-.375	.328	.375	-.422
	Sig.	.021		.009	
Dominance	**Mean**	-.516	.547	.141	-.109
	Sig.	.000		.372	

Table 4.6: Variations in Emotions Between Pretest and Posttest for Both the Interactivity and the Motion factors (Interaction)

Dependent Variable	**Interactivity**	Non interactive		Interactive	
	Motion	Picture (Group 4)	Video (Group 3)	Picture (Group 1)	Video (Group 2)
Pleasure	**Mean**	0.0313	-.656	.344	-.500
	Sig.	.729			
Arousal	**Mean**	.188	-.938	.563	0.0938
	Sig.	.276			
Dominance	**Mean**	-.469	-.563	.750	.344
	Sig.	.577			

Several significant variations related to the two principals factors could be observed. While the picture stimuli were associated with an increase in pleasure, groups exposed to the video stimuli showed a decrease in pleasure (p = .001). Conversely, no significant differences were found between the interactive and the non-interactive settings. In addition, relatively important differences in arousal means were found within each factor, with increased arousal in the picture (p = .009) and interactivity (p = .021) settings and decreased arousal in video and non-interactivity settings. It is however surprising that these differences lose their significance when the two factors are

combined (p = .276). The greatest discrepancy between two means for these emotion-related variables was found in the variation in dominance for the interactivity factor, which revealed a highly significant (p = .000) difference between the non-interactive settings (mean = -.52) and the interactive settings (mean = .55).

Regardless, it should be mentioned that these variations are relatively small compared to the overall size of each scale (nine points).

Immersion

The telepresence index was based on a series on five items that were measured with five-point Likert scales, ranging from 1, "strongly agree," to 5, "strongly disagree." The ensuing index ranged from 1, "high telepresence" (i.e. high feeling of "being there") to 5, "low telepresence." A similar index was constructed to measure the intensity of evaluation (crowding, light, games pace, and athletes involvement), based on a series of four items. The overall means were 3.7 for telepresence and 2.8 for intensity of evaluation. Table 4.7 shows the telepresence and intensity of evaluation means for the aggregated groups depending on the two main factors. Table 4.8 shows the means for each of the actual groups; that is, for the four factor-based combinations.

The only significant (p = .000) finding for the immersion-related variable was that participants in the interactive settings had a higher feeling of "being there" (i.e. telepresence) than participants in the non-interactive settings (reversed Likert scales).

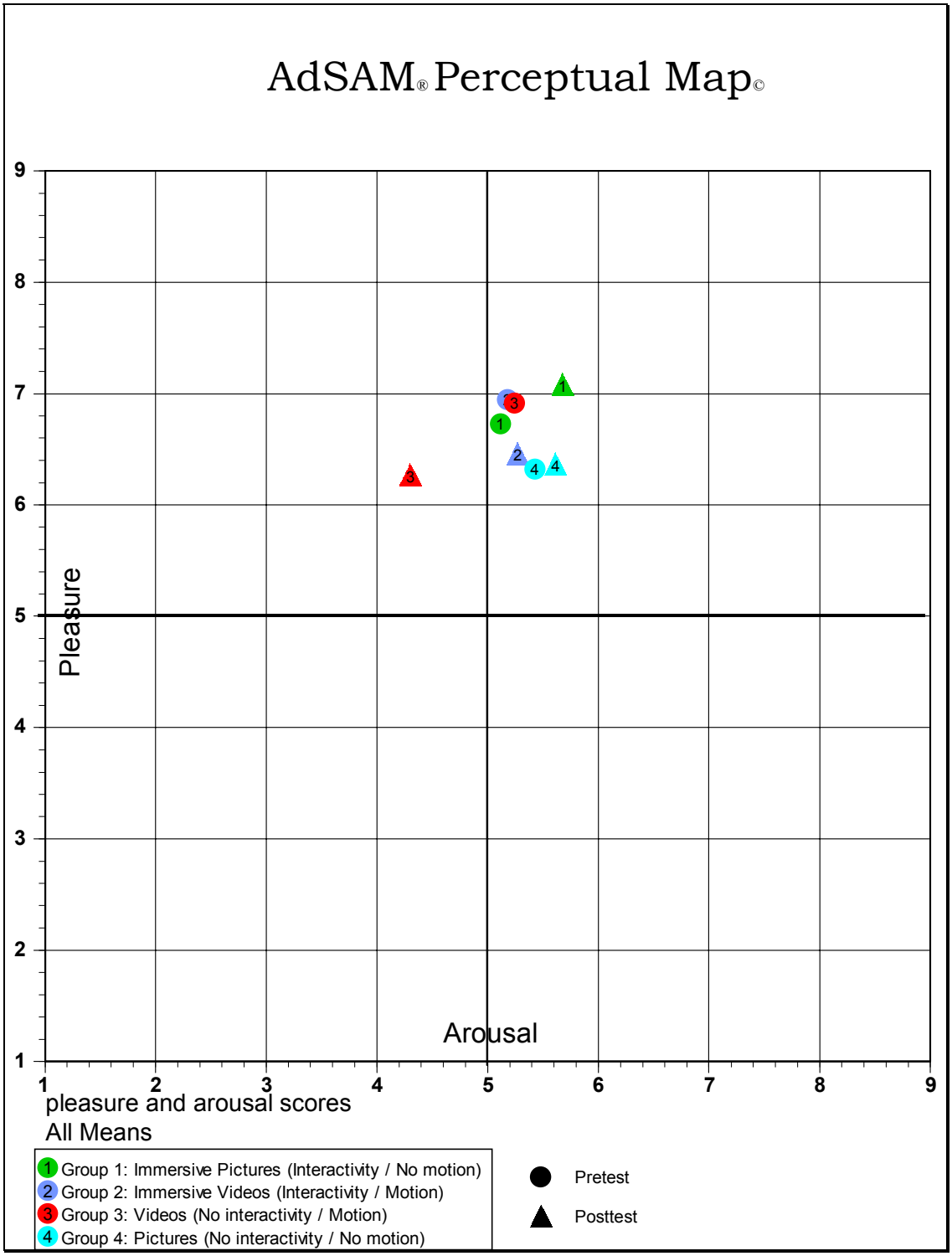


Figure 4.1: Perceptual Map

In addition, a positive correlation was found between the "familiarity with sports (media or event)" and the telepresence variables (Pearson coefficient = -.274, p = .002). A significant (p = .001) negative correlation of .3 was also found between the highest diploma earned variable and the telepresence variable. Length of exposure had no effect on telepresence.

Table 4.7: Means for Telepresence and Intensity of Evaluation for the Interactivity and the Motion Factors

Dependent Variable		Interactivity factor		Motion factor	
		Non interactive	Interactive	Picture	Video
Telepresence	**Mean**	4.013	3.384	3.594	3.803
	Sig.	.000		.163	
Intensity of Evaluation	**Mean**	2.805	2.828	2.825	2.809
	Sig.	.850		.895	

Table 4.8: Means for Telepresence and Intensity of Evaluation for Both the Interactivity and the Motion Factors (Interaction)

Dependent Variable	**Interactivity**	Non interactive		Interactive	
	Motion	Picture (Group 4)	Video (Group 3)	Picture (Group 1)	Video (Group 2)
Telepresence	**Mean**	4.013	4.012	3.175	3.594
	Sig.	.163			
Intensity of Evaluation	**Mean**	2.774	2.836	2.875	2.781
	Sig.	.524			

<u>Interest and perceived knowledge</u>

Level of interest in the games was rated from 1, "Very Interesting," to 5, "Very boring." Overall, games were found to be "neither interesting, nor boring" (mean = 3.06).

The participants' perceived knowledge about the games was rated in the opposite direction, 1 being "Not knowledgeable at all" and 4 being "Very Knowledgeable." The mean of the entire sample for this variable was 2.74.

The means are presented table 4.9 for the aggregates and table 4.10 for each of the four groups (i.e. interaction).

Table 4.9: Means for Interest in the Games and Perceived Knowledge for the Interactivity and for the Motion Factors

Dependent Variable		**Interactivity factor**		**Motion factor**	
		Non interactive	Interactive	Picture	Video
Interest in the games	**Mean**	3.265	2.803	2.677	3.391
	Sig.	.009		.000	
Perceived knowledge	**Mean**	2.777	2.698	2.677	2.797
	Sig.	.609		.441	

Table 4.10: Means for Interest in the Games and Perceived Knowledge for Both the Interactivity and the Motion Factors (Interaction)

Dependent Variable	**Interactivity**	Non interactive		Interactive	
	Motion	Picture (Group 4)	Video (Group 3)	Picture (Group 1)	Video (Group 2)
Interest in the games	**Mean**	2.968	3.562	2.387	3.219
	Sig.	.496			
Perceived knowledge	**Mean**	2.710	2.844	2.645	2.750
	Sig.	.925			

Perceived interest of the games varied across both factors' attributes. Games were perceived as more interesting by the interactive groups (mean difference = .462, p = .009) and by the pictures groups (mean difference = .713, p = .000). No significant mean differences were found for the "perceived knowledge" variable.

An interesting, significant (p = .023) finding was that the mean for perceived interest of the games decreased as the level of education (i.e. "highest diploma earned") increased. Differential means of "perceived knowledge" were also found for the "gender" and the "importance of sports" variables, with males feeling as being more knowledgeable about the games than females (p = .001), and, not surprisingly, "perceived knowledge" means increasing as the "importance of sports scores" increased. A .435 Pearson correlation (p = .000) was found between the "perceived knowledge" and the "importance of sports" variables.

Tests of Hypotheses

Cognition

H_1: Cognition-oriented participants in the interactive settings will recall information better than participants in the non-interactive settings.

H_2: Non cognition-oriented participants in the interactive settings will recall information less than participants in non-interactive settings.

Hypothesis 1 and 2 were simultaneously tested with a single analysis of variance. To operationalize cognition *orientation*, the sample was divided into two groups, based on the overall median (median = 2.50) of the sample for the cognition orientation index. As the results presented table 4.11 show, hypotheses 1 and 2 were rejected. Neither there were associations between each of the two factors investigated –cognition orientation and interactivity– and recall scores, nor there was an interaction between these two factors,

whether or not motion was introduced as a control variable. Motion was introduced as a control variable because, as mentioned earlier, the recall questions were slightly different in the motion and in the no-motion groups. In addition, as shown in the descriptive analysis, there was a significant interaction between interactivity and motion.

Table 4.11: ANOVA Table for Recall Score

Source	df	F	p
Cognition Orientation	1	.024	.878
Interactivity	1	1.575	.212
Interactivity x Cognition Orientation	1	.914	.341
Error	117		

R Squared = .026 (Adjusted R Squared = -.007)

Table 4.12: Recall Means for the Interactivity and the Cognition Orientation Factors, Control for Motion

		Interactivity factor		**Cognition factor**		**Interaction**			
						Non interactive		Interactive	
		Non Interactive	Interactive	Non-Cog. Oriented	Cog. Oriented	Non-Cog. Oriented	Cog. Oriented	Non-Cog. Oriented	Cog. Oriented
Recall	**Mean**	.431	.398	.413	.413	.442	.421	.383	.413
	Sig.	.212		.878		.341			

<u>Emotions</u>

<u>Dominance</u>

H_3: In interactive settings, the higher the participant's familiarity with interactivity the higher the participant's feeling of dominance.

Hypothesis 3 predicted that, in interactive settings, the participant's familiarity with interactivity would be positively correlated with (variation in) feeling of dominance. This hypothesis was rejected, for such a correlation was not found to be significant

(Pearson coefficient = .167, p = .187), even when the investigator controlled for gender (β = .181, p = .157).

H_4: Participants who are more familiar with interactivity and who are in the interactive settings will have a higher feeling of dominance than participants in the non-interactive settings.

H_5: Participants who are less familiar with interactivity and who are in the interactive settings will have a lower feeling of dominance than participants in the non-interactive settings.

Hypotheses 4 and 5 were tested simultaneously by conducting an analysis of variance, with interactivity and familiarity with interactivity as independent variables, and variation in dominance as the dependent variable. The familiarity with interactivity index was recoded into two categories based on the median score of the sample (median = 3.66) for this index. The two hypotheses were rejected, since neither the familiarity factor nor its interaction with interactivity was significantly associated with dominance. However, the interactivity factor was significantly associated with variation in feeling of dominance, $F(1, 101) = 12.002$, p = .001. The results for this test are presented table 4.13.

Table 4.13: ANOVA Table for Variation in Dominance

Source	df	F	p
Familiarity with Interactivity	1	.711	.401
Interactivity	1	12.002	.001
Interactivity x Familiarity with Interactivity	1	.482	.489
Error	101		

R Squared = .130 (Adjusted R Squared = .104)

Table 4.14: Means of the Variations in Dominance for the Interactivity and the Familiarity with Interactivity Factors

		Interactivity factor		Familiarity with Interactivity factor		Interaction			
						Non interactive		Interactive	
		Non Interactive	Interactive	Unfamiliar	Familiar	Unfamiliar	Familiar	Unfamiliar	Familiar
Variation in Dominance	**Mean**	-.565	.518	-.155	.108	-.588	-.542	.278	.759
	Sig.	.001		.401		.489			

Although, as shown on the plot representing the interaction of the two independent variables (figure 4.2), there seems to be a trend sustaining our proposition, we must refute the idea that familiarity with interactivity has an influence on dominance in interactive settings.

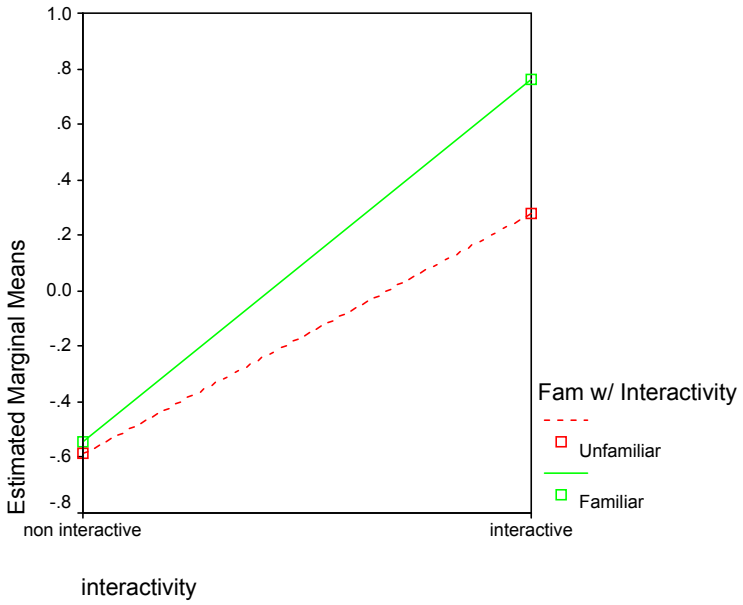


Figure 4.2: Means for Variation in Dominance

Arousal

H_6: Participants in the interactive settings will be more aroused than participants in the non-interactive settings.

A t-test was conducted to examine hypothesis 6. The mean of variation in arousal was significantly higher in the interactive groups than in the non-interactive groups, $t(126) = 2.287$, $p = .024$, mean difference = .7031. Hypothesis 6 was accepted. Because no other variables, including importance of sport in life, had been found to influence arousal, no tests incorporating control variables were performed. In addition, as mentioned above, no interaction was found between motion and interactivity.

H_7: In interactive settings, the higher the participant's motivation for excitement, the higher the participant's arousal.

Hypothesis 7 anticipated a positive correlation between the participant's motivation for excitement and the participant's arousal in interactive settings. A regression analysis was conducted to investigate this association. A positive association falling just short of statistical significance was found between the two variables, $\beta = .239$, $p = .064$. However, as mentioned in the literature review (see the "law of initial value"), initial arousal can greatly affect the mediated experience's influence on arousal. Running the same test with initial arousal as a control variable, the association became significant, $\beta = .251$, $p = .045$. Gender was not found to influence this association. In addition, an ANOVA confirmed the existence of a relationship between motivation for excitement and variation in arousal, $F(9, 51) = 2.327$, $p = .028$. Hypothesis 7 was accepted.

<u>Pleasure</u>

H_{8a}: Participants in the interactive settings will find the experience more pleasurable than participants in the non-interactive settings.

H_{8b}: Participants in the interactive settings will find the experience less pleasurable than participants in the non-interactive settings.

H_{8a} and H_{8b} are mutually exclusive.

As mentioned in the descriptive analysis, interactivity was found to have no influence on the participant's variation in pleasure. A t-test confirmed this analysis, $t(126) = 1.003$, $p = .318$. Hypothesis 8a and 8b, which anticipated that interactivity would influence the pleasurability of the experience, were both rejected.

H_9: In interactive settings, the higher the participant's motivation for diversion, the higher the participant's feeling of pleasurable experience.

A Pearson correlation was conducted to test hypothesis 9, which anticipated a positive correlation between the participant's motivation for diversion and the variation in feeling of pleasure. No significant associations –positive or negative– were found between these two variables. Hypothesis 9 was rejected.

Immersion

Telepresence

H_{10}: Participants in the interactive settings will have a higher feeling of "being there" than participants in the non-interactive settings.

An analysis of variance (t-test) was conducted to examine hypothesis 10. T value for this test was –4.211, and the mean difference (.628) was significant at the .01 level of confidence (see also table 4.7 in the descriptive analysis). A similar difference between the two means remained, at the same level of confidence (98%), when controlling for

motion, diploma, and familiarity with sports, $F(1, 123) = 19.141$, (corrected model: R Squared = .272; Adjusted R Squared = .248). Hypothesis 10 was accepted.

H_{11}: In interactive settings, the higher the participant's motivation for parasocial interaction, the higher the participant's feeling of "being there."

Correlations and linear regressions analyses were conducted to investigate hypothesis 11. This hypothesis was rejected. What is more, the investigator found just the opposite, not in terms of the direction of the correlation but in terms of the predicted contrast in uses and gratifications effects between the interactive and the non-interactive settings. Indeed, no association between motivation for parasocial interaction and reported telepresence was found in the interactive settings, even when controlling for the two possibly influential variables, level of education and familiarity with sports. On the other hand, a positive, significant ($p = .004$) association was found between these two variables in the non-interactive settings (see table 4.15). It should be noted that the Likert scale for telepresence was reversed, which explains that the correlation appears as negative on the table.

The association remained ($\beta = .2$, $p = .019$) when the test was conducted on the overall sample (i.e. the aggregate of the four groups) with interactivity introduced as a control variable.

H_{12}: In interactive settings, the higher the participant's familiarity with interactivity, the higher the participant's feeling of "being there."

Hypothesis 12 anticipated a positive correlation between familiarity with interactivity and telepresence in the interactive settings. This hypothesis was rejected: No significant association between familiarity with interactivity and telepresence was found in the interactive settings (see table 4.15).

In addition, hypothesis 12 was rejected when considering familiarity with immersive images, rather than familiarity with interactivity. In this occurrence, the hypothesis was disproved because of the direction of the association. The coefficient of the association (p = .028) between the two variables –familiarity with immersive images and telepresence– was indeed negative. In other words, it appeared that the higher the participant's familiarity with immersive images, the lower the feeling of telepresence.

Table 4.15: Linear Regression Coefficients for the Dependent Variable Telepresence in Interactive and Non-interactive Settings. Control for Motion.

Predictor		Interactive Conditions	Non-Interactive Conditions
Parasocial Interaction	**Beta**	-.057	-.363
	T	-.443	-2.988
	Sig.	.660	.004
Familiarity with Interactivity	**Beta**	.067	-.320
	T	.538	-2.638
	Sig.	.593	.011
Familiarity with Immersive Images	**Beta**	.276	N/A
	T	2.255	N/A
	Sig.	.028	N/A

Sensory evaluation

H_{13}: Participants in the interactive settings will have more intense evaluation of the scenes than participants in the non-interactive settings.

Hypothesis 13 was tested using analyses of variance. No significant differences were shown between the two conditions and among the four groups, even when controlling for other variables such as motion or familiarity with sports. The same tests were also applied to each item of the index, but no significant differences were found either.

Interest

H_{14}: Participants in the interactive settings will find the games more interesting than participants in the non-interactive settings.

A t-test revealed significant differences between these two groups, with the mean for the interactive groups being .47 (on a four-point reversed scale) higher than the non-interactive mean for perceived interest, $t(126) = -2.548$, $p = .012$.

Table 4.16: Means for Perceived Interest of the Games in the Interactive and the Non-interactive Groups

Dependent Variable		Interactive	Non-interactive
Perceived Interest of the Games	Mean	2.83	3.30
	Sig.	.012	

CHAPTER 5
DISCUSSION

Although we failed to accept a large number of hypotheses, the acceptance of some of them, as well as the rejection of others, brings important insights on the immersive experience.

In the hypotheses' testing and post analyses it has been *shown* that immersive images increase telepresence, feeling of dominance, and arousal. Moreover, it has been shown that motivation for excitement made the experience more arousing in interactive settings, while, consistent with previous research, video decreased the participant's arousal. This study's findings also verified one of the main propositions of the uses and gratifications approach, that is, recall is positively influenced by the participant's involvement in content. Finally, the present analyses also established a positive association between parasocial interaction and telepresence in non-interactive settings, and suggested that such an association may also be observed in interactive settings, although this latest association (i.e. in interactive settings) was not significant in the present study.

In addition, the present study *suggested* that familiarity with media (i.e. frequency of media exposure) might increase the feeling of telepresence, while familiarity with interactivity might decrease such feeling. It was also suggested that the technology used in this study might be easy to grasp, and that the pleasure dimension of emotions might

be essentially different from the two other dimensions (arousal and telepresence) in terms of its sensitivity to media forms, as opposed to content. Reflections on familiarity with interactivity and feeling of dominance also confirmed that the notion of familiarity with interactivity could be ambiguous, as mentioned in the literature review. Suggestions on methodological issues associated with uses and gratifications effects research in general, and the difficulties of relying on forced exposure in particular, are also presented in this chapter.

Finally, this chapter points at some *possible flaws* of this study and relies on post analyses to further explore these flaws, which include: the low reliability of the evaluation and the familiarity with interactivity indexes, differences among the stimuli other than the two factors under study (interactivity and motion), the low image quality of the video stimuli, and a possible flaw in the questionnaire's design for the measurement of uses and gratifications.

Immersive Images and Telepresence

Immersion

The acceptance of hypothesis 10 ("Participants in the interactive settings will have a higher feeling of 'being there' than participants in the non-interactive settings") provided substantial empirical support for the idea that the technology used in this study is indeed immersive. In both the video and the picture groups, feeling of telepresence was significantly increased in the interactive settings. Throughout this study, we have used the

terms “immersive” and “interactive” as if they were interchangeable. The acceptation of hypothesis 10 has justified such assimilation, at least in the context of the present study.

Telepresence and Vividness

As noted above, immersive images have been shown to increase the feeling of telepresence. However, since vividness has been presented as a constituent of telepresence, one may wonder why such images have not also increased the perception of the images’ vividness, as the rejection of hypothesis 13 (“Participants in the interactive settings will have more intense evaluation of the scenes than participants in the non-interactive settings”) suggests. The following discussion is aimed at showing that the rejection of hypothesis 13 should not be conceived as the refutation that there are differences in vividness between the immersive and the non-immersive images.

We have operationalized telepresence as a feeling of “being there,” and thus concluded that immersive images trigger telepresence. However, our conclusions do not seem to empirically fulfill the requirements for telepresence, as defined by Steuer. Indeed, for Steuer, interactivity and vividness constitute the two dimensions of telepresence. While, as explained in the propositions, immersive images theoretically rank relatively high in these two dimensions, the idea that immersive images are high in vividness has been somewhat alleviated by the rejection of hypotheses 13. Indeed, one could have expected the high vividness of *iPIX* images to be reflected in the participant’s reported sensory evaluations. This did not happen. As a result one could challenge the idea that immersive images are truly vivid, or are more vivid than still pictures and

traditional videos. However, a closer look at the methods and stimuli used in this experiment calls for assuaging the importance of the finding of H13 and its implications.

The evaluation index

Two considerations seem to indicate that the index that was used to measure intensity of evaluation was not well suited to measure variation in vividness of the images. First, the index had a low reliability score and included only one item related to sensory evaluations. Second, the index did not measure the only element of vividness that varied across interactive and non-interactive settings, that is, orientation.

This index was indeed very diverse, for it included variables such as pace of the game, the perceived athletes' involvement, and the extent to which the participants felt these events were packed with supporters (crowding). In addition to the low reliability of the index (the α for this scale was .4137), triggered by the diversity of the index's items and the fact that they may even be unrelated to one another, it should be emphasized that the only variable that could be truly considered as a sensory evaluation was the reported intensity of light. Indeed, as noted in Chapter Two, the five perceptual channels that were identified by Gibson and considered as attributes of the breadth of vividness are orienting, auditory, haptic, taste and smell, and visuals. Only a very specific aspect – intensity of light– of only one perceptual channel –the visuals channel– was measured in the index. The rational for putting together such a diverse set of questions was that the researcher wanted to investigate whether the idea that media forms influence the intensity of the viewer's response, including evaluation about sensory and psychological experiences (Grabe et al., 1999; Lombard et al. 1997), could apply to a study on interactivity.

Nevertheless, the fact that the t-test for a possible mean difference between the interactive settings and the non-interactive settings for the variable "intensity of light," taken this time individually, did not lead to significant results suggests that other factors prevent one from considering this hypothesis as a test assessing the vividness of immersive images.

In fact, as mentioned in the propositions section, the interactive settings featured only one more element of vividness –orientation– than the non-interactive settings. In addition, interactive and non-interactive conditions were similar in terms of sensory depth. Therefore, the only element that differed in terms of vividness between the interactive groups and the non-interactive groups was orientation, and this element, or more precisely its perception by the participants, was not measured in this experiment. However, since orientation can be considered as a patent element (i.e. either the participants can change the views and "move" in the picture, or they cannot), it seems pointless to rely on measurements of the users' perception to assess its presence, or non-presence.

In short, despite the rejection of hypothesis 13, immersive images deserve their labeling because, in addition to being essentially interactive (increased user control over the presentation of information) and vivid (the orientation element, in fact, is tangible and does not need to be measured), they actually increase the sensation of telepresence among users.

Variations in vividness across stimuli

The issue of sensory depth leads to considerations that are related to the stimuli and, more specifically, their quality and comparability. While this issue was tackled in

the methodology sections, findings related to hypothesis 13 have corroborated, or illustrated, the fact that the picture and the video stimuli had intrinsic content-related differences other than the two factors under study (motion and interactivity). Indeed, when pursuing the analysis of variance for each of items of the "intensity of evaluation" index, significant differences were found between the video and the picture settings. It seems highly likely that these differences could be attributed to actual differences in the content of these stimuli. Perceived crowding, or the extent to which the participant considered that a lot of persons were attending the games, was significantly higher for the pictures setting than for the video conditions (mean difference = .625, $F(1, 126) = 11.496$, $p =. 001$). This could be explained by the fact that one of the no-motion scenes (immersive and non-immersive) was a shot taken from inside the crowd at a basketball game. As a result, participants could feel that they were part of the supporters, who were on the foreground on most of the represented scene (i.e. most of the 360º view for the immersive image, and most of the still pictures for the non-immersive scene). It is highly possible that participants in the picture settings have transposed this particular scene or experience into a general impression about the attendance at all of the games presented in the treatment. Similarly, the light was perceived as more intense by participants in the video settings than by participants in the picture settings (mean difference = .578, $F(1, 126) = 7.542$, $p = .007$). This difference seems sensible since the videos were a little overexposed.

Finally, it should be taken into consideration that the substandard visual depth of the videos and the lack of audio (i.e. reduced breadth) might have resulted in the stimuli

generating a lower telepresence than the one that professional images found in natural setting usually elicit.

Telepresence and Familiarity with Sports

The positive correlation between familiarity with sports viewing, mediated or not, and feeling of telepresence deserves some attention and clarifications. Indeed, one may wonder whether telepresence is influenced by familiarity with sports per se or whether the real factor influencing telepresence is in fact mere familiarity with the media. The index does not allow distinguishing between these two options. However, when running correlation for each of the items, it appears that all of the items that involved familiarity with sports through media correlated with telepresence, while attendance to sports events did not. In addition, there was no association between importance of sports and perceived telepresence (see table 5.1). In view of such findings, and although no data were collected on familiarity with non-sports-related media, it seems reasonable to assert that the individual's media habit influences telepresence: The higher the individual's media exposure, the higher the feeling of telepresence.

On one hand, the exclusion of familiarity with the content itself (i.e. sports) as a factor of telepresence somewhat contradicts Tafler's (1995) view (Chapter Two, Familiarity section) that the individual's personal interests and history affect the vividness of the experience and therefore also influence telepresence. On the other hand, the assertion presented above makes sense if one considers that as the individual's familiarity with media increases, it is likely that the individual forgets about the technological aspects (e.g. the tangible device) and therefore enters more easily the

mediated environment. In short, familiarity with media breaks the wall that separates the mediated world from the real world. This association, which could be categorized into what Steuer calls the individuals' factors influencing telepresence, can have far-reaching implications in media research. For instance, it may explain phenomena of "addiction" to media channels such as the Internet or television, where the mediated world ends up taking precedence over the real world.

Table 5.1: Linear Regression Coefficients for the Dependent Variable Telepresence. Control for Interactivity. (Reversed Telepresence Scale)

Predictor	Attendance	Television	Magazines and Newspapers	Internet	Importance of Sports in Life
Beta	-.105	-.224	-.291	-.163	.086
T	-1.254	-2.749	-3.627	-1.967	1.025
Sig.	.212	.007	.000	.051	.307

Telepresence and parasocial interaction

A flaw in the questionnaire design could account for the rejection of hypothesis 11. Hypothesis 11 (i.e. there is an association between motivation for parasocial interaction and the magnitude of telepresence in interactive settings) was a constituent of this study's main proposition that, because interactivity epitomizes user activity and because the user has the potential to actually do what he or she wants, uses and gratifications effects related to the user's specific orientations should be considerable. Therefore, a positive association between parasocial interaction and telepresence was expected only, or at least mainly, in the interactive conditions.

Unexpectedly, a positive correlation was found between the two variables, but only in the *non-interactive* settings. When conducting an ANOVA for the *whole sample*,

a significant relationship was found between motivation for parasocial interaction and telepresence, $F(12, 98) = 1.463$, $p = .009$. Logically, the same test applied individually to the interactive and the non-interactive settings showed a significant association in the non-interactive settings only $F(12, 50) = 3.208$, $p = .002$ (see table 5.2).

Table 5.2: ANOVA Scores for the Dependent Variable Telepresence.

Factors		Interactive and Non-interactive Settings (All groups)*	Interactive Settings (Groups 1& 2)	Non-Interactive Settings (Groups 3& 4)
Parasocial interaction	**F**	2.399	.807	3.208
	df	12	12	12
	Sig.	0.009	.642	.002
Interactivity	**F**	7.958	N/A	N/A
	df	1	N/A	N/A
	Sig.	0.006	N/A	N/A
Interactivity x Parasocial interaction	**F**	1.188	N/A	N/A
	df	12	N/A	N/A
	Sig.	.303	N/A	N/A

**R Squared = .383 (Adjusted R Squared = .226)*

But it is when looking at the plots for the means that an explanation seems to emerge. The plot for the means in non-interactive settings (figure 5.2) shows a positive correlation (negative on the plot) between parasocial interaction and telepresence. As mentioned earlier, this association was found to be significant. The fact that the means in the center of the plot stray away from the linear model (downward then upward from “not very important” to “somewhat important”) is noteworthy because a similar disruption of the curve can be observed on the plot for the interactive settings (figure 5.1). Indeed, the plot for the interactive settings also reveals a trend corroborating a positive association (negative on the plot) between parasocial interaction and telepresence, and displays a

bigger disruption of the curve in the middle ("not very important" to "somewhat important" groups, 4 values, 29 individuals, almost half of the sample). It also has two outliers (value "not important at all," two participants), but they can be disregarded in the present analysis.

This disruption of the linear model in the center of the curves could be attributed to the possibility that participants who had no real opinion on this motivation checked a value somewhere in the middle. Since these values may not reflect what they were intended to, these "no opinion" groups may have hindered the establishment of a clear linear relationship. The fact that more participants fell into this category in the interactive settings may explain why a positive correlation, although apparent on the plot, was not significant in the interactive settings. In other words, a plausible explanation for the absence of a relationship in the interactive settings is that participants who, in reality, had no opinion on the matter –that is, whether they watched sports for parasocial interaction reasons– chose a value in the middle, introducing biases in the analysis. Had a neutral, or "no opinion" value been included in the scale, the investigator could have removed the participants included in this neutral category, and the findings (i.e. a positive correlation between motivation for parasocial interaction and telepresence) might have then been significant.

However, despite this possible rationale for the absence of a relationship in the interactive groups, the rejection of the hypothesis remains: As far as parasocial interaction is concerned, interactivity does not trigger uses and gratifications effects.

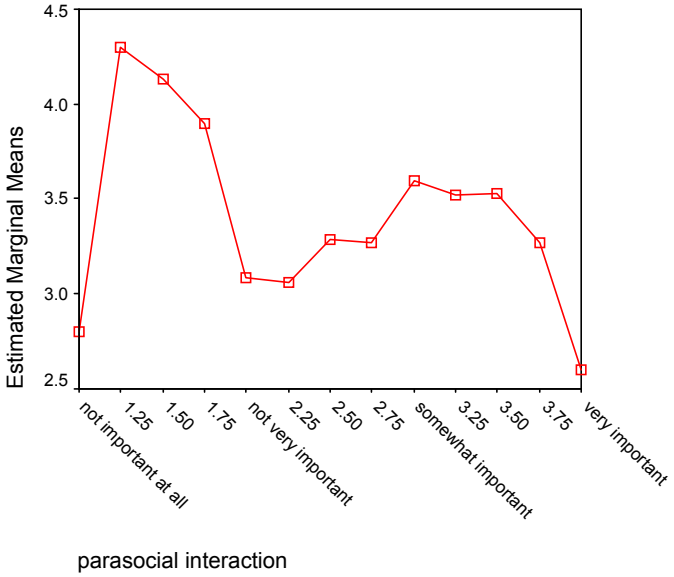


Figure 5.1: Mean Scores for Telepresence. Interactive Setting.

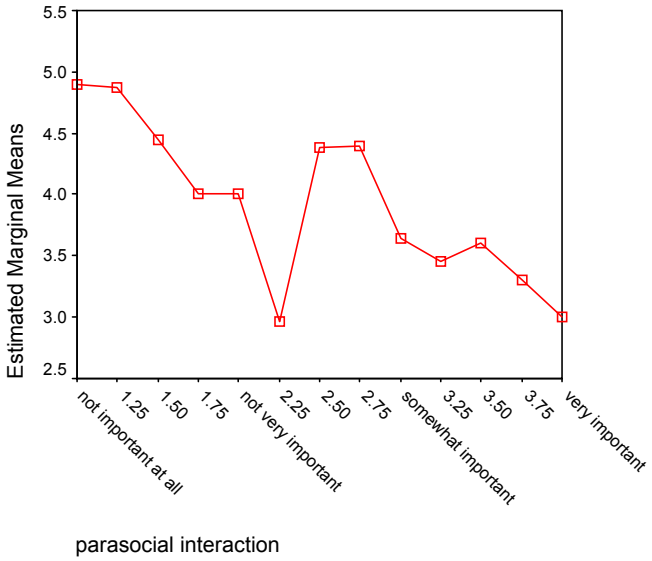


Figure 5.2: Mean Scores for Telepresence. Non-interactive Setting.

Telepresence and Familiarity with Interactivity

The rejection of hypothesis 12 (i.e. "In interactive settings, the higher the participant's familiarity with interactivity, the higher the participant's feeling of 'being there'") seems to be an interesting case. An analysis of the variance of both variables ruled out the possibility that insufficient variance affected the testing of the hypothesis. The standard deviation was .8606 for telepresence and .7450 for familiarity with interactivity. However, the problem appeared to stem from the low reliability of the familiarity index ($\alpha = .2094$). It is therefore highly possible that this low reliability hindered the testing of this hypothesis. The three items included in this index were frequency of video game playing, frequency of Internet use, and average length of Internet session.

When reconsidering this index, it seems that the first two items are inappropriate for measuring familiarity with interactivity. Indeed, although video games can be, and have been, considered as highly interactive, a close look at the frequency distribution shows that the sample distribution is markedly skewed to the left. More than half of the sample (53.1%) answered that they never play video games or play less than once a month. This finding is not surprising considering that females were a majority in the sample and that previous research has consistently found important gender differences in video games playing (Sakamoto, 1994; Barnett et al. 1997; Cassell and Jenkins, 1999), with involvement in, and frequency of videogame playing being prominently higher for males. As result, the restricted range of the values and non bell-shaped distribution of the sample may have prevented the establishment of an association between telepresence and familiarity with video games. The familiarity index may have suffered from this issue.

The second items, frequency of Internet use, seem to have low face validity in terms of measuring familiarity with interactivity. Indeed, and although the question stipulated "how often do you *surf* the Internet" (emphasis added), it is possible that a substantial number of participants who answered that they frequently surfed the Internet (i.e. "once everyday" or "several times a day") go in fact online mainly to check their emails. Such an Internet use cannot be considered as a very interactive activity, as compared to surfing the Web.

The only remaining item, which seems more appropriate in terms of actually measuring Web surfing, is the average length of Internet session. The interesting thing is that the testing of hypothesis 12 (a regression analysis) for this single item uncovers a significant negative association between this item and telepresence, $\beta = .342$, $p = .007$. Moreover, the direction of this association is consistent with the association, also significant, tested with the familiarity with immersive images index and presented in Chapter Four. If this analysis is correct, then, it contradicts the positive correlation that was expected between familiarity with interactivity and telepresence. On the other hand, it would corroborate the proposition of sociologists, presented in Chapter Two (Section "Interactivity, Vividness, and Telepresence"), arguing that the perception of "being there" in mediated experience may be hindered by interactivity because, by communicating with the medium, the participants may realize that the "depicted reality" is "an illusion" (Vorderer, 1995). Such findings could solve the ambiguity of interactivity that is claimed by sociologists by refining their proposition and showing that this is not the interactive experience itself that may hinder the feeling of telepresence, as the acceptation of hypothesis 10 showed. Rather, this is the *habit* of communicating with the

media that may make the participants aware the mediated experience is an illusion and may therefore result in lower telepresence. It should be emphasized that these considerations do not contradict the assertion that was presented above and that contended that media exposure increases telepresence. Indeed, there is a fundamental difference between being used to being *exposed* to the media and being used to *communicating* with the media. The former may make the user forget the existence of a device, the later may make the user cognizant that a technology drives the experience.

Immersive Images and Cognition

Immersive Images and Recall

H_1: Cognition-oriented participants in the interactive settings will recall information better than participants in the non-interactive settings.

H_2: Non cognition-oriented participants in the interactive settings will recall information less than participants in non-interactive settings.

The rejections of hypotheses 1 and 2 reveal that the participants' cognitive processing, which was measured as their recall of different elements of the games, was free of the influence of interactivity or cognition-related motivations, as well as the combination of these two factors. The adequate variance of the recall responses (standard deviation = .1484) and the normal distribution of the sample for this variable seem to exclude the possibilities that measurement-related biases had hindered the hypotheses testing. In addition, the index measuring the level of the cognition-related motivations of

the participants for watching sports had a satisfactory reliability coefficient (α = .9242). This relatively high coefficient, added to the inter-item correlations (mean = .511) and inter-sub-index correlations (reported in the Methods section), seem to confirm the appropriateness of the uses and gratifications typology established in this study for the cognition orientation. In other words, this seems to corroborate the idea that, in certain cases at least, interpersonal utility and cognition can be combined into one cognition-oriented index: Although the final purposes of these orientations are different –one is purely cognition-related, the other is socially motivated– these orientations have similar media-related means, or intermediate motivations, for achieving their respective objective.

However, there was a possibility that index's recoding, which consisted in the categorization of the cognition-orientation variable (originally an interval measure) into two clusters, had lessened the power of the statistical test. To investigate this possibility, the investigator recoded the original cognition orientation index into another variable made up of four categories (instead of the two that were created at the first recoding). The test in general, and significance levels in particular, were not affected by that change.

Had the test only been applied to the interactive settings, it would have been possible to envisage that the novelty of the medium had diverted the participants, resulting in low attention to the content of the stimuli. Although this may have played a role in the rejection of the hypothesis, this event cannot be considered as the sole element responsible for the non-association of the variables. Indeed, even the main and long-established proposition of uses and gratifications and effects –the fact that information seeking triggers attention and recall– was refuted in this test because no significant

association between cognition orientation and recall were found in the non-interactive settings. A plausible explanation, then, would contend that the cognition orientation of the participants did not result in higher attention. Information seeking, rather than cognition orientation, seems to be the key of the uses and gratifications proposition. Although these two concepts –information seeking and cognition orientation– are likely to be intertwined in natural settings, it may not be the case in artificial settings. Indeed, in forced exposure conditions, it is unlikely that the participants have the same motivations as in natural settings. Although the issue of forced exposure will be discussed later, it seems important to consider this specific case. First, there is little chance that the participants had any information need or content-related cognition motivation when they started the experiment. Second, most of the players featured in the games were unknown to the participants. Information seeking, indeed, seems triggered by team support and/or interest in specific sports leagues or athletes. This could not happen in this experiment, except, to a certain extent, for the Gators gymnastics part of the stimuli. In addition, in the case of motivations related to interpersonal utility, information seeking is activated by the prospect of sharing the information with others. It is unlikely that the participants would want to share information about the games or players involved in this study with fellow classmates or friends, although they might have shared information about the experiment itself, which is different from the content per se. These issues of forced exposure and unfamiliarity with players and games, as well as the non-professional playing of most of the games, resulted in ruling out the main condition for the uses and gratifications proposition to take effect, that is, an inclination for information seeking among cognition-oriented participants. A measurement of the participants' attention level

and focus may have corroborated such an explanation. Indeed, the participants' attention might have been high, but it might have focused on non-content-related elements (e.g. technological device, interface, surrounding).

Familiarity with Sports and Recall

The correlation observed between familiarity with sports and recall seem to indicate that the individuals' motivation and interest for a particular type of content – sports in this study– could influence the cognitive processing of the message. This would be consistent with the *general* proposition of the uses and gratifications approach. Indeed, greater involvement may lead to greater attention to the message.

However, one could oppose to this argument the fact that participants who consider sports as important in their life may have had a higher prior knowledge of some of the elements featured in some of the stimuli's scenes and recall questions (e.g. names of gymnastics athletes, jersey colors). This argument was not supported by the findings of a partial correlation conducted between importance of sports in life and each of the recall questions. Indeed, none of the Gators-gymnastics-related recall questions correlated significantly with the importance of sports variable. Another explanation, then, could be that these individuals may be used to looking at the scoreboards and other key elements of the screen's frame (or photo) when watching (or looking at) sports events. As a matter of fact, recall correlated more significantly with familiarity with sports media than with importance of sports in life (see Table 5.3).

Table 5.3: Bivariate Correlations Among Importance of Sports, Familiarity with Sports, and Recall Scores.

		Importance of sports in life	Familiarity with sports	Recall score
Importance of sports in life	**Pearson Correlation**	1.000	-.671**	-.194*
	Sig. (2-tailed)	.	.000	.028
	N	128	128	128
Familiarity with sports	**Pearson Correlation**	-.671**	1.000	.256**
	Sig. (2-tailed)	.000	.	.004
	N	128	128	128
Recall score	**Pearson Correlation**	-.194*	.256**	1.000
	Sig. (2-tailed)	.028	.004	.
	N	128	128	128

** *Correlation is significant at the 0.01 level (2-tailed).*
* *Correlation is significant at the 0.05 level (2-tailed).*

Immersive Images and Emotions

A descriptive analysis of the three emotion-related variables –dominance, arousal and pleasure– showed that these variables had satisfactory levels of variance (standard deviations were, respectively, 1.655, 1.7679, and 1.3225) and sample distributions.

Dominance

Familiarity with interactivity and dominance

The rejection of hypothesis 3 ("In interactive settings, the higher the participant's familiarity with interactivity the higher the participant's feeling of dominance") signifies that familiarity was not associated with variation in the feeling of dominance in the interactive settings. Two possible explanations for this finding –the ambiguity of the notion of familiarity with interactivity and the prospect that most of participants quickly learned how to use the interactive technology– are discussed in this section.

The issue of the low reliability of the familiarity scale discussed above in the context of hypothesis 11 was not relevant here, since individual regression tests for each

of the index's items, as well as with the familiarity with immersive images index, yielded results that were not significant.

Two explanations come to mind when considering these negative results. First, as explained in the literature review, the feeling of dominance is conceptualized as the extent to which the individual feels unrestrained. In this study's context, this operationalization is ambiguous. This issue was apparent in the Familiarity section of the literature review. Indeed, on one hand, one could envision that individuals who are familiar with interactivity in general, and immersive image in particular, would have the technology in control and therefore feel free to manipulate the technology easily. They would therefore not feel restricted by the technology, as opposed to novices who could feel "lost" in the images. On the other hand, as Tafler (1995) explains (see the Familiarity section), increased familiarity with interactivity can result in the participant having "cognitively mapped [the] cybernetic corridors [of the interactive system]." As a result, the participants could feel confined in a world which boundaries are well known, as compared with the feeling of freedom some novices may have felt. It is possible that this ambiguity was reflected in the results, as some participants may have reacted according to the first model, and the others to the second model.

The second explanation considers the possibility that participants who had never used this technology before, whether they were familiar with interactivity or not, were comfortable with manipulating and navigating these images, at least at the end of the experiment when the posttest measures were conducted. This suggests that the technology is relatively easy to use and that the participants quickly learned how to

navigate the images. Intermediate measures (e.g. after training and/or after each scene) could have provided more insights on this possibility.

The fact that the association predicted in the hypothesis was accepted when considering only the interactive video group could validate this latest explanation. Indeed, when hypothesis 3 was tested only with the video group, the results were significant when controlling for gender ($\beta = .415$, $p = .016$), and fell just short of statistical significance when no control was performed (Pearson coefficient = .332, $p = .063$). This could be explained by the fact that the video stimulus was confusing, especially because of the image quality and the mirrored view. Therefore, even at the end of the experiment, novices did not felt that they were in control, while participants who were familiar with interactivity and used to seeing all kinds of interactive features on Web sites –some of them are sometimes confusing– felt in control in the imperfect interactive video condition. In addition to corroborating the explanation based on the ease of use of *iPIX* images, this latest findings seem to confirm the unreliability of the familiarity index and the validity of "length of Internet session" as a measure of familiarity with interactivity. Indeed, when the latest test was applied to each individual items of the index, the "length of use" item was the only one that resulted in truly significant results ($\beta = .399$, $p = .027$).

H_4: Participants who are more familiar with interactivity and who are in the interactive settings will have a higher feeling of dominance than participants in the non-interactive settings.

H_5: Participants who are less familiar with interactivity and who are in the interactive settings will have a lower feeling of dominance than participants in the non-interactive settings.

The rejection of hypotheses 4 and 5 is not surprising considering that H3 rebutted the idea that familiarity with interactivity influences feeling of dominance in interactive settings.

Immersive images and dominance

The significant association that was found in the analysis of variance between interactivity and dominance is remarkable and deserves some attention. First, these findings show that interactivity increases the feeling of dominance among participants. Table 5.4 presents the means of variation in dominance for the interactive and the non-interactive settings.

Table 5.4: Estimated Marginal Means for Interactivity. Dependent Variable: Variation in Dominance

Interactivity	Mean	Standard Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Non-interactive	-.565	.208	-.977	-.153
Interactive	.518	.234	0.054	.982

These results are important because not only do they show that immersive images have a substantial effect on dominance, but they also reveal that, while mere exposure to photos and videos tend to reduce the feeling of dominance, an immersive experience may actually increase such a feeling. In other words, immersive images seem to have the potential to "reverse" the negative effects that traditional media usually have on the

user's feeling of dominance. Indeed, the confidence interval of the means for each of the two conditions –interactive and non-interactive– indicates that we can be relatively confident in the sign –positive or negative– of these two means.

The negative sign of the dominance variation mean in the non-interactive settings is consistent with the idea that "freedom of choice" is limited when individuals are exposed to traditional media. Indeed, it seems that their media experience per se (i.e. excluding any concurrent, non-media-related activity they can have during this experience) gives them little choice but watching or looking at whatever is presented to them. In a natural setting, this score would somewhat increase (toward zero) because, in the case of television for instance, viewers are able to choose among different channels.

In contrast, the positive sign of the dominance variation mean in the interactive settings makes sense if we consider Mehrabian's remarks on the feeling of dominance:

> This feeling can be hampered by settings which limit the forms of behavior and enhanced by settings which facilitate a variety of behavior. . . . A kitchen or an office that is well stocked with a variety of tools facilitates more behavior (and enhances a feeling of dominance) than one which is sparsely equipped. Flexible interior decorations, such as movable room partitions, adjustable levels of lighting, or movable furniture allow many arrangements suited to a greater variety of activity. Thus, relative to others which are fixed and difficult to change, such flexible arrangements are conductive to a feeling of dominance. (1980: 18)

The present study has therefore shown that these observations also apply to the virtual, or mediated, world. It should be added, however, that even though these findings make sense and empirically confirm that interactivity empowers the user, the fact that they switch, or reverse, the impact of media exposure on feeling of dominance has far-reaching consequences, some of which will be discussed in the next chapter.

Arousal

Immersive images and arousal

Immersive experiences are more arousing than traditional media experiences. This is confirmed by the acceptance of hypothesis 6 ("Participants in the interactive settings will be more aroused than participants in the non-interactive settings).

We may also suggest that immersive experiences increase arousal not only in relative terms (i.e. compared to non-interactive settings) but also in absolute terms. However, contrary to what was found for dominance, we cannot contrast this latter finding with the non-immersive settings, for the confidence interval for the arousal mean in no-interactive settings covers positive and negative values (see Table 5.5).

Table 5.5: Estimated Marginal Means for Interactivity. Dependent Variable: Variation in Arousal

Interactivity	Mean	Standard Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Non-interactive	-.375	.217	-.389	.764
Interactive	.328	.217	-.014	1.139

In any case, these results empirically corroborate the idea that the interactive audience is indeed an active audience. The term activity, here, should be understood in its broadest sense. Indeed, in reference to Mehrabian's dichotomy of arousal, we have no means to determine whether activity, or alertness, or both, were affected by the immersive experience. Had mouse activity been measured in the non-immersive settings, we may have been able to detail the relationship between arousal and interactivity.

Because the "law of initial value" asserts that initial arousal can influence the participant's variation in arousal (see Chapter Two), an analysis of variance was conducted by adding initial arousal as a control variable. The association between variation in arousal and interactivity remained, $F(1, 125) = 5.009$, $p = .027$.

However, one may object that this variation in arousal may not be due to the interactivity per se; rather, the novelty, or "coolness" of the medium, as well as the unfamiliarity of the sample with this technology and the laboratory setting, could be held responsible for the change. While this possibility cannot be completely ruled out, such occurrence seems unlikely in this context: A test analyzing a possible association between familiarity with immersive images and arousal yielded to no significant results.

When considering the absolute increase in arousal in the immersive group, it should be taken into consideration that, as mentioned in the literature review, sports programs have been shown to breed high level of arousal. However, alleviating this competing explanation for the increase in arousal, it should be remembered that the games featured in the stimuli triggered very little involvement on the part of the participants, as compared to professional or college sports.

Motion and arousal

The influence of motion on arousal presented in the analysis of variance for the two main factors (see the Descriptive Analysis section) is also noteworthy. Table 5.6 provides further details on this association. While exposure to, or manipulation of, pictures resulted in increased arousal, arousal decreased for participants who were in the video settings. These findings are consistent with the widespread contention that exposure to video, like television, is fundamentally a passive experience. This

proposition, as well as its theoretical rationales, has been discussed earlier, but this study brings yet another empirical piece of evidence for it.

The fact that, conversely, pictures elicited an increase in arousal is somewhat surprising. On one hand, this could make sense if we consider Schnotz's and Boeckheler's (1999) assertion that animated images, as compared to still images, decrease the cognitive load of the viewer, and therefore his or her alertness, because they add temporal structure to the experience. Although their proposition was made in the context of a logical reasoning assignment, we could apply this reasoning to sports content, for which the viewer of still images has to rely to *imagination* (a cognitive task) to place the picture in the context of the game. Such an effort is not required from video viewers, because the progress of game is presented in the video, and each particular scene is embedded is this broader context.

On the other hand, the increased arousal in the still images conditions seems to contradict the idea, maintained by Reeves and Nass (1996), among others, that motion triggers alertness. However, it could be argued that Reeves' and Nass' argument applies to specific (e.g. fast) motions within frames, rather than the overall motion that succession of frames generates in video. Indeed, while reporting the findings of their "sausage ad" experiment, Reeves and Nass insist on the fact that the viewer's EEG started changing when motion *followed* a still frame –"When the sausage package first appears in the upper portion of the screen, it is still. . . . Three seconds into the ad the sausage starts rolling"– or when motion represents a threat to, or a surprise for the viewer– "This is not just because the sausage is moving; it is also moving toward the

viewer's face." In other words, the impact of motion on *alertness* seems to be an ambiguous one.

Another explanation for this finding, then, may be that arousal, or more specifically *activity*, had been triggered by the necessity of browsing these pictures, as opposed to merely watching the video. Finally, the difference in image quality between the video stimuli and the picture stimuli may also have played a role in this discrepancy, the low quality of the video resulting in lowering the arousal of the participants.

Table 5.6: Estimated Marginal Means for Motion. Dependent Variable: Variation in Arousal

Motion	Mean	Standard Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Picture	.375	.212	-.045	.795
Video	-.422	.212	-.842	-.002

Motivation for excitement and arousal

As the acceptance of hypothesis 7 ("In interactive settings, the higher the participant's motivation for excitement, the higher the participant's arousal") suggests, the motivation for excitement does have an influence on arousal in interactive setting.

One could question the influence of interactivity in this association by saying that motivation for excitement always correlates positively with arousal, no matter the conditions –interactive or non-interactive– of the experience. Such argument was rebutted by the investigator after he conducted the same test in non-interactive settings and found no significant association between motivation for excitement and variation in arousal, $\beta = .174$, $p = .117$.

However, another issue was of more concern for the investigator. Indeed, hypothesis 7 was based on the general proposition that interactivity in general, and immersion in particular, would result in the viewer better achieving his or her goal, namely excitement in this particular hypothesis. The confirmation of this specific proposition could be greatly hindered by the possibility that the participants' arousal had been triggered by the "coolness" of the medium and the originality of the experience. If such a thing happened, then it casts doubt over the proposition that interactivity had catalyzed the participant's excitement about the games (i.e. the content itself). In other words, although there is a relationship between motivation and arousal, it might not be for the reason expected. Corroborating such a competing argument, it has been observed that the association slightly lost its significance when the linear regression was applied only to participants who were familiar with immersive images. The uses and gratifications section below further discuss this issue.

Pleasure

Immersive images and pleasure

The failure to accept hypothesis 8 (i.e. interactivity influences the pleasurability of the experience) is at first sight surprising. Indeed one could have expected an influence, positive or negative, of interactivity on the feeling of pleasure. However, such a finding seems to indicate that the pleasure dimension of emotions is distinct from the two other dimensions –arousal and dominance– for it may be less sensitive to formal features of a mediated experience.

The acceptable variance of the pleasurability scores and the normal distribution of the sample for this variable exclude the possibility of intrinsic biases in the measuring instruments.

However, a closer look at the conceptualization of this dimension seems to bring some elements of explanation. It should be remembered that, as mentioned in the literature review, the concept of pleasurability is different from the notion of preference or approach-avoidance. Although Mehrabian only gives a very brief overview of this dimension, a look at other scholars' interpretations of the concept shows that pleasure could be assimilated to the valence of the content (see literature review), or more precisely, the message's perception by the individual. In other words, the notion of pleasure seems to be intrinsically related to the content of the medium, rather than to the overall experience. For instance, Mehrabian shows that the following specific emotional responses correlated with the measure of pleasurability: hopeful/despairing, contented/melancholic, happy/unhappy, relaxed/bored. These adjectives seem to engage particularly the mood and sense of judgment of the participant, on which elements other than content, such as the formal features of the media, can have little influence. Such a concept, then, contrasts with the arousal dimension, which is associated with descriptors such as excited/calm and stimulated/relaxed, and the dominance dimension (controlling/controlled, autonomous/guided etc.). These two dimensions, indeed, seem to be more sensitive to formal features and the overall media experience than the pleasure dimension, which is the one that is the most dependent on the individual's personal interpretation of the message. This argument of the limited influence of formal features on the participant's feeling of pleasure seems to be corroborated by the fact that other

studies (e.g. Kim, 1996; Detender and Reeves, 1996; Lombard et al., 1997) have found no support for the idea that screen size –a formal feature– has any influence on the viewer's pleasantness of the experience.

Motion and pleasure

Conversely, the present study has found a significant influence of the motion factor on the variation in the feeling of pleasure: The picture settings were found to be more pleasurable than the video settings, and the video settings were even found to decrease pleasure, $F(1, 124) = 11.549$, $p = .001$ (see the descriptive analysis). The main explanation for this difference is that the low resolution of the video may have resulted in making the experience not pleasurable for participants who were in the video settings. Their numerous remarks about this image quality issue (noted in the "comments" section of the posttest questionnaires) further substantiate this argument. This latest finding also supports the previous argument suggesting that there is a fundamental difference between form and content in terms of their potential influence on pleasure. Indeed, while one might argue that image resolution is often considered as a formal feature of the media, it must be acknowledged that unusual low resolution of image (e.g. the participants can barely see what happens on the periphery of the frame) is more than likely to affect the content itself, as well as the participant's perception and assessment of the message.

Finally, the rejection hypothesis 9, which investigated the pleasurability of the experience and its possible association with the motivation for diversion in interactive settings, reinforces the argument developed earlier on the difficulties of observing uses and gratifications effects in artificial settings. The investigator also tested a possible association between these two variables in non-interactive settings and found no

significant results for this test. A discussion dedicated to this issue is presented later in this chapter.

Interest

Hypothesis 14 ("Participants in the interactive settings will find the games more interesting than participants in the non-interactive settings") was exploratory and was not founded on any particular proposition or rationale. The fact that interactivity increased the perceived interest of the game is indeed somewhat surprising. As mentioned above (see the "pleasure" section), associations between interactivity and the participant's evaluation of, or judgment about, the content itself seem usually difficult to establish.

One possibility for this observed difference in interest could be that the novelty of the technology, rather than the content of the games, triggered the participants' interest. As Tafler (1995) explains, "An interactive involvement does not mean that the spectator is always consciously engaged. . . . With a natural childlike fascination with kinetic imagery, the spectator's initial encounter with this 'expanded' cinema may be a moment of jubilation, a child's play before the mirror" (p. 249).

Another possibility for this observed difference in perceived interest is that the participant's ability to zoom and concentrate on various fields of view allowed him or her to better grasp the actions and performances of the athletes, and therefore better appreciate the games.

Applying the same reasoning (i.e. a variety of views and shots triggers the perceived interest of the games) to the comparison between the picture and the video

settings, participants in the video settings should have found the games more interesting than participants in the picture settings. The findings of this study revealed just the opposite: Participants in the picture settings found the games more interesting than participants in the video settings, $t(126) = 3.659$, $p = .000$, mean difference = .66. A plausible explanation for this unexpected finding could be that the poor image quality and mirrored view of the video stimuli resulted in a poor evaluation of the games.

This brings us to the idea that there might have been confusion among the participants between perceived interest *of the games* and perceived interest *of the experience*. Such confusion would account, to a certain extent, for the observed differences in perceived interest of the game between the motion and the no-motion groups, and the immersive and the non-immersive groups.

Uses and Gratifications and Effects

The main proposition, related to the uses and gratifications effects in interactive conditions and anticipating that the user's control would result in the user better achieving his or her particular goals was not substantiated in this study. As explained in the present chapter, the main challenge encountered during the investigation of this proposition seems to stem from the design of the study. More specifically, it appears that in forced exposure conditions it is unlikely that the participants have the same motivations as when they are in a natural setting. For instance, in real life, individuals turn on the television because they *want to* get something from it, including maybe killing time. In an experiment, participants are exposed to, or interact with, images

because they are *asked to*. In addition, some individuals may even *never* turn on the television. As a matter of fact, more than 6 percent of the participants reported that they never watch sports on television. While it is a common problem of forced exposure, this issue seems particularly crucial for this type of exploration. Experimental designs seem not well suited to research on uses and gratifications effects.

This remark is not only given as a possible explanation for why most of the uses-and-gratifications-related hypotheses were rejected. The findings presented earlier also present a reasonable amount of support for such an assertion. Indeed, this study has revealed that uses and gratifications effects could be observed only when the motivations were related to *general aspects of the experience*, such as interest in sports and need for excitement or parasocial interaction. When the motivations were related to *specific aspects of the content* (e.g. information seeking), no significant results were found.

In any case, except for the excitement orientation, it seems that the motivations were unaffected by the interactive features that the immersive conditions offered.

The reliance on self-reports may have also hindered the results, but this possibility was not, and could not be, investigated in the present study. Finally, as mentioned earlier, the novelty of the technology in general, and the low familiarity of the sample with the technology in particular, may also have hindered this investigation. Indeed, participants did not know what they could do with, or *get from*, such a technology. Their actual motivations did not truly apply to the experience they had during the experiment, because the reported motivations were associated with the use of traditional media.

CHAPTER 6
CONCLUSION

Summary

The purpose of this study was to provide an overview of a sports-related, image-based immersive experience, as compared with the traditional viewing of sports pictures and videos. This investigation was conducted based on data collected though pretest and posttest measures, as well as computer monitoring, in a 2x2 factor design experiment, with interactivity and motion as the main factors. Exposure to, or interaction with, the four ensuing stimuli (interactive pictures, interactive videos, videos, and pictures) constituted the core of the experimental treatment. Borrowing from Steuer's (1992) approach to virtual reality, interactivity was conceptualized as the *malleability* of the medium's form and content.

This study provided the theoretical and empirical rationale supporting the idea that the interactive technology used in this study, whether still or animated, is indeed immersive. Feeling of telepresence, or feeling of "being there," was substantially increased for participants who were in either of the two interactive settings.

However, beyond the immersive quality of the experience, the main question of this study, metaphorically formulated as two possible alternatives –diving or drowning– revolved around investigating how the participants perceived, and reacted to, this

immersive experience. Would the participants feel overwhelmed by such an experience? Would they be affected cognitively or emotionally by such conditions? If so, would these changes hinder or improve the mediated experience?

Although the findings of the present study suggest that that interactivity had no effects, positive or negative, on the cognitive process, it seems that the immersive images made the experience more arousing, increased the participants' feeling of being in control, and probably induced a more positive evaluation of the content in terms of perceived interest.

The principal proposition of the study was that the interactive feature, typical of immersive images, would allow the participants to better achieve their goals, which were operationalized using a uses and gratifications approach. Although in immersive conditions arousal increased as the participants' motivation for excitement increased, such proposition was not supported for the other three motivations –cognition, diversion, and parasocial interaction.

Theoretical Implications

Most of this study's findings, such as the increased activity and feeling of control of the interactive user, are consistent with theories and studies developed in previous research.

This study also corroborated the approach adopted by Steuer and other scholars on telepresence, immersion, and parasocial interaction. However, it seems that the concept of telepresence has been rarely been invoked in mass communication research,

although it seems to be an important part of the media experience in general, and new media use in particular. Although the influence of media exposure on telepresence was significant only in the non-immersive conditions, such finding is noteworthy and should be considered in future research. This study also suggested that there might be a distinction between familiarity with communicating with a medium and frequent media exposure in terms of potential media effects, such as feeling of telepresence. The implications of these two findings, if confirmed, may be crucial both in terms of academic and applied research.

It seems, for instance, that such phenomena could be related to many other aspects of mass communication research, such as the impact video game playing or heavy Internet use on the individuals, whether they are adults or children. If we consider that telepresence can have bad effects on the user in the case of violent videogames (e.g. it may facilitate the participant's identification with, or projection onto, violent characters), such findings would indicates that persons frequently exposed to television would more easily enter the mediated world of violent video games –and therefore be more vulnerable– than frequent video game players. However, such a proposition seems debatable and has only been suggested by the post-analysis. Further research seems needed in this area.

The reversing effect of interactivity on arousal and dominance also is remarkable. It has indeed been shown that interactivity increases dominance and arousal, while traditional media presentations decrease dominance and tend to decrease arousal. This may have profound implications on audience and effects research. This shift in the participant's feeling of control in immersive settings illustrates that the idea that "the

control of mass communication systems . . . moves from the message producers to the media consumers" (Rogers, 1986: 4) is not only a technology-oriented assertion, but also a process occurring in the mind of interactive media audiences. Although Mehrabian had evoked the idea that dominance increases as the number of tools available to the individuals increases, he also insisted that this proposition was tentative and noted the lack of research to sustain his point. The present study contributed to research in this area by comparing two groups: one tool available (i.e. interactivity) vs. no tool (traditional media).

However, although the empowerment of the user can be considered as a positive advancement in media development, it has triggered some concerns among communications scholars and professionals. Indeed, there is a fundamental paradox between the control and freedom associated with interactivity and the risk that the user overlooks important information. This dilemma is also of much concern for HCI scholars, who suggest that the user be guided in his or her interactive experience.

The positive influence of interactivity on arousal was also a major point of this study. The audience activity in interactive settings is indeed reflected in audience arousal. This confirms the idea that many mass communications theories, which are based on the assumption that the audience is passive, or even pacified, when engaged in a mass mediated experience, should be reconsidered in view of such a change. Secondarily, this study has also corroborated the "law of initial value," which asserts that initial arousal does have an influence on the change in arousal that a mediated experience may induce. This study has also verified the audience passivity (i.e. reduced arousal) triggered by video exposure. Finally, this study has evoked the possibility that the pleasure dimension

of emotion has looser links with content than the arousal and dominance dimensions. This suggestion calls for further research.

In addition, the present study has stressed the difficulties that researchers are likely to encounter when relying on an artificial design for the study of uses and gratifications effects. It has also validated the general proposition of uses and gratifications effects, that is, the individuals' involvement in particular content, such as sports, influences his or her processing (e.g. cognition) of the mediated message. Our findings also provided substantial support for the uses and gratification typology that would combine the interpersonal utility and cognition orientations.

Practical Implications

The prospect, mentioned in the previous chapter, that the participants quickly learned how to use the technology and navigate the images is not only beneficial to the consumer, but also to organizations or individuals who rely on such a technology to present information. The ease of manipulation is indeed a major concern when considering the use or creation of interactive devices. As Clark (1998) explains, "A good interactive video program must deal directly with the user's concerns and requirements in ways that do not eat up scarce thinking capacity for tasks unconnected with the job at hand" (p. 41).

Although this study considered the immersive experience from a user-oriented perspective and without much attention to marketing-related concepts, such as attitude change, the present findings may have crucial implications for organizations that rely on

immersive technologies to communicate with their public. The differential length of exposure that was observed between the immersive and the non-immersive picture settings can be considered as one of the consequential findings. For instance, as Grabe et al. note:

> Producers of World Wide Web entertainment and news face the challenge to select and package media content to counteract the effects of small screen viewing situations. By using rapid point-of-view movement, direct address, and perhaps the eyewitness camera perspective, Web messages may at least partially overcome the sense of distance, lack of realism, and decreased attention and memory that studies on screen size have shown to be associated with small screen viewing condition. (1999: 7)

Immersive images, it seems, can be even more efficient than any of the techniques that Grabe et al. mention.

The increased arousal that is triggered by immersive images may also be of interest for media organizations and advertisers. Indeed, as mentioned earlier, it has been shown that, until a certain level, arousal facilitates attention to media messages. The increased interest in content that was found in immersive settings certainly reinforces the argument that immersive conditions generate a more positive evaluation on the part of the user.

However, increased feeling of control, although beneficial to the consumers, may result in the audience being more skeptical and less vulnerable to persuasive media messages. Further research is needed in this area.

Finally, it should be noted that the feeling of telepresence might also have an impact on the participant's involvement. Indeed, one can expect that individuals who feel immersed in the mediated world are likely to be more receptive to mediated messages and more captivated or passionate about the content. Although this possibility has been somewhat verified by the fact that participants in the interactive conditions found the

games more interesting than the other participants, this observation calls for further research.

Finally, while it was mentioned previously that the role of the director and/or producer was greatly diminished with this immersive technology, it may be possible that, instead of being diminished, this role is only changing. Indeed, in addition to requiring sound camera placement, this technology offers to producers new opportunities for original shots and story lines based on multiple actions.

Limitations and Suggestions for Future Research

It seems that the main limitation of this study consisted in the disparities that existed between the video and the picture stimuli, as well as the low quality of the video images. In addition, as explained earlier, the artificial conditions of this study may have played an important role in the rejection of the uses-and-gratifications-related hypotheses.

Such limitations could be overcome by producing better images and using more popular, high-involvement games to investigate the effects of uses and gratifications. Indeed, it seems possible to implement the same measures in a natural setting, provided that the technology is available. More significant results may be obtained by relying on such a design.

Further studies could also introduce other factors (e.g. audio) into the research design or could focus on other types of content (e.g. news).

Because this study was only an *overview* of the participant's experience, the researcher only partially investigated each of the components (i.e. cognition, emotion,

telepresence) of this experience. Many problems are still unsolved, and may be addressed in studies focusing independently on each of these dimensions.

APPENDIX A
PRESTEST QUESTIONNAIRE

The following pages contain a sample of the pretest questionnaire that was given to participants in the interactive settings (Group 1 and 2).

NI #

Questionnaire – Pretest

Thank you for answering the following questions by **circling** the number preceding the appropriate answer.

Some information about yourself:

1. Your age:

1. 18-22 2. 23-27 3. 28-32 4. 33 or more

2. Gender:

1. Female 2. Male

3. Highest degree that you earned:

1. High-school diploma 2. Associate 3. Bachelor's 4. Graduate

6. Other, please specify: _____

4. Please indicate your major: _____

On a scale from 1 to 7, please tell us how you consider yourself. For each question, circle the number that best describes where you stand between the two personality characteristics.

You consider yourself as:

5. An indoor person	1.	2.	3.	4.	5.	6.	7.	An outdoor person
6. Outgoing	1.	2.	3.	4.	5.	6.	7.	Shy

7. How many groups, clubs, or organizations are you involved in?

1. 0 2. 1-2 3. 2-3 4. 4-5 5. More than 5

8. How often do you attend sports events?

1. Never
2. Less than once a month
3. Less than once a week
4. Once a week
5. More than once a week
6. Everyday

9. How often do you watch sports events on TV (including rentals)?

1. Never
2. Less than once a month
3. Less than once a week
4. Once a week
5. More than once a week
6. Everyday

10. How often do you read the sports section in newspapers and/or magazines?

1. Never
2. Less than once a month
3. Less than once a week
4. Once a week
5. More than once a week
6. Everyday

11. How often do you read about sports on the Internet?

1. Never
2. Less than once a month
3. Less than once a week
4. Once a week
5. More than once a week
6. Everyday

12. How often do you play videogames/computer games?

1. Never
2. Less than once a month
3. Less than once a week
4. Once a week
5. More than once a week
6. Everyday

13. How often do you surf the Internet:

1. Never
2. Less than once a week
3. Once a week
4. Twice to five times a week
5. Once everyday
6. Several times a day

14. How long are your Internet sessions in general:

1. 1-5 minutes
2. 5-15 minutes
3. 15-30 minutes
4. 30 minutes to an hour
5. 1-2 hours
6. More than 2 hours

15. How important are sports in your life?

1. Very important 2. Somewhat important 3. Not very important 4. Not important at all

16-20.

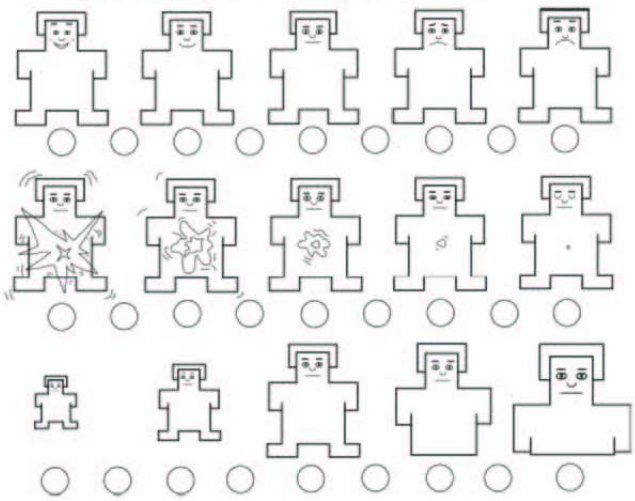
Below is a list of reasons people have given for watching sports on TV. Please tell us how each of these reasons applies to you. Circle a value between 1 and 4, according to the following scale:

1 = Not important at all
2 = Not very important
3 = Somewhat important
4 = Very important

I watch sports on TV because...

	Not important at all			Very important
I want to keep up with current sports events	1	2	3	4
It gives me a sense of accomplishment when the team/athlete I support wins	1	2	3	4
I want information I can trust	1	2	3	4
I want to experience some drama	1	2	3	4
It helps me escape the real world	1	2	3	4
I want to be informed about important sporting events	1	2	3	4
It allows me to let off steam	1	2	3	4
I want to know about things I can tell people after the games	1	2	3	4
It is a source of stimulation	1	2	3	4
I want to learn about the game	1	2	3	4
It lets me identify with athletes/teams	1	2	3	4
I want to get some entertainment	1	2	3	4
I want to know about things I can share with people after the games	1	2	3	4
It helps me forget my problems	1	2	3	4
Keep current with my team/season championship	1	2	3	4
Athletes are like people I know	1	2	3	4
I want to see things that are exciting	1	2	3	4
I want to get something to talk about with others	1	2	3	4
It helps me pass the time	1	2	3	4
It gives me interesting things to talk about	1	2	3	4
I want to support my own viewpoint about the game/team to other people	1	2	3	4
It adds some excitement to my day	1	2	3	4
I can pass the information on the other people	1	2	3	4
I want to learn about learn about athletes	1	2	3	4
I enjoy rooting for a player or team	1	2	3	4

THIS IS A SAMPLE- DO NOT FILL



This is SAM. 

SAM represents you and your feelings. We would like you to use SAM to indicate how you feel.

You'll notice that measure consists of three rows of graphic characters.

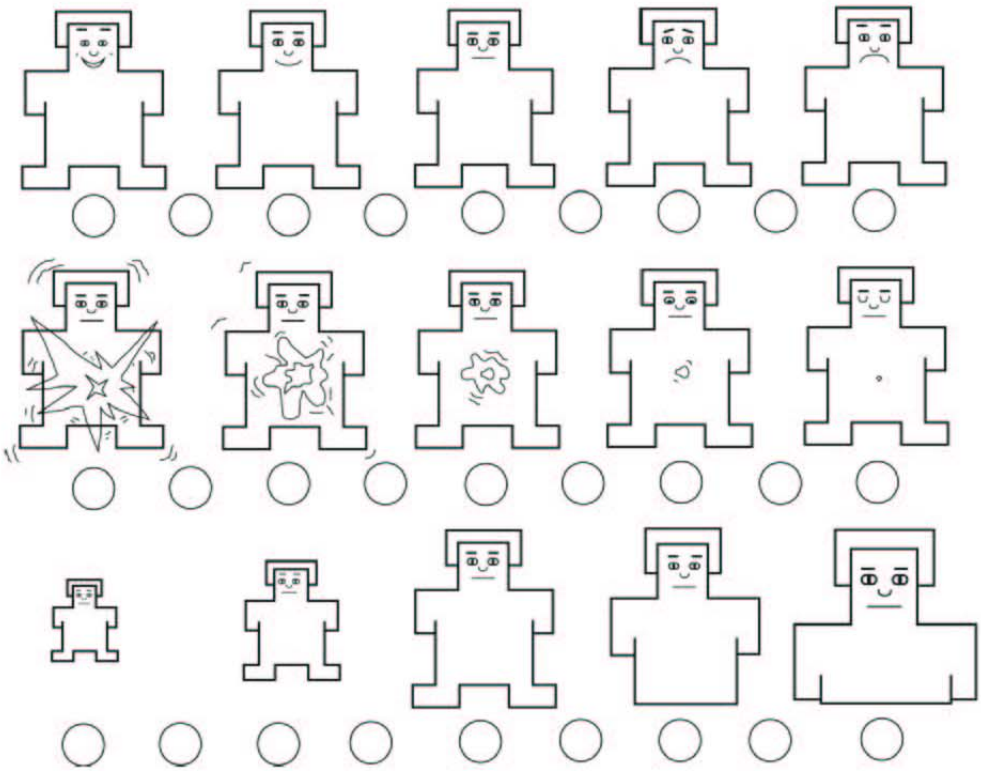
The top row ranges from a big smile to a big frown. This represents feelings that range from extremely HAPPY or ELATED to extremely UNHAPPY or SAD.

Look at middle row
The middle row represents feelings that range from extremely STIMULATED or INVOLVED, (on the left) to very CALM or BORED (on the right).

Look at the bottom row
On the bottom row SAM goes from a little figure to great big figure. The row represents you feeling as though you are BEING CONTROLLED, or CARED FOR on the left, or completely IN-CONTROL, or DOMINANT on the right. This row does not represent positive or negative feelings, just how much in-control you feel.

Mark one circle on each row!
You can mark a circle directly below a figure, or between two figures.
Remember the ends of the scale are extremes.
Don't spend a lot of time thinking about the question. Just indicate how you feel.

21. How do you feel now?



APPENDIX B
POSTTEST QUESTIONNAIRE

The following pages contain a sample of the posttest questionnaire that was given to participants in the picture settings (Group 1 and 4).

P#

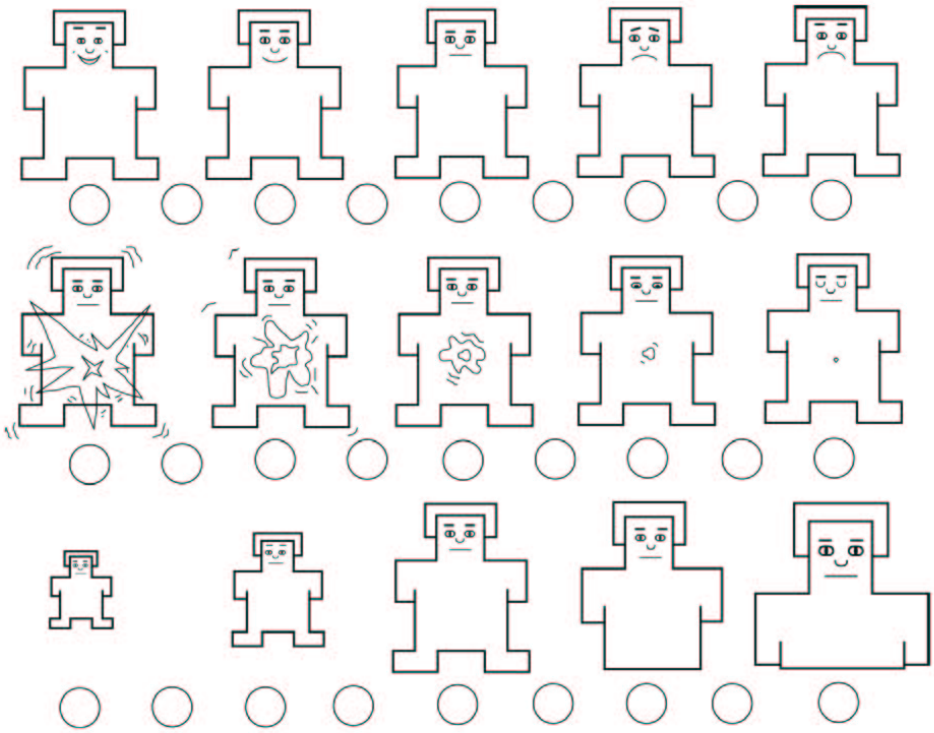
Questionnaire – Posttest

Please, fill this questionnaire once you are finished with the visual presentation. It is important that you do not restart the visual presentation.

The top row ranges from a big smile to a big frown. This represents feelings that range from extremely HAPPY or ELATED to extremely UNHAPPY or SAD.
The middle row represents feelings that range from extremely STIMULATED or INVOLVED, (on the left) to very CALM or BORED (on the right).
The bottom row represents you feeling as though you are BEING CONTROLLED, or CARED FOR on the left, or completely IN-CONTROL, or DOMINANT on the right. This row does not represent positive or negative feelings, just how much in-control you feel.

Mark one circle on each row!
You can mark a circle directly below a figure, or between two figures.
Remember the ends of the scale are extremes.
Don't spend a lot of time thinking about the question. Just indicate how you feel.

1. How do you feel?



Questions 2-15: Please fill in the blanks

2. List the different sports you watched during this experiment.

_____

3. What is the name of the athlete who performed at the beam?_____

4. What is (are) the color(s) of the Gator Gymnastics athletes' leotard? _____

5. How many Gator(s) was (were) on the podium? _____

6. What was (were) her (their) position(s)? _____

7. **What do athletes on the podium hold?**_____

8. **Describe the outfit of the two competing teams playing volleyball:**

Team 1: _____

Team 2: _____

9. Describe the jersey of the player who was training for the soccer game (he had his back to the camera):

Color: _____

Number: _____

10. What were the jerseys' color(s) of the two competing team at the soccer game?

Team 1: _____

Team 2: _____

11. What time was displayed on the clock when the black team tried to score a basket (first game)? _____

12. Which fraternity was disputing a basketball game? _____

13. Describe the crowd reaction at the last basketball game:

_____

14. In which activity did an athlete get hurt? _____

15. Tell us about some details that you noticed or that struck you in these games/competitions:

_____

_____

_____

Thank you for answering the following questions by **circling** the number preceding the appropriate answer.

Please tell us about the experience you just had (NOT INCLUDING THE TRAINING STAGE):

16. "This experience was…"

1. Very interactive
2. Somewhat interactive
3. Neither interactive nor non-interactive
4. Not very interactive
5. Not interactive at all

17. "In average, the games were…"

1. Very interesting
2. Somewhat interesting
3. Neither interesting nor boring
4. Somewhat boring
5. Very boring

Please tell us how much you agree or disagree with the following statements:

Circle a value between 1 and 4, according to the following scale:
1 = Strongly agree
2 = Somewhat agree
3 = Neither agree nor disagree
4 = Somewhat disagree
5 = Strongly disagree

18-19	Strongly agree				Strongly disagree
I felt like I was part of the action	1	2	3	4	5
In general, there were a lot of people attending the games	1	2	3	4	5
I felt like I was attending the games	1	2	3	4	5
The athletes were really into the games	1	2	3	4	5
Sometimes I felt like I was part of the crowd	1	2	3	4	5
The games were fast paced	1	2	3	4	5
I almost forgot I was in the lab	1	2	3	4	5
The lights on the courts/fields were bright	1	2	3	4	5
Sometimes I felt like I was on the field / court	1	2	3	4	5

20. How knowledgeable do you feel you are on these games?

1. Not at all 2. A little 3. Moderately 4. Very

21. Have you seen any of these specific games before this experiment?

1. Yes 2. No

FOR INVESTIGATOR USE ONLY

Please do not fill the following items.

22. Activity

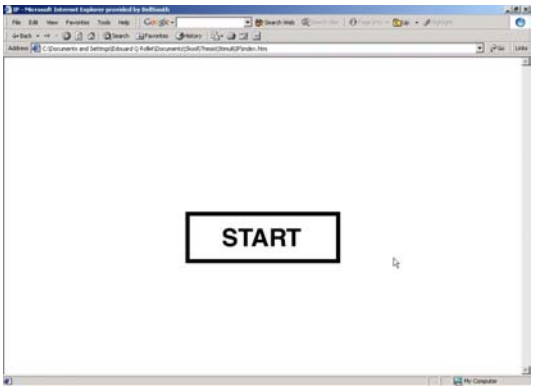
#C: _____

#DC: _____

#PX: _____

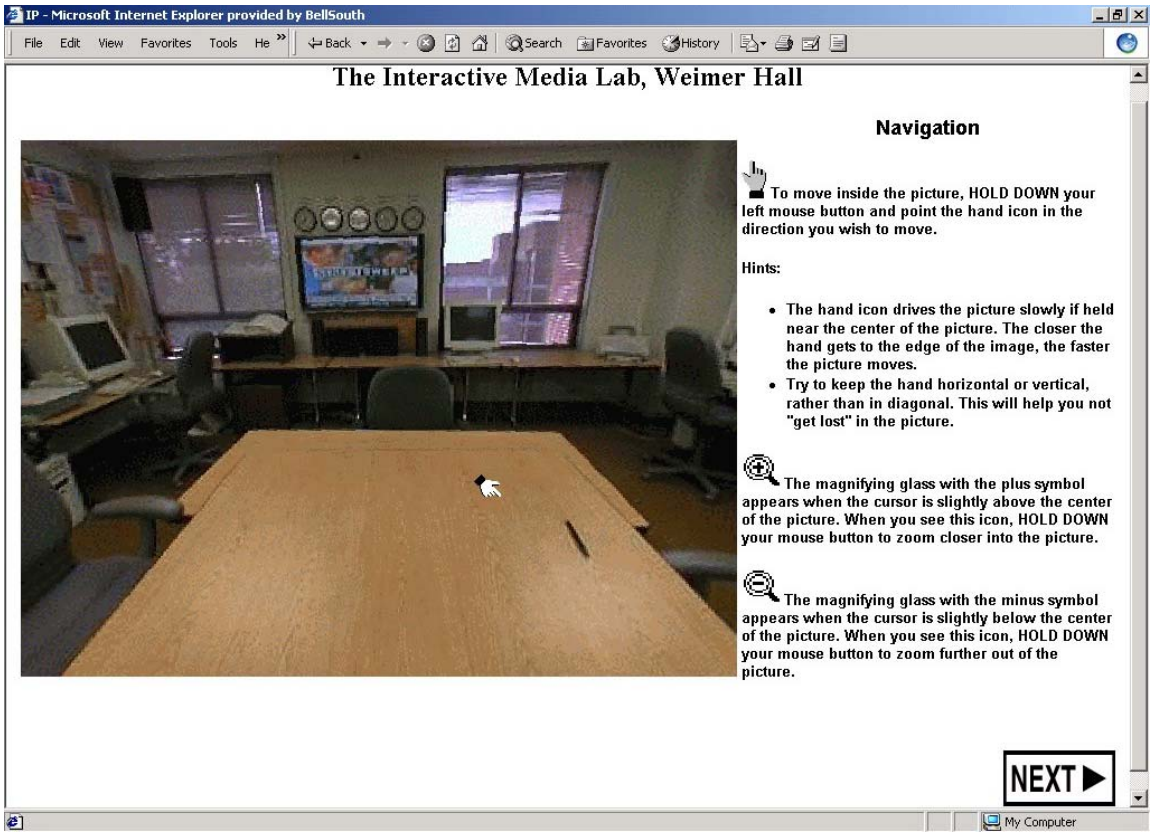
22. Duration: _____

APPENDIX C
SCREENSHOTS SELECTION: IMMERSIVE PICTURES TREATMENT

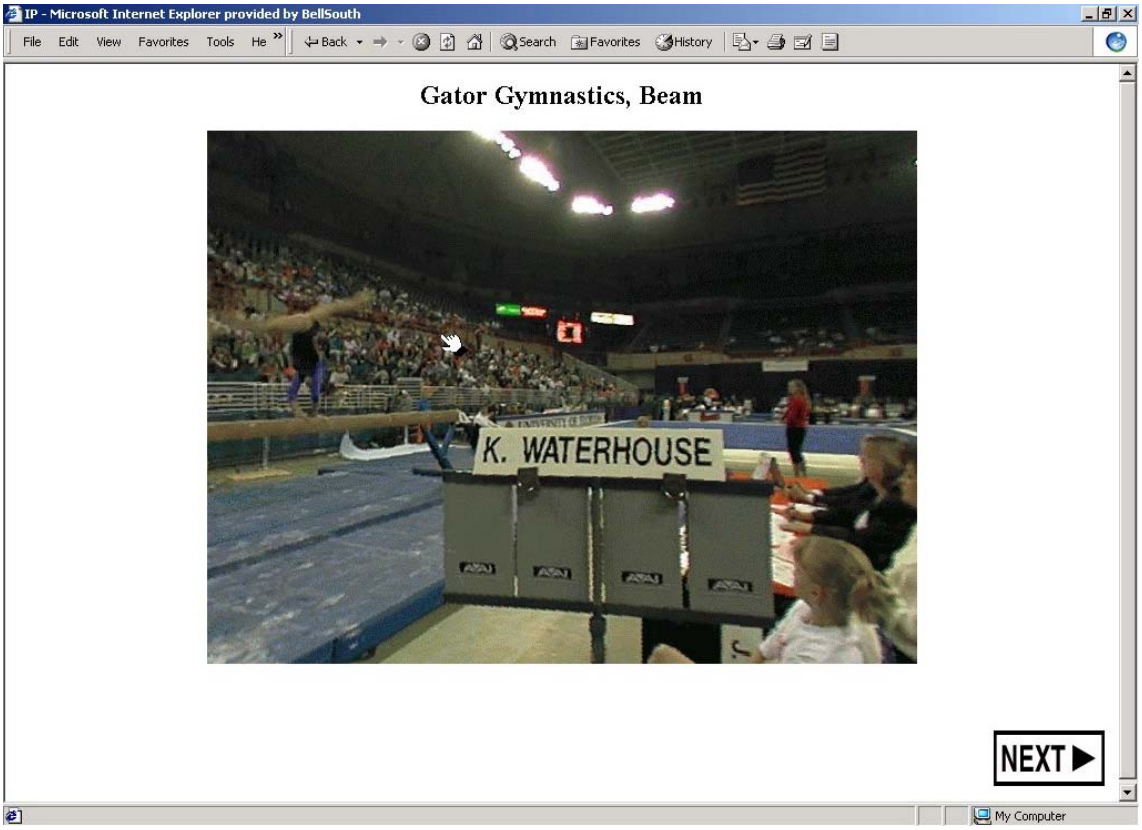


1 - Start Screen

2 - Instructions Screen

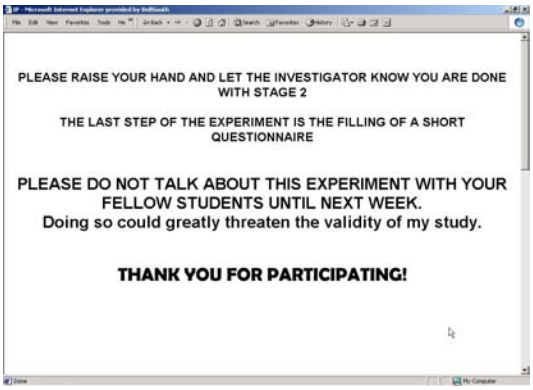


3 – Training Screen



4 - Photo 2 – Gymnastics

5 - Photo 10 - Basketball



6 - Final Screen

LIST OF REFERENCES

Anderson, D. R., & Field, D. E. (1991). Online and offline Assessment of the television audience. In J. Bryant & D. Zillmann (Eds.), *Responding to the screen: Reception and reaction processes* (Chap. 8, pp. 199-216). Hillsdale, NJ: Lawrence Erlbaum Associates.

Atkin, C. K. (1972). Anticipated communication and mass media information seeking. *Public Opinion Quarterly*, *36*, 188-199.

Auter, P. J., & Davis, D. M. (1991). When characters speak directly to viewers; Breaking the fourth wall in television. *Journalism Quarterly*, *68*, 165-171.

Babbie, E. (1998). *The practice of social research.* New York, NY: Wadsworth Publishing.

Barnett, M. A., Vitaglione, G. D., Harper, Kimberley K. G., & Quackenbush. (1997). Late adolescents' experiences and attitudes towards videogames. *Journal of Applied Social Psychology*, *27* (15), 1316-1334.

Becker, L. B. (1979). Measurement of Gratifications. *Communication Research*, *6* (1), 54-73.

Biocca, F. & Delaney, B. (1995). Immersive virtual reality technology. In F. Biocca & M. R. Levy (Eds.), *Communication in the age of virtual reality* (pp. 57-124). Hillsdale, NJ: Lawrence Erlbaum Associates.

Biocca, F., & Levy, M. R. (1995). Virtual reality as a communication system. In F. Biocca & M. R. Levy (Eds.), *Communication in the age of virtual reality (*pp. 127-157). Hillsdale, NJ: Lawrence Erlbaum Associates.

Blumler, J. G. (1979). The role of theory in uses and gratifications studies. *Communication Research*, *6* (1), 9-36.

Blumler, J. G., & McQuail, D. (1969). *Television in politics*. Chicago, IL: university of Chicago Press.

Bordewijk, J. L., & van Kaam, B. (1986). Toward a new classification of TeleInformation services. *Inter Media*, *14* (1).

Borgman, C. (1982). *Theoretical approaches to the study of human interaction with computers*. Stanford, CA: Stanford University Institute for Communication Research.

De-Bruijin, D., de-Mul, S., & Van-Oostendorp, H. (1992). The influence of screen size and text layout on the study of text. *Behaviour and Information Technology*, *11* (2), 71-78.

Bryant, J. (1989). Message features and entertainment effects. In J. J. Bradac (Ed.), *Message effects in communication science* (pp. 231-262). Newbury Park, CA: Sage Publications.

Bryant, J., & Raney, A. A. (2000). Sports on the screen. In D. Zillmann & P. Vorderer (Eds.), *Media entertainment. The psychology of its appeal* (pp. 153-174). Mahwah, NJ: Lawrence Erlbaum Associates.

Bryant, J., & Zillmann, D. (1977). The mediating effect of the intervention potential of communications on displaced aggressiveness and retaliatory behavior. In B. D. Ruben (Ed.), *Communication yearbook* (Vol. 1, pp. 291-306). New Brunswick, NJ: Transaction Books.

Bryant, J., & Zillmann, D. (Eds.). (1986). *Perspectives on media effects.* Hillsdale, NJ: Lawrence Erlbaum.

Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Chicago: Rand McNally.

Carey, J. W., & Kreiling, A. L. (1974). Popular culture and uses and gratifications: Notes toward an accommodation. In J. G. Blumler & E. Katz (Eds.), *The uses of mass communications: Current perspectives on gratification research* (pp. 355-371). Beverly Hills, CA: Sage.

Cassell, J., & Jenkins, H. (1999). *From Barbie to Mortal Kombat: Gender & computer games*. Cambridge, MA: MIT Press.

Chen, M. (1984). Computers in the lives of our children: Looking back on a generation of television research. In R. Rice (Ed.), *The new media* (pp. 269-286). Beverly Hills, CA: Sage.

Christianson, S., & Mjörndal, T. (1985). Adrenalin, emotional arousal and memory. *Scandinavian Journal of Psychology*, *26*, 237-248.

Clark, D. (1988, March). Hard lessons for interactive video. *Educational Computing*, p. 41.

Coffey, S., & Stipp, H. (1997). The interactions between computer and television usage. *Journal of Advertising Research*, *37* (2), 61-67.

Crabb, P. B., & Goldstein, J. H. (1991). The social psychology of watching sports: From Ilium to living room. In J. Bryant & D. Zillmann (Eds.), *Responding to the screen: Reception and reaction processes* (Chap. 8, pp.355-371). Hillsdale, NJ: Lawrence Erlbaum Associates.

Csikszentmihalyi, M. (1995). Das Flow-Erlebnis und seine Bedeutung für die Psychologie des Menschen. In M. Csikszentmihalyi & I. S. Csikszentmihalyi (Eds.), *Die aussergewöhnliche Erfahrungim Alltag: Die Psychologie des Flow-Erlebniz* (pp. 28-49). Stuttgart: Klett-Cotta.

Daly, E. M., Lancee, W. J., & Polivy, J. (1983). A conical model for the taxonomy of emotional experience. *Journal of Personality and Social Psychology*, *45* (2), 443-457.

Davis, J. (2000). The good word. *Editor and Publisher, 133* (21), i6-i10.

Detenber, B., & Reeves, B. (1996). A bio-informational theory of emotion: Motion and image size effects on viewers. *Journal of Communication*, *46* (3), 66-84.

Ditton, T. B. (1997). *The unintentional blending of direct experience and mediated experience: The role of enhanced versus limited television presentations in inducing source-monitoring errors.* Unpublished doctoral dissertation, Temple University, Philadelphia.

Dozier, D. M., & Rice, R. E. (1984). Rival theories of electronic newsreading. In R. Rice (Ed.), *The new media* (pp. 103-127). Beverly Hills, CA: Sage.

Duffy, T. M., & Jonassen, D. H. (Eds.). (1992). *Constructivism and the technology of instruction: A conversation.* Hillsdale, NJ: Lawrence Erlbaum.

Durlak, J. T. (1987). A typology for interactive media. In M. L. McLaughlin (Ed.). *Communication Yearbook* (Vol. 10, pp. 743-757). Newbury Park, CA: Sage.

Ferguson, D. A., & Perse, E. M. (2000). The World Wide Web as a functional alternative to television. *Journal of Broadcasting & Electronic Media*, *44* (2), 155-174.

Festinger, L. (1957). *A theory of cognitive dissonance.* Evanston, IL: Row & Peterson.

Fredin, E., & Krendl, K. (1984, November). *Computer frames: The evolution of thoughts concerning computers among adolescents.* Paper presented at the Midwest Association for Public Opinion Research (MAPOR), Chicago.

Gantz, W. (1980, May). *Exploring the motives for viewing televised sports*. Paper presented at the Annual Meeting of the International Communication Association, Acapulco, Mexico.

Garramone, G. M. (1984). Audience motivation effects: More evidence. *Communication Research, 11* (1), 79-96.

Gibson, J. J. (1966). *The senses considered as perceptual systems*. Boston, MA: Houghton Mifflin.

Gibson, W. (1984). *Neuromancer*. New York, NY: Ace Books.

Goertz, L. (1995). Wie interavktiv sind Medien? Auf dem Weg zu einer Definition von Interaktivität. In *Rundfunk und Fernsehen,* n. 4.

Grabe, M. A., Lombard, M., Reich R. D., Braken C. C., & Ditton, T. B. (1999). The role of screen size in viewer experiences of media content. *Visual Communication Quarterly,* 6 (2), 4-9.

Green, C. D. (1996). Where did the word "cognitive" come from anyway? *Canadian Psychology*, *37*, 31-39.

Greeno, J. G., Smith, D. R., & Moore, J. L. (1993). Transfer of situated learning. In D. K. Dettermann & R. J. Sternberg (Eds.), *Transfer on trial: Intelligence, cognition, and instruction* (pp. 99-167). Norwood, NJ: Ablex.

Grodal, T. (2000). Video games and the pleasures of control. In D. Zillmann & P. Vorderer (Eds.), *Media entertainment. The psychology of its appeal* (pp. 21-36). Mahwah, NJ: Lawrence Erlbaum Associates.

Hallenberger, G. (1995). Fernsehen 2000. Von Utopien und Anti-Utopien. *Aesthetikund Kommunikation*, *24* (1), 22-27.

Hatada , T., Sakata, H., & Kusaka, H. (1980). Psychological analysis of the perception of reality induced by a visual widefield display. *SMPTE Journal*, *89*, 560-569.

Havlena, W. J., & Holbrook, M. B. (1986). The varieties of consumption experience: Comparing two typologies of emotions in consumer behavior. *Journal of Consumer Research*, *13*, 394-404.

Hebb, D. O. (1955). Drives and the C.N.S. (conceptual nervous system). *Psychological Review*, *62*, 243-254.

Heeter, C. (1989). Implications of new interactive technologies for conceptualizing communication. In J. L. Salvaggio, & J. Bryant (Eds.), *Media use in the information*

age: Emerging patterns of adoption and consumer use (pp. 217-235). Hillsdale, NJ: Lawrence Erlbaum Associates.

Horton, D., & Wohl, R. (1956). Mass communication and para-social interaction. Observations on intimacy at a distance. *Psychiatry*, *19,* pp. 215-229.

Howard, G. E. (1912). Social psychology of the spectator. *American Journal of Sociology*, *18*, 33-50.

Jauss, H. R. (1982). *Toward an aesthetic of reception* (T. Bahti, Trans.). Minneapolis, MN: University of Minnesota Press.

Jensen, J. F. (1999). The concept of 'interactivity' in 'interactive television' and 'interactive media.' In J. F. Jensen & C. Toscan (Eds.), *Interactive television: TV of the future or the future of TV?* (pp. 25-66). Aalborg East, Denmark: Aalborg University Press.

Katz, E., Blumler, J., & Gurevitch, M. (1974). Utilization of mass communication by the individual. In J. Blumler & E, Katz (Eds.), *The uses of mass communication* (pp. 19-34). Beverly Hills, CA: Sage.

Khoo, D., & Gopal, R. (June 1996). Implications of the Internet on print and electronic media. *Journal of Development Communication*, *7*, 21-23.

Kim, T. (1996). *The memory and persuasion effects of presence in television advertisement processing.* Unpublished doctoral dissertation. University of North Carolina, Chapel Hill.

Krueger, M. W. (1990). Videoplace and the interface of the future. In B. Laurel (Ed.), *The Art of human-computer interface design* (pp. 417-422). Reading, MA: Addison-Wesley.

Krueger, M. W. (1991). *Artificial reality*. Reading, MA: Addison-Wesley.

Lang, P. J. (1985). *The cognitive psychophysiology of emotion: Anxiety and the anxiety disorders*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Lasswell, H. (1948). The structure and function of communication in society. In L. Bryson (Ed.). *The communication of ideas* (pp. 37-51). New York: Harper & Row.

Laurel, B. (1990). Interface agents: Metaphors with character. In B. Laurel (Ed.). *The art of human-computer interface design* (pp. 355-365). Reading, MA: Addison-Wesley.

Levy, M. R., & Windahl, S. (1984, January). Audience activity and gratifications. A conceptual clarification and exploration. *Communication Research*, *11* (1), 51-78.

Lin, N. (1977). Communication effects: Review and commentary. In B. Ruben (Ed.), *Communication yearbook* (Vol. 1). New Brunswick, NJ: Transaction Books.

Lombard, M. (1995). Direct responses to people on the screen: Television and personal space. *Communication Research*, *22* (3), 288-324.

Lombard, M., Ditton, T. B., Grabe, M. E., & Reich, R. D. (1997). The role of screen size on viewer responses. *Communication Reports*, *10* (1), 95-106.

Lombard, M., Grabe, M. E., Reich, R. D., Campanella, C. M., & Ditton, T. B. (1996, August). *Screen size and viewer response to point-of-view movement impact*. Paper present at the annual conference of the Association for Education in Journalism and Mass Communication, Anaheim, CA.

Maletzke, G. (1987). Aspekte der Medienzukunft: Wertewandel, Nutzungstrends, Veränderungen im Angebot. In M. Grewe-Partsch & J. Groebel (Eds.), *Mensch und Medien: Zum Stand von Wissenschaft und Praxis in nationaler und internationaler Perspektive.* Munchen, Germany: Saur.

Massey, B. L., & Levy, M. R. (1999). Interactivity, online journalism, and English-language Web newspapers in Asia. *Journalism and Mass Communication Quarterly*, *76* (1), 138-151.

Mayer, R. E. (1997). Multimedia learning: Are we asking the right questions? *Educational Psychologist*, *32*, 1-19.

McLeod, J. M., & Becker, L. B. (1974). Testing the validity of gratifications measures through political effects analysis. In J. G. Blumler & E. Katz (Eds.), *The uses of mass communications: Current perspectives on gratification research* (pp. 137-164). Beverly Hills, CA: Sage.

McLuhan, M. (1964). *Understanding media. The extensions of man*. New York: McGraw-Hill.

Melton, G. W., & Galician, M-L. (1989, November 18-21). *A Comparative Analysis of the Audience for Broadcast Sports and In-Person Sports.* Paper presented at the annual meeting of the Speech Communication Association, San Francisco, CA.

Mehrabian, A. (1980). *Basic dimensions for a general psychological theory: Implications for personality, social, environmental, and developmental studies*. Cambridge, MA: Oelgeschlager, Gunn & Hain Publishers.

Mehrabian, A. & Russell, J. (1977). Evidence for a three-factor theory of emotions. *Journal of Research in Personality*, *11*, 273-294.

Miller, G. (1983). Taking stock of a discipline. *Journal of Communication*, *33* (3), 31-41.

Miller, R. (Ed.). (1988). Videodisc and related technologies: A glossary of terms. *The Videodisc Monitor*.

Monge, P. (1982). Systems theory and research in the study of organizational communication: The correspondence problem. *Human Communication Research, 3*, 245-261.

Monge, P., & Cappella, J. (Eds.). (1980). *Multivariate techniques in human communication research*. New York, NY: Academic Press.

Morris, J. D. (1995). SAM: The self-assessment manikin. An efficient cross-cultural measurement of emotional response. *Journal of Advertising Research, 35* (6), 63-68.

Morris, J. D. (2000, March). *AdSAM: Advantages*. [Online document] Available FTP: Hostname: adsam.com Directory: presentations File: page3.html [Accessed 01-2001]

Morris, J. D., Roberts, M. S., & Baker, G. F. (1999). Emotional responses of African American voters to ad messages. In L. L. Kaid & D. G. Bystrom (Eds.), *The electronic election: Perspectives on the 1996 campaign communication* (Chap. 19, pp. 257-274). Hillsdale, NJ: Lawrence Erlbaum Associates.

Morris, M., & Ogan, C. (1996). The Internet as mass medium. *Journal of Communication 46* (1), 39-50.

Neuman, W. R. (1990, July). *Beyond HDTV: Exploring subjective responses to very high definition television.* A research report for GTE Labs and the TVOT Consortium. MIT, Cambridge, MA.

Paisley, W. (1983). Computerizing information: Lessons from a videotext trial. *Journal of Communication*, *33* (1), 153-161.

Palmgreen, P., & Rayburn, J. D. (1979). Uses and gratifications and exposure to public television: a discrepancy approach. *Communication Research*, *6*, 155-179.

Palmgreen, P., Wenner, L. A., Rayburn II, J. D. (1980, April). Relation between gratifications sought and obtained. A study of television news. *Communication Research, 7* (2), 161-192.

Papacharissi, Z., & Rubin, A. M. (2000). Predictors of Internet use. *Journal of Broadcasting and Electronic Media*, *44* (2), 175-196.

Parente, D., E. (1977). Interdependence of sports and television. *Journal of Communication*, *27* (3), 120-132.

Plummer, J. T., & Leckenby, J. D. (1985). Copy research foundation and futures. In *Transcript proceedings of the second annual copy research workshop.* New York, NY: Advertising Research Foundation.

Rafaeli, S. (1985, May). *If the computer is a medium, what is the message: Explicating interactivity*. Paper presented at the International Communication Association convention, Dallas, TX.

Rafaeli, S. (1988). Interactivity: From new media to communication. In R. P. Hawkins, J. M. Wiemann, & S. Pingree (Eds.), *Advancing communication science: Merging mass and interpersonal processes* (pp. 110-134). Newsbury Park, CA: Sage.

Reeves, B. (1991). "*Being there:" Television as symbolic versus natural experience.* Unpublished manuscript.

Reeves, B., Lombard, M., & Melwani, G. (1992, May). *Faces on the screen: Pictures or natural experience?* Paper presented at the annual conference of the Internal Communication Association, Miami, FL.

Reeves, B., & Nass, C. (1996). *The media equation.* Cambridge: Cambridge University Press.

Reichenbach, H. (1951). *The rise of scientific philosophy.* Berkeley, CA: The University of California Press.

Resnick, L. (1987). Learning in school and out. *Educational Researcher*, *16*, 13-20.

Rice, R. (1984). New media technology: Growth and integration. In R. Rice (Ed.), *The new media* (pp. 33-54). Beverly Hills, CA: Sage.

Rice, R., & Rogers, E. (1984). New methods and data for the study of new media. In R. Rice (Ed.), *The new media* (pp. 81-99). Beverly Hills, CA: Sage.

Rice, R., & Williams, F. (1984). Theories old and new: The study of new media. In R. Rice (Ed.), *The new media* (pp. 55-80). Beverly Hills, CA: Sage.

Rogers. E. (1986). *Communication technology. The new media in society*. NewYork: Free Press.

Rogers, E., & Chaffee, S. (1983). Communication as an academic discipline: A dialog. *Journal of Communication*, *33* (3), 18-30.

Roser, C. (1987, May). *Cognition and affect in persuasion: An empirical analysis of involvement.* Paper presented at the annual conference of the International Communication Association, Montreal.

Russell, J. A. (1989). Measures of emotion. In R. Plutchik & H. Kellerman (Eds.), *Emotion: Theory, research and experience* (Vol. 4, pp. 83-111). San Diego, CA: Academic Press.

Sakamoto, A. (1994). Video game use and the development of socio- cognitive abilities in children: Three surveys of elementary school students. *Journal of Applied Social Psychology*, *24* (1), 21-42.

Schnotz, W., & Boeckheler, J. (1999, June). Individual and co-operative learning with interactive animated pictures. *European Journal of Psychology of Education*, *14* (2), 245-265.

Schönbach, K. (1997). Das hyperaktive Publikum – Essay über eine Illusion. *Publizistik*, *42*, 279-286.

Schramm, W. (1983). The unique perspective of communication: A retrospective. *Journal of Communication*, *33* (3), 6-17.

Severin, W. J., & Tankard, J. W. Jr. (1979). *Communication theories: Origins, methods, uses.* New York, NY: Hasting House.

Shannon, C., & Weaver, W. (1949). *The mathematical theory of communication*. Urbana, IL: University of Illinois Press.

Shapiro, M. A., & McDonald, D. G. (1992). I'm not a doctor, but I play one in virtual reality: Implications of virtual reality for judgments about reality. *Journal of Communication*, *42* (4), 94-115

Sheridan, T. B. (1992). Musings on telepresence and virtual presence. *Presence, 1* (1), 120-126.

Shuell, T. J. (1988). The role of the student in the learning from instruction. *Contemporary Educational Psychology*, *13*, 276-285.

Schulz, W. (1997). Neue Medien – Chancen und Risken: Tendenzen der Medienentwicklung und ihre Folgen. *Aus Politik und Zeitgeschichte*, *42*, 3-12.

Sloan, L. R. (1979). The function and impact of sports for fans. In J. H. Goldstein (Ed.), *Sports, games, and play* (pp. 219-262). Hillsdale, NJ: Lawrence Erlbaum Associates.

Spiro, R. J., Feltovich, R. L., Jacobson, M. J., & Poulsen, R. L. (1991). Cognitive flexibility, constructivism, and hypertext: random access instruction for advanced knowledge acquisition in ill-structured domains. *Educational Technology*, *31*, 24-33.

Steuer, J. (1992). Defining virtual reality: Dimensions determining telepresence. *Journal of Communication, 42* (4), 73-93.

Sullivan, D. B. (1991). Commentary and viewer perception of player hostility: Adding punch to televised sports. *Journal of Broadcasting and Electronic Media*, *35* (4), 487-504.

Swanson, D. L. (1977). The uses and misuses of uses and gratifications. *Human Communication Research*, *3*, 214-221.

Szuprowicz, B. O. (1995). *Multimedia networking.* New York: McGraw-Hill.

Tafler, D. (1995). Boundaries and frontiers: Interactivity and participant experience – Building new models and formats. In P. d'Agostino & D. Tafler (Eds.), *Transmission: Toward a post-television culture* (pp. 235-267). Thousand Oaks, CA: Sage Publications.

Turkle, S. (1984). *The second self: Computers and the human spirit*. New York, NY: Simon & Schuster.

U.S. Census Bureau. (March 2001). *School Enrollment in the United States - Social and Economic Characteristics of Students-Population Characteristics*. P20-533. Available FTP: Host: census.gov Directory: prod/2001pubs File: p20-533.pdf

Van Tassel. (1987) *Affect, involvement, and interactivity: Modifying health behavior using the interactive video disc.* Unpublished doctoral thesis. University of Southern California, Los Angeles.

Vorderer, P. (1992). *Fernsehen als Handlung: Fernsehfilmrezeption aus motivationspsychologischer Perspektive*. Berlin: Edition Sigma.

Vorderer, P. (2000). Interactive entertainment and beyond. In D. Zillmann & P. Vorderer (Eds.), *Media entertainment. The psychology of its appeal* (pp. 21-36). Mahwah, NJ: Lawrence Erlbaum Associates.

Wærn, Y. (1989). *Cognitive aspects of computer supported tasks.* New York, NY: John Wiley and Sons.

Whannel, G. (1979). Football, crowd behavior, and the press. *Media, Culture, and Society*, *1*, 327-342.

Wiener, N. (1954). *The human use of human beings. Cybernetics and society.* New York, NY: Da Capo Press.

Williams, M., L. (2001, January 18). Demanding interactive. *The Standard Newsletters, Box Office*.

Williams, F., Rice, R., Rogers, E. (1988). *Research methods and the new media*. New York: The Free Press.

White, R. (1983). Mass communication and culture: Transition to a new paradigm. *Journal of Communication*, *33* (3), 279-301.

Wyer, R. S., & Carlston, D. E. (1979). *Social cognition, inference, and attribution.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Zillmann, D. (1991). Television viewing and physiological arousal. In J. Bryant & D. Zillmann (Eds.), *Responding to the screen: Reception and reaction processes* (Chap. 5, pp. 103-133). Hillsdale, NJ: Lawrence Erlbaum Associates.

Zillmann, D., Bryant, J. & Sapolsky, B. S. (1989). Enjoyment of sports spectatorship. In J. H. Goldstein (Ed.), *Sports, games, and play* (pp. 241-278). Hillsdale, NJ: Lawrence Erlbaum Associates.

BIOGRAPHICAL SKETCH

Edouard Rollet was born in Lyon, France, in 1975. He earned a Bachelor of Science in Business Administration from the European Institute of Business (IEA) in Paris, France, and a Bachelor of Science in Mass Communication from Florida International University in Miami.

His research interest focuses on the international context of media development, media convergence and integration, and the impact of new media and technologies on institutions, audiences, and mass communication theories. His recent explorations include a critical review of the European Union's communications policy (*Gazette,* Fall 2001), and reflections on the Internet and global communications ethics.

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