University of Alberta

THEORIES OF COMPUTER-MEDIATED INTERACTIVITY: FROM THEORY TO PRACTICE

by

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ABSTRACT

Interactivity, as a central characteristic of new media, has attracted much attention from researchers in various disciplines. One such field, computer-mediated communication studies, has produced a vibrant discussion of the concept. Among the diverse views, three dominant approaches are identified: structural, process-based, and perceptual. Their fundamental differences, strengths, and weaknesses are pointed out. The conceptual approaches are further scrutinised through the critical analysis of some empirical operationalisations of their respective conceptual models. In the second part, four fundamental conceptual issues which have not received sufficient attention in the interactivity studies—the need for a holistic interactivity framework, terminological inconsistencies and confusion, unexplained causal mechanisms among interactivity types, and the issue of the interactivity "ideal"—are outlined. Solutions to the above issues are discussed, including a proposal for a new interactivity framework.

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INTRODUCTION

Statement of the Problem

> Interactivity has been identified as a core concept of new media, yet despite nearly three decades of study and analysis, we scarcely know what interactivity *is*, let alone what it *does*. (Bucy, 2004b, p. 373)

Interactivity is not a new concept in humanities and social sciences research. However, in the context of computer-mediated communication, it has acquired a new meaning and significance compared to that of the traditional face-to-face or mass media communication. Interactivity is often deemed as a central characteristic or even the single defining property of the new media. Such positioning of interactivity in new media studies has prompted researchers of different academic backgrounds to become increasingly interested in this phenomenon. Each discipline and research tradition, however, approaches and conceptualizes this notion from its own perspective. Interactivity research interests encompass a wide range of areas, from computer-assisted learning to interactive advertising. As a result, "interactivity means different things to different people in different contexts" (McMillan, 2006, p. 205).

One thing the new media researchers seem to agree about is that the networked computer as a communication medium has brought about a shift in the communication paradigm, "skewing the boundaries involved in traditional mass communication theories" (Kiousis, 2002, p. 355). Traditional definitions and models of interactivity fail to provide workable operational definitions for computer-mediated interactivity and to account for its effects (Heeter, 1989; Jensen, 1998; Rice & Williams, 1984; Rogers, 1986). This

problem has prompted today's scholars to rethink the traditional media theories in terms of computer-based interactivity. Because of the fundamental role of interactivity in new communication technologies, how it is understood has direct implications for developing theories of new media, in general, and research about interactivity effects, in particular. While some researchers agree about the basic dimensions of interactivity, "the lack of theoretical consensus regarding the concept" persists (Kiousis, 2002, p. 357). As a result of the differences in conceptualisations, the interactivity research has produced varied and, at times, contradictory results.

The popular use of the terms *interactivity* and *interactive* in both popular and scholarly discourse, without a proper definition, only further obscures interactivity's meaning and adds to the confusion surrounding the concept. With the Internet rapidly becoming a dominant mass communication medium, interactivity has become a buzzword, a marketing pitch, which bombards us every day. We often hear about "interactive learning," "interactive television," and "interactive entertainment," to mention only a few of the ways that interactivity is now being used. The term *interactivity* is so broadly understood today that it is attached to almost all digital products and web-based applications:

> '[I]nteractivity' has naturally entered common usage. And this watering down of the concept has not become less significant after the worlds of advertising and entertainment have annexed the term as a common, value-added word in the effort to sell new products and services. ... At the same time, it seems relatively unclear just what 'interactivity' and 'interactive media' mean. (Jensen, 1998, p. 185)

Jensen (1998) further remarks that "[t]he positiveness surrounding the concepts [of interactivity and interactive media] and the frequency of their use seem, in a way, to be reversely proportional to their precision and actual content of meaning" (p. 185).

Interestingly, some scholars like Manovich (2001) consider it a tautology to call new media interactive since interactivity is an inherent quality of any modern computer-human interfaces which enable us to control new media:

> Modern HCI is by definition interactive. In contrast to earlier interfaces such as batch processing, modern HCI allows the user to control the computer in real-time by manipulating information displayed on the screen. Once an object is represented in a computer, it automatically becomes interactive. Therefore, to call computer media "interactive" is meaningless—it simply means stating the most basic fact about computers. (p. 55)

For scholarly inquiry into interactivity, where the precision of a definition has direct implications for the quality of research outcomes, such diffusion of meaning is unacceptable.

So far, the scholarly work on interactivity has taken an inductive approach, using results and observations to arrive at generalisations and conclusions. Bucy (2004b) observes that "the study of interactivity remains for the most part pretheoretical, focused on description and typologizing rather than prediction and testing" (p. 373). The current state of scholarly inquiry into computer-mediated interactivity is arguably understandable considering that the Internet, as a communication medium, keeps evolving by leaps and bounds. A good example of such evolution is the recent explosion in the number and popularity of Web 2.0 applications on the Internet, which create virtual social networking spaces, facilitate collaboration, and help construct meaning collectively. Technological innovations like Web 2.0 continuously create new forms of collective and individual computer-based interactivity. This process, in turn, calls for continuous re-examination and re-validation of the previously proposed interactivity conceptualisations against the current state of communication technologies.

One important but seldom-mentioned observation involves the weak link between computer-mediated interactivity research and interactivity design practices. My review of the interaction design literature did not find any references to the computer-mediated communication publications discussed in this thesis. Where a link between academic research and interaction design does exist, most of the interactivity design practices appear to be guided by empirically unverified guidelines based on a trial-and-error approach:

> Many studies primarily offer guidelines or research frameworks, but wait for others to verify and validate their findings. Some developers blindly depend on such guidelines without considering whether they have been verified. Despite its obvious value, there has been very limited research that empirically examines interactivity dimensions and their relationship with an important design outcome—quality (Chena & Yen, 2004, p. 218)

Downes and McMillan (2000) observe that most academic literature on computer-based *interactivity* provides theoretical frameworks and definitions but offers "few tools for operationalizing the concept of interactivity in computer-mediated environments" (p. 157). As the theories of computer-mediated interactivity evolve, the design principles and guidelines need to be continuously updated to reflect the latest findings in conceptual and empirical research. Doing so calls for a tighter link between academic knowledge about interactivity and interaction design practices.

My personal interest in the thesis subject-matter lies in the practical application of theoretical knowledge to interaction design process. While using heuristic principles to guide the design process may produce acceptable results, I believe that understanding what makes things interactive will lead to better design practices. A designer cannot always easily translate academic discourse into tangible design principles. I hope that this thesis will offer some guidance and help in this endeavour.

In this thesis, I adopt the perspective of the computer-mediated communication (CMC) studies on the concept of interactivity for the following two reasons. First, the communication perspective is particularly suited for the study of technologically-mediated interactivity because "interactivity is quintessentially a communication concept" (Rafaeli, 1988, p. 113). Second, CMC studies are a relatively new multidisciplinary field which effectively combines knowledge from human-computer interaction (HCI) and communication studies, as well as other related disciplines. Over two decades of interactivity studies in CMC studies have produced a large body of literature and many views on the subject.

Based on the above perspective, the purpose of this thesis is to identify the current state of computer-mediated interactivity research and to provide a holistic view of the phenomenon by unifying the disparate approaches into a new workable framework. To this end, I review and critically analyze the theoretical and empirical CMC literature on the subject, and assess the validity, strengths and weaknesses of the individual interactivity frameworks in the light of the ongoing evolution of new media and interactive technologies. I also propose a new interactivity framework, which builds on the current interactivity research and identifies new ways to advance the field. To this end, I attempt to answer the following research questions:

1) What are the current approaches to interactivity conceptualisation? What are their fundamental differences, strengths and weaknesses?

2) What are the current operationalisation approaches to measuring computer-mediated interactivity? What are their strengths and weaknesses?

3) What fundamental conceptual issues have not yet received sufficient attention in

interactivity research? How can addressing these issues advance the study of interactivity?

This thesis focuses on the concept of interactivity alone. This thesis does not set out to theorize on the *effects* of computer-mediated interactivity on users. This interesting, large topic deserves a thesis of its own. However, any discussion of interactivity would be impossible outside the context of interactivity effects. In fact, the desire to understand new media and interactivity effects is the primary driving force behind the interactivity research. Furthermore, some concepts and notions are central for the discussion of interactivity in this thesis. However, because of their ambiguous usage in literature or very technical nature, they require a precise definition or further clarification. For a list of such terms, please refer to Appendix One.

This thesis consists of an introduction, four chapters, a list of references, and appendices. Chapter One will present the various approaches to interactivity research and discuss individual conceptualisations of interactivity from the computer-mediated communication perspective. This chapter will offer a comparative critical analysis of the core theories and will also highlight the strengths and weaknesses of the individual research approaches. This chapter will also identify the conceptual issues requiring further theoretical explication. Chapter Two will discuss the practical application of the various theoretical frameworks to empirical academic research. This chapter will provide an overview and critical analysis of the operational definitions of interactivity, as well as the quantitative and qualitative methods of measuring levels of interactivity. This chapter will also discuss how to improve the validity and research value of future empirical studies. Chapter Three will use the previous discussion of theoretical conceptualisations

and empirical research methods to highlight and discuss some conceptual issues, which have not yet received sufficient attention in interactivity studies. This chapter will also propose a holistic interactivity framework which will offer a new look at the causal relationships among the various interactivity types. Chapter Four will conclude the study by summarizing the key findings, revisiting the main issues, and discussing suggestions for further research.

CHAPTER 1

THEORIES OF COMPUTER-BASED INTERACTIVITY

The increased interest in new media studies from researchers of different academic backgrounds has produced a large body of scholarly literature on the subject of computer-mediated interactivity. Among many academic fields contributing to the theorizing of interaction and interactivity, some of the most prolific disciplines are media and communication studies, human-computer interaction (HCI), sociology and psychology (Jensen, 1998; Kiousis, 2002; McMillan, 2006). However, some theorists have argued that the communication perspective is particularly suited for the study of technologically-mediated interactivity. Kiousis (2002) asserted that "communication theorists perhaps afford the most systematic overview of interactivity" (p. 363). Rafaeli (1988) maintained that "interactivity is quintessentially a communication concept" (p. 113). A relatively new multidisciplinary field that offers such a communication perspective on new media and interactivity, while bridging the gap between communication studies and other contributing disciplines, is computer-mediated communication (CMC) studies. Most of the interactivity conceptualisations discussed below are from the CMC tradition.

The criteria for categorizing the existing interactivity theories and approaches range from none to very discriminating typologies. Typically, authors use categorisations in their literature reviews to support their problem definition and position their own theoretical submissions. In this thesis, I am using the 'place where interactivity resides' as a classification criterion for discussing computer-mediated interactivity conceptualisations. This classification approach has been adopted from Bucy (2004b),

who pointed out that "careful delineation of the concept should also address the question, implied but often unarticulated in research, of where interactivity resides" (p. 376). The conceptual location of interactivity serves as the primary basis for all other building blocks of an interactivity theory. As the starting point of theorizing, the 'place of interactivity' affects definitions and operationalisations of such key interactivity constructs as *feedback*, *control*, and *time*. It also has implications for which disciplines contribute to the resulting definition of interactivity and to what extent they do so. Based on the above classification criterion, I identify the following four main approaches in the computer-mediated interactivity studies:

1. the technology-driven approach.
2. the interactive exchange approach.
3. the perceptual approach.
4. other approaches.

1.1 Technology-driven Approach

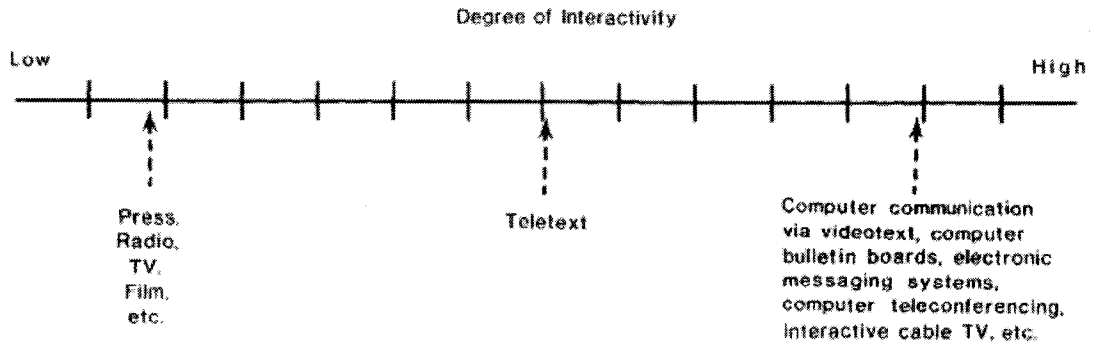
Some of the earliest conceptualisations of interactivity place the concept within the structure of a communication medium. They view interactivity as an attribute of communication technologies that enable human-media or mediated human-human interactions. This approach, commonly referred to as the "structural"[1] approach, defines interactivity in terms of the interactive features or functions afforded by or available in the medium. The deliberate exclusion of a "human factor" from the definition allows the treatment of interactivity as a variable that is constant among all users. This practice is viewed as a major conceptual advantage by the supporters of this approach and as a

[1] Some authors (Sohn & Lee, 2005) refer to the structural approach as 'functional'. Others (Tremayne, 2005) use 'functional' to describe the interactive exchange approach. To prevent confusion, I am deliberately avoiding the expression 'functional approach' in my thesis.

drawback by its opponents. While earlier structural-approach studies focused on building typologies of interactive media (Durlak, 1987; Rogers, 1986), later theories offered more elaborate theoretical frameworks with deeper levels of classification of interactivity types (Jensen, 1998; McMillan, 2000) and a transition to interactivity effects studies (Bucy & Tao, 2007).

Rogers (1986), a well-known communication scholar, was one of the first to offer a conceptualisation of mediated interactivity. He submitted that the single unique characteristic that defined new media was its interactivity, which he defined as a *feedback* functionality enabled by communication technologies: "*Interactivity* is the capability of new communication systems (usually containing a computer as one component) to 'talk back' to the user, almost like an individual participating in a conversation" (p. 4). Essentially, Rogers applied the classical Shannon–Weaver model of communication to the new media and equated the *feedback loop* with technologically-mediated interactivity. He treated interactivity as a single-dimensional construct and a variable dependent on communication technology, which can be measured on a scale from low to high. Using the "talking back" criterion, Rogers produced a typology of all communication media on the interactivity continuum (see Figure 1).

Figure 1. Rogers' typology of communication technologies on the interactivity continuum



Note. From *Communication technology: The New media in society* (p. 34), by E.M. Rogers, 1986, New York: Free Press.

Rogers' conceptualisation, illustrative of the early, pre-Internet era, attempts to apply old communication theories to the study of new media and interactivity. As Jensen (1998) noted, "The basic model is clearly 'human-machine interaction,' understood in the context of interpersonal communication ('talking back')" (p. 193). The uni-dimensional model of interactivity appears to be somewhat oversimplified and based on a single criterion of technology's inherent capability to enable a two-way exchange between the sender and receiver. Rogers' focus on *feedback* as the defining construct of interactivity is not unique. Most interactivity conceptualisations position *feedback* or two-way exchange as the central dimension of interactivity, but few limit their definitions to only one dimension. Rogers did not develop the idea of two-way exchange enough to apply it as a classification criterion for the differentiation of new media (videotext, bulletin boards, etc.). As a result, the media using different communication channels and technologies such as computer-based systems and interactive cable TV are located at the same place on Roger's interactivity continuum (see Figure 1).

Like Rogers, Durlak (1987) attempted to build a typology of interactive media. However, unlike the previous scholar, Durlak developed an elaborate, two-dimensional model of interactivity to be used for determining the level of medium's interactivity. The underlying assumptions for Durlak's conceptualisation were that face-to-face communication was the model for computer-mediated interactivity and that the roles of the sender and receiver in the fully interactive media had to be interchangeable. Durlak also pointed out that the previously "discrete distinctions among intrapersonal, interpersonal and mass-mediated communication is [*sic*] giving way to a continuum of communication behaviors" (p. 744). He constructed his conceptual model of interactivity by combining components of an interactive media system (hardware, software, tools, people[ware]) on one dimension with the three interactive design objectives (simulation of face-to-face interaction, maintaining the illusion of interaction, and mind amplification) on the other dimension (see Figure 2). Each media component comprised a number of interactivity variables. For instance, the *hardware* component included sensory richness, spatial management and system responsiveness. The resulting interactivity conceptualisation represented a two-dimensional matrix populated with interactivity variables, which could be used to describe, compare, and analyse interactive media.

Figure 2. Durlak's typology for interactive media

Designer Goals	Components of an Interactive Media System				
	HARDWARE		SOFTWARE	TOOLS	PEOPLE
SIMULATING FACE-TO-FACE	Sensory Richness	Social Presence		Natural Language Translation	Group Leader Animateur
MAINTAINING THE ILLUSION	Responsiveness	Transparency Personalization	Reactive Selective Access Structure	Integration	Technician Programmer
MIND AMPLIFICATION	Spatial Management	User Friendliness Metaphor Graphics	Dialog Provision Structure Functional Freedom Knowledge Dialog	Speculation Idea Generation Visualization	Dispatcher-Mediator Weaver Creator

Note. From "A typology for interactive media," by J.T. Durlak, 1987, p. 754. In M.L. McLaughin (Ed.), *Communication Yearbook 10* (pp. 743–757). Newbury Park, CA: Sage.

Although Durlak's interactivity conceptualisation is generally a step forward compared to Rogers' typology, it contains a number of problematic features. For example, the list of interactivity variables is quite lengthy, and some of them overlap between categories. Durlak admitted that "[o]ne of the difficulties in focusing on 'interactivity' is that it is becoming more difficult to find out where, for example, hardware ends and software/tools or people begin" (p. 745). Durlak also confessed that "the classification of the variables is based on intuitive rather than objective criteria" (p. 753). Indeed, in

Durlak's conceptual model, it is confusing why, for example, *responsiveness* is listed where it is and not under the *software* media component and the *simulating face-to-face* interaction goal. It is also unclear how individual media components, interaction goals, and interactivity variables rank against each other in terms of their level of interactivity. Durlak stops short of applying his own interactivity conceptualisation to create a typology of interactive media, leaving more questions than answers. One such question is the definition of interactivity. The closest Durlak comes to defining it is by enumerating what he considers interactive media:

> Interactive media systems include the telephone; "two-way television; audio conferencing systems; computers used for communication; electronic mail; videotext; and a variety of technologies that are used to exchange information in the form of still images, line drawings, and data." (p. 743)

According to Durlak, not all media are interactive. However, neither Durlak's interactivity conceptualisation nor his general discussion clarify what exactly makes media "interactive" in the first place.

In his article, Durlak touched upon but does not go into much detail about a rather interesting conceptual issue that is a point of hot debate in the interactivity literature to date: the use of *face-to-face* (or, more precisely, *interpersonal*) communication as the standard for judging mediated interactivity. Durlak subscribed to Bretz's (1983) view of a face-to-face conversation as the model of interactivity "because the sender and receiver use all their senses, the reply is immediate, the communication is generally closed circuit, and the content is primarily informal or 'ad-lib'" (pp. 22-23). Clearly, such a rationale is based on the classical model of information transmission driven by the notion of information entropy. Along with Bretz and Durlak, the use of the interpersonal communication as the ideal for mediated interactive communication has quite a few

proponents among interactivity researchers (Heeter, 1989; Steuer, 1992; Williams, Rice, & Rogers, 1988). Strommer-Galley (2004) noted a tendency in the interactivity literature to conceptualise interactivity "as an ordinal-level variable, with the highest degree being face-to-face communication and the lowest being user-to-system interactivity" (p. 391). Such an approach to evaluating interactive experiences stems from the conviction that "interactivity generally refers to the processes of communication that take on some of the characteristics of interpersonal communication" (DeFleur and Ball-Rokeach, 1989, p. 341). Accordingly, sociological research on interpersonal interaction can be directly applied to the study of technologically-mediated interactivity. Jensen (1998) described the above approach as follows:

> According to this way of thinking, media whose communication form comes closest to face-to-face communication are therefore also the most 'interactive.' . . . [I]t also becomes clear that the concept of interactivity, understood in this way (in the form of the conversation communication pattern), is related to the sociological concept of 'interaction', understood as 'actions of two or more individuals observed to be mutually interdependent.' (p. 191)

Interestingly, not only some interactivity scholars but also some engineers seem to be preoccupied with the conversational ideal, trying to design systems that approximate interpersonal human communication. Rogers (1986) observed,

> Computer designers try to create a computer that can interact with an individual in a way that is similar to human-to-human communication. User friendly is the degree to which a computer and an individual can communicate with the same ease that two individuals can converse. (p. 39)

Beside its supporters, the conversational ideal of interactivity has many critics (Bucy, 2004b; Newhagen, 2004; Rafaeli, 1988). For example, Rafaeli (1988) warned against holding human conversation as an ideal type of interactivity, no matter how attractive this approach may seem. He perceived it to be both subjective and problematic,

a concept that is not reliable "across judges, culture, or time" (p. 117). He further compared this approach to artificial intelligence rhetoric in computer science:

> The "conversational ideal" has often been mentioned as a standard of comparison for media (see Avery & McCain, 1982; Schudson, 1978). The conversational ideal represents the notion that "better" media somehow emulate the way in which humans conduct face-to-face conversations. The conversational ideal is close kin to the human intelligence ideal in computer science, where, for example, Turing (1950), Licklider (1960, 1968), and Winograd (1979) popularized the "Turing test," "man-computer-symbiosis," and "convivial computing" terms, all of which refer to the ways in which the performance of the computer as a medium is judged against human-to-human interaction as an ideal type. (p. 117)

Almost two decades later, Bucy (2004b) echoed the same concern by emphasizing the need to explicitly establish the boundaries for the concept's meaning:

> Interactivity, first and foremost, should be reserved to describe reciprocal communication exchanges that involve some form of media, or information and communication technology. [I]nteractivity should not be considered synonymous with social interaction, person-to-person conversation, or face-to-face communication" (p. 375).

In retrospect, Durlak's interactivity conceptualisation may have been a side step from the general direction of interactivity studies. However, it helped raise a number of important conceptualisation issues that resonated in the later interactivity research. First, Durlak's model unwittingly showed that conceptualisations based on cataloguing interactive functions of existing communication media are short-sighted and do not stand the test of time. Such conceptualisations often fail to accommodate newer communication technologies and require constant updating. Second, contrary to Rogers (1986), Durlak proposed that interactivity is a complex construct which has more than one dimension. Most structural theories of interactivity that followed (Heeter, 1989; Jensen, 1998; McMillan, 2000) differed in the number and types of interactivity dimensions but retained a multi-dimensional view of the concept. Third, in his discussion of individual

interactivity variables, Durlak pointed out that some disciplines are better suited than others for the operationalisation of certain variables. This point reinforced the importance of utilising a multidisciplinary approach in interactivity studies.

Heeter (1989) offered one of the most popular early theories of interactivity. Her conceptualisation attempted to synthesize the diversity of the existing views on and the theories of interactivity in mediated communication. She produced, arguably, the broadest conceptualisation of interactivity, defining it as a six-dimensional construct. Based on her review of the interactivity literature, Heeter singled out the following six key dimensions of interactivity:

1. complexity of choice.
2. effort users must exert.
3. responsiveness to the user.
4. monitoring information use.
5. ease of adding information.
6. facilitation of interpersonal communication.

Four of the above dimensions address the user-to-medium interaction while the other two cover the user-to-user interaction. However, Heeter considered all six dimensions as the functions of the medium.

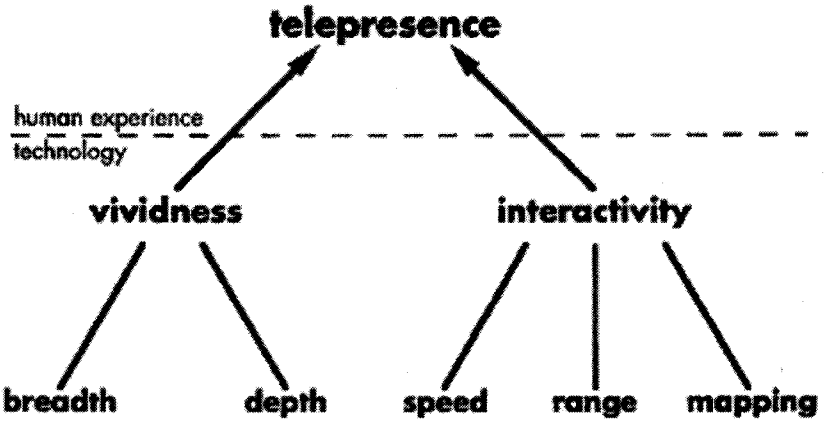
The popularity of Heeter's conceptualisation among empirical researchers was largely due to her clear suggestions and examples for the operationalisation of each interactivity dimension. Even though Heeter offered her interactivity theory before the Internet established itself as a dominant new communication medium, her conceptualisation offered a helpful framework for analysing the interactivity of websites. Like other interactivity theorists, Heeter tried to apply her interactivity conceptualisation to all communication technologies. Although she did not provide a typology of

interactive media, large parts of her explanations of individual dimensions deal with various media types. Despite its popularity, Heeter's definition of interactivity attracted much criticism. For example, Jensen (1998, p. 200) criticized Heeter's six-dimensional model for its complexity, overlapping of some dimensions, and general difficulty for practical application. For example, 'complexity of choice' and 'ease of adding information' will directly affect the amount of user effort required.

Like Durlak (1987) and contrary to Heeter (1989), Steuer (1992) introduced a single-dimensional conceptualisation of interactivity. However, instead of the bi-directionality of interactive media, Steuer chose user control as the central construct for his definition of interactivity. Steuer proposed a mediated-interactivity model within his theory of virtual reality, which he defined in experiential rather than in hardware terms. From Steuer's perspective, virtual reality is a technology-mediated perceptual experience, "a real or simulated environment in which a perceiver experiences telepresence" (p. 76). Since the technological mediation is a necessary precondition for experiencing telepresence, the properties of a medium will affect the perception. Steuer singled out two such quintessential media properties, or *dimensions* as he called them: *vividness* and *interactivity*. While *vividness* refers to sensorial richness of the medium, *interactivity* is defined as "the extent to which users can participate in modifying the form and content of a mediated environment in real time" (p. 84). Although Steuer considered telepresence an experiential phenomenon (see Figure 3), he submitted that "the variables vividness and interactivity refer only to the representational powers of the *technology*, rather than to the individual" (p. 80). Steuer admitted that while other factors may influence interactivity as well, *speed*, *range* and *mapping* are the main elements of interactivity. Essentially, Steuer

saw interactivity in terms of technology-enabled user control influenced by the system's responsiveness, the range of user choices, and the usability of the interface.

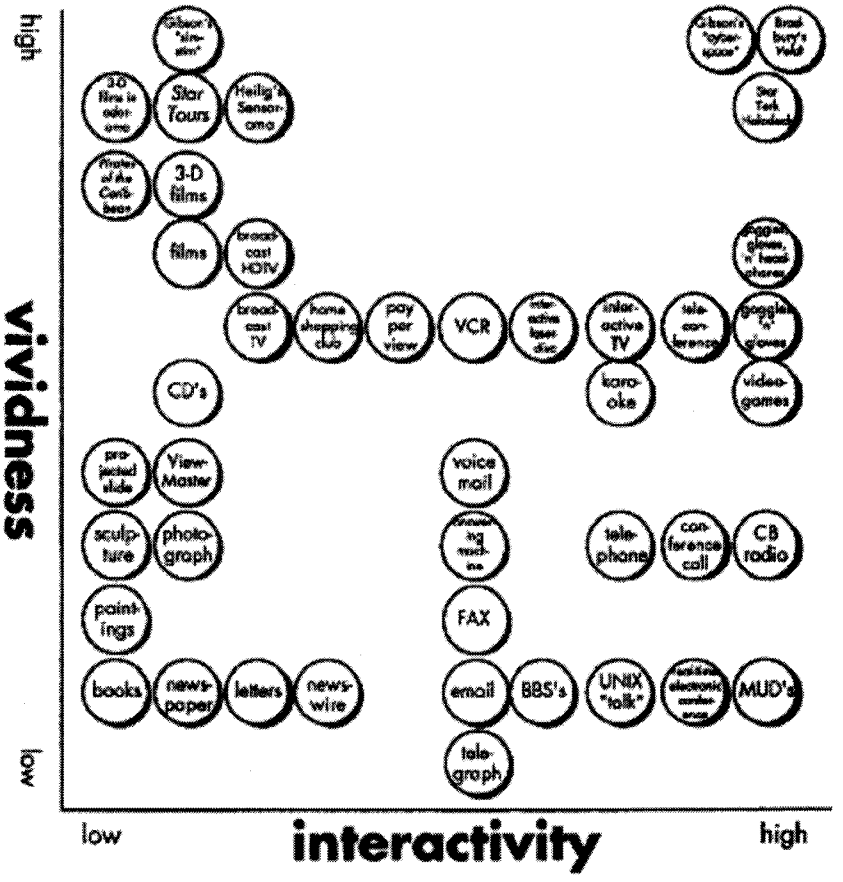
Figure 3. Steuer's model of technological variables influencing telepresence



Note. From "Defining virtual reality: Dimensions determining telepresence," by J. Steuer, 1992, p. 81, *Journal of Communication, 42,* pp. 73–93.

Since the effect of telepresence is created by "a communication medium" (p. 76), Steuer extended his definition of virtual reality and his conceptualisation of telepresence to include all mediated communication environments. He then applied his theoretical framework to classify media technologies in terms of their telepresence potential (see Figure 4). Steuer's typology of communication media is undoubtedly based on a more solid scientific argumentation than Rogers' or Durlak's. In addition, Steuer's theoretical model is straightforward and easy to operationalize. Somewhat ironically, however, Steuer's typology places books at the lowest end while the non-existent artefacts from sci-fi books—Bradbury's "veldt," Gibson's "cyberspace," and Star Trek's Holodeck—are located at the highest end.

Figure 4. Steuer's classification of media by vividness and interactivity



Note. From "Defining virtual reality: Dimensions determining telepresence," by J. Steuer, 1992, p. 90, *Journal of Communication, 42,* pp. 73–93.

Steuer's choice of *user control* as the core construct of mediated interactivity may be explained by a particular role of a user and the specifics of information transmission in virtual reality environments. Steuer observed that, from the telepresence perspective, the same user can be viewed as both the sender and the receiver of communication. Furthermore, Steuer suggested that "[i]nformation is not transmitted from sender to receiver; rather, mediated environments are created and then experienced" (p. 78). This view contrasts with that of traditional communication models based on two-channel information exchange and may explain Steuer's omission of the traditionally popular

feedback dimension from his definition of interactivity. Interestingly, the above observation also problematizes the validity of the application of Steuer's theory across all communication media types.

Another interesting point in Steuer's discussion is his argument for viewing interactivity as an attribute of a communication medium rather than an experiential phenomenon. Steuer treated telepresence as a psychological variable that varies across users even in identical virtual reality environments. However, to create this sense of environmental presence in an individual's consciousness, technologically-mediated stimuli should exist. The ability to create such stimuli is determined by the technological structure of a medium. Thus, different media have different telepresence potential. However, for the perception of telepresence or interactivity to arise, technological stimuli should be present in the first place. Later on, Sundar (2004) extended this argument by stating that the "experiential aspect of interactivity is not part of its definition, but rather its effect, specifically a behavioral effect" (p. 386). He further argued that "interactivity is a message (or medium) attribute, not a user attribute" (p. 386). The user may or may not realise the full interactive potential of a technological interface, depending on the individual's personal characteristics and the quality of programming, but interactivity exists independently of the user's perception. Interestingly, this argument for applying the structural approach to the study of interactivity persists in the interactivity literature to date.

Later structural conceptualisations of interactivity (Jensen, 1998; McMillan, 2000) added sophistication and complexity to the dimensions of interactivity. However, the general approach remained the same. For example, Jensen (1998) offered a three-

dimensional model of interactivity, which revolved around different aspects of user control. Jensen built his conceptualisation on Bordewijk and van Kaam's (1986) 'Information Traffic' typology of communication patterns (see Figure 5). This typology identifies four distinct communication patterns based on two types of media control hierarchies, by cross-tabulating the *'owner/provider of information'* and *'controller of distribution and consumption'* variables.

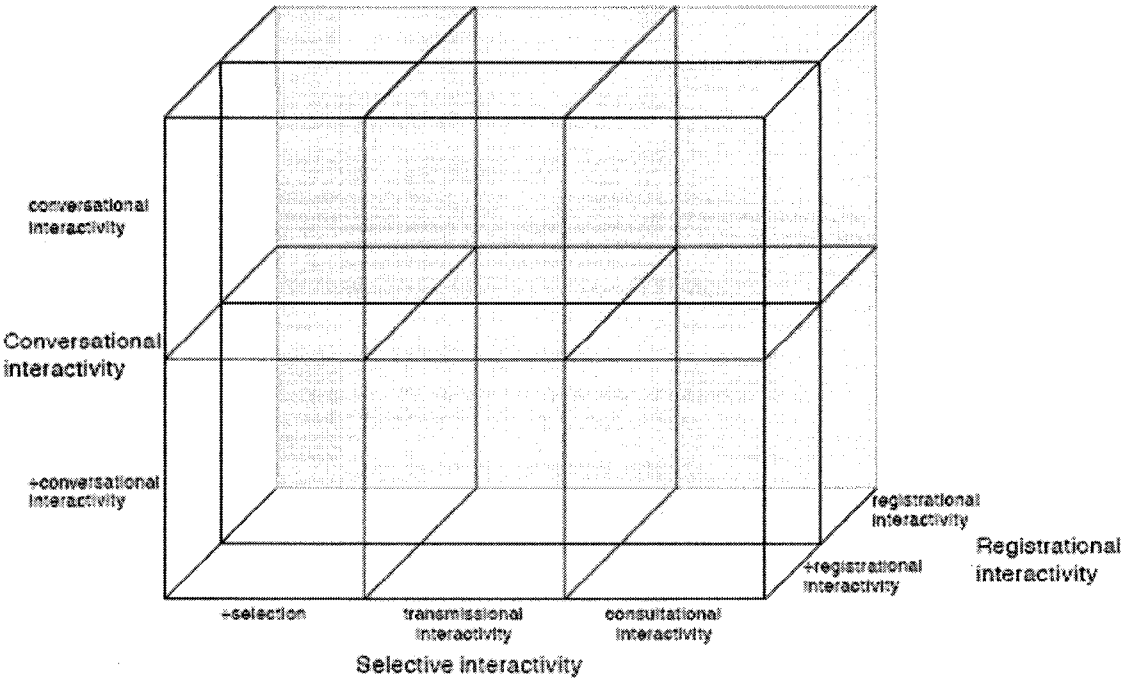
Figure 5. Bordewijk and Kaam's matrix for the four communication patterns

	Information produced by a central provider	*Information produced by the consumer*
Distribution controlled by a central provider	**1) Transmission**	**4) Registration**
Distribution controlled by the consumer	**3) Consultation**	**2) Conversation**

Note. From "Defining Interactivity: Tracing a new concept in media and communication studies," by J.F. Jensen, 1998, p. 187, *Nordicom Review, 19,* pp. 185-204.

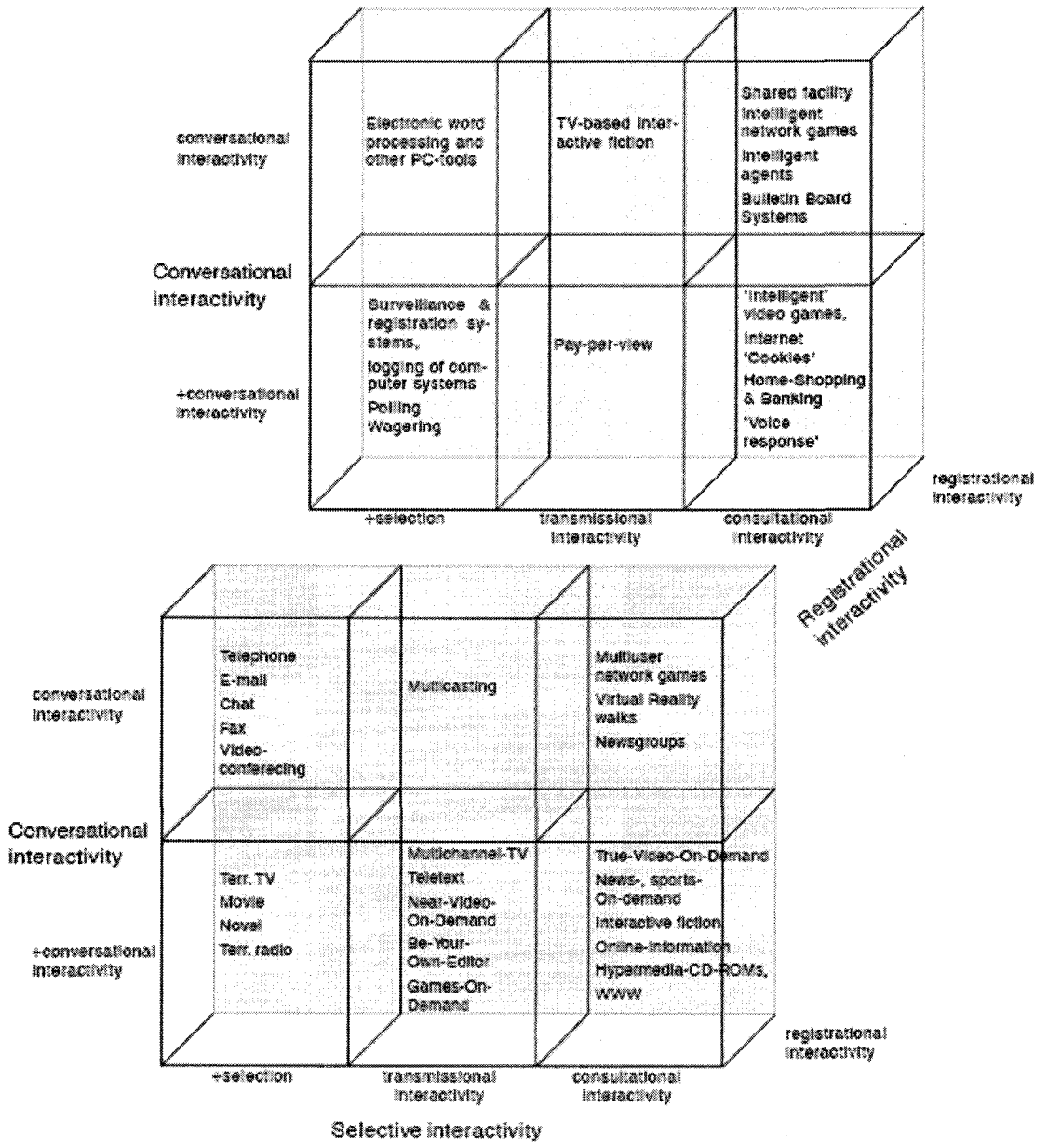
Jensen translated these four communication patters into respective four types of interactivity: *transmissional, consultational, conversational and registrational.* By combining *transmissional* and *consultational* interactivities (both of which deal with the user choice) into the single *selective interactivity* dimension, Jensen produced the "cube of interactivity" (see Figure 6). He then used this three-dimensional model of interactivity, with its 12 cells, to create a typology of interactive media (see Figure 7).

Figure 6. Jensen's "Cube of Interactivity": a three-dimensional representation of the dimensions of interactivity



Note. From "Defining Interactivity: Tracing a new concept in media and communication studies," by J.F. Jensen, 1998, p. 201, *Nordicom Review, 19,* pp. 185-204.

Figure 7. Jensen's "Cube of Interactivity" with the typology of interactive media



Note. From "Defining Interactivity: Tracing a new concept in media and communication studies," by J.F. Jensen, 1998, p. 202, *Nordicom Review, 19,* pp. 185-204.

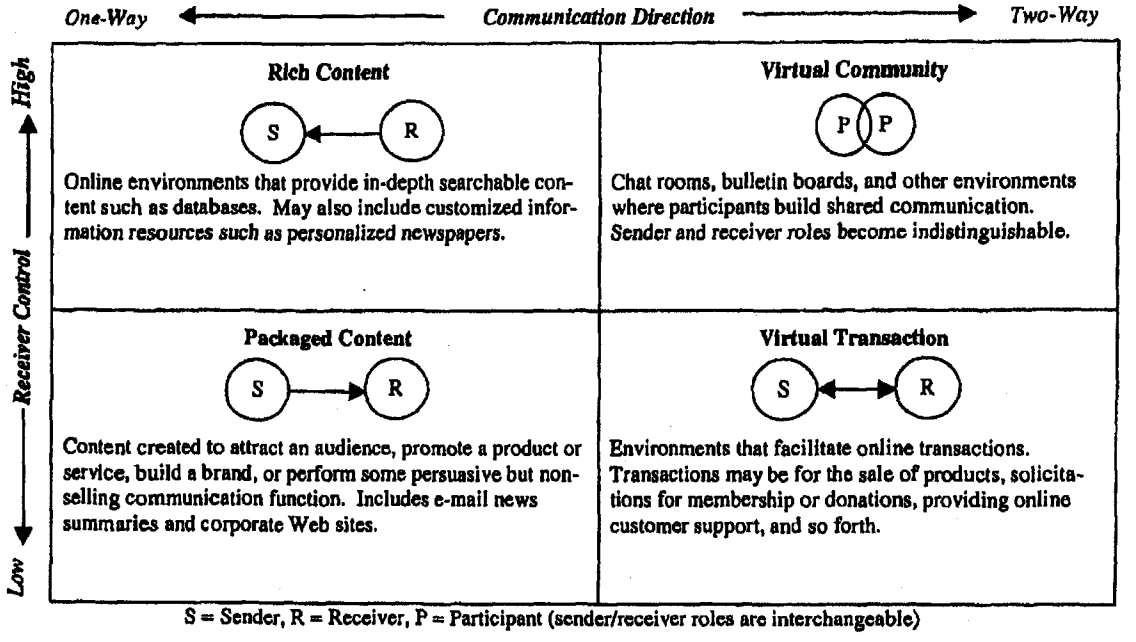
It may be difficult to visually embrace Jensen's three-dimensional model of interactivity when presented in a two-dimensional medium like paper, but the importance

of some of the conceptual principles advanced by this model is hard to miss. First, Jensen advanced further the idea that mediated interactivity is a complex multi-dimensional construct. He argued that treating individual interactivity dimensions as continua was a "more appropriate, or at least more flexible" (p. 200) way of interactivity evaluation. His model showed that interactive media can place high on some interactivity dimensions and low on others. This observation prompts deeper levels of analysis along individual interactivity dimensions when comparing individual media technologies or interactive functions. Jensen supported a conceptual distinction between *interaction* in its sociological meaning and *interactivity* as the concept of mediated communication. He defined interactivity as "a measure of a media's potential ability to let the user exert an influence on the content and/or form of the mediated communication" (p. 201). Interestingly, Jensen intentionally used the word *influence* rather than the widely accepted term *(user) control* in his definition. *Influence* implies that users are never in full control of the content and/or communication medium. This aspect of Jensen's model shows the strong influence of the traditional approach in mass media studies on his conceptualisation.

McMillan's (2000) input to interactivity conceptualisation spans two research approaches: structural and perceptual. Although she supports the perceptual approach, she developed an interactivity model, albeit from the media user's perspective, that could be applied both to the perception-based and feature-based measures of website interactivity. Through her review of interactivity theories and by using Downes and McMillan's (2000) findings about the key dimensions of interactivity, McMillan (2000) identified the interactivity dimensions which were most dominant in the interactivity

literature and foremost in other interactivity dimensions: *direction of communication* and *control of communication experience*. Based on the variation of the above two dimensions, McMillan produced a four-part model of interactivity types where the 'packaged content' type is least interactive and the 'virtual community' type provides the highest level of interactivity (see Figure 8). The advantage of McMillan's model of interactivity is that it can be used in the empirical research where both perceptual and structural interactivity measures are important. In fact, McMillan (2000) applied this model in her own study of the relationship between the interactive functions of websites and the user's perception of website interactivity.

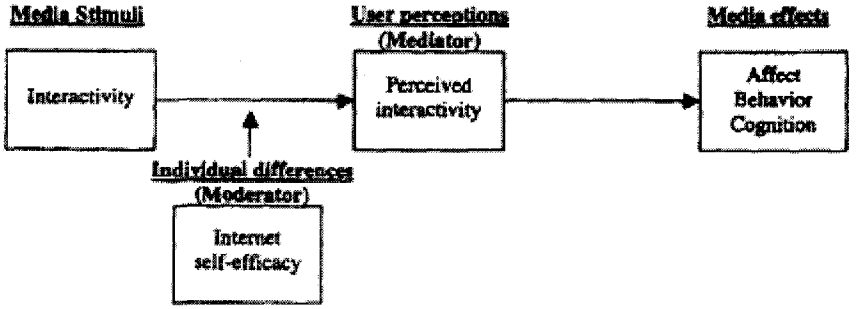
Figure 8. McMillan's four types of cyber-interactivity



Note. From "Interactivity is in the eye of the beholder: Function, perception, involvement, and attitude toward the web site," by S.J. McMillan, 2000, p. 72. In M.A. Shaver (Ed.), *Proceedings of the 2000 Conference of the American Academy of Advertising* (pp. 71-78). East Lansing: Michigan State University.

Bucy and Tao's (2007) article represented the transition in the structural approach from conceptualizing interactivity to theorizing its effects, a tendency apparent in the interactivity literature in the last decade. As a result, Bucy and Tao's mediated interactivity model encompasses elements and variables surrounding both interactivity and its outcomes (see Figure 9). With this model, Bucy and Tao offered a framework "for placing previously scattered observations about technological attributes, user perceptions, and motivational traits into a conceptual framework useful for prediction [of interactivity effects]" (p. 667). As a part of a bigger interactivity outcome model, interactivity per se was understood as media stimuli. The authors defined interactivity as the "technological attributes of mediated environments that enable reciprocal communication or information exchange, which afford interaction between communication technology and users or between users through technology" (p. 656). The degree of interactivity, therefore, is determined by the strength of the medium stimuli. The greater the number of media attributes and their qualities to engage users, the higher the supposed degree of interactivity. Bucy and Tao further identified three major forms of interactivity based on the function performed: *information selection, adaptive content* and *interpersonal communication.* The *information selection* form describes either static or dynamic retrieval of information by users. The *adaptive content* form refers to the medium capabilities for customisation and personalisation. The *interpersonal communication* form of interactivity stands for computer-mediated user-to-user interaction.

Figure 9. Bucy and Tao's mediated moderation model of interactivity



Note. From "The mediated moderation model of interactivity," by E.P. Bucy, & C.-C. Tao, 2007, p. 663, *Media Psychology, 9*, pp. 647-672.

Bucy and Tao's (2007) conceptual model does not stand out among other structural theories only for its comprehensiveness but also for the authors' argument that any interactivity conceptualisation should simultaneously include both interactivity and perceived interactivity since they are interrelated, albeit independent, variables. The authors stressed, however, the importance of isolating the concept of interactivity from any other communication environment variables, including the above-mentioned perceived interactivity. Accordingly, Bucy and Tao also insisted on clear distinction between interactivity and non-mediated interpersonal interaction. They emphasized that "interactivity, as a research term, should be reserved for mediated communication" (p. 657).

In sum, the structural approach in interactivity studies evolved through several stages: from the early period of cataloguing interactive features and building typologies of interactive media, through the period of searching for the proper kinds and the number of interactivity dimensions, to the transition to the study of interactivity effects. Among the structural interactivity theories, two particular dimensions—*direction of*

communication and *user control*—appear to play a defining role in most conceptualisations.

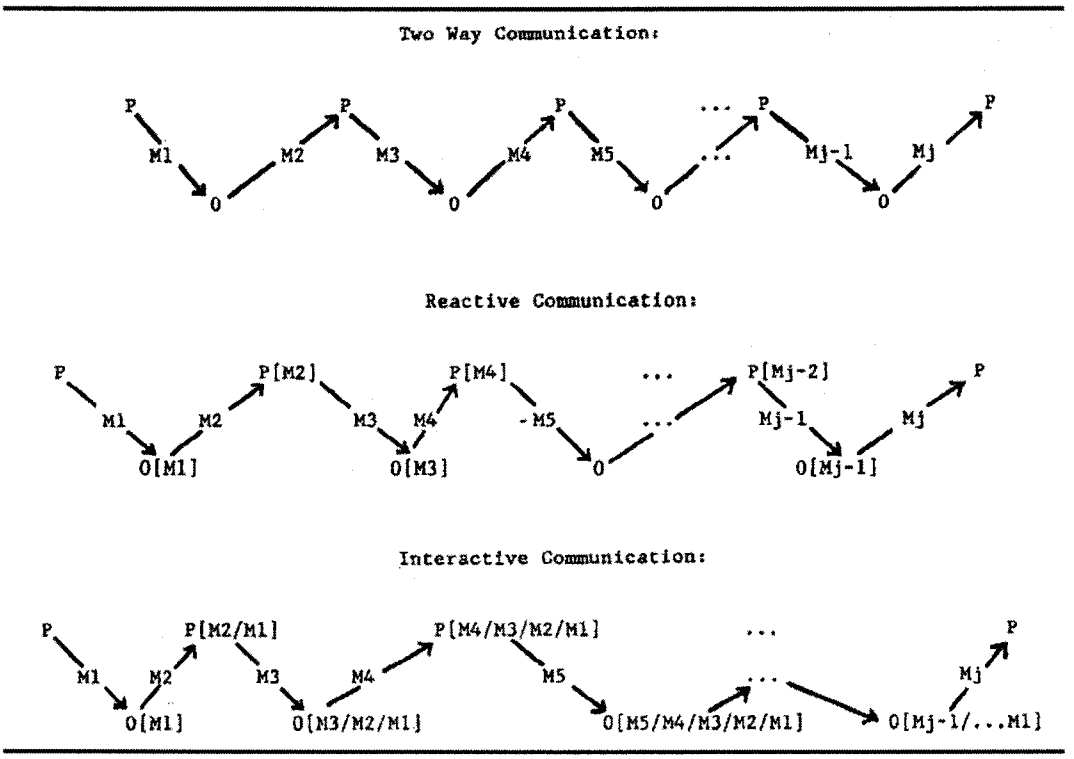
1.2 Interactive Exchange Approach

The 'interactive exchange' approach, also called the 'message-centred' approach, rejects the idea that interactivity is located either in the structure of a communication medium or the user's consciousness. Message-centred theories define interactivity as a behavioural variable measured in terms of message exchanges and the degree of the semantic relatedness of messages. The theoretical premise for this approach, pioneered and advanced by Rafaeli (1988), is rooted in the sociological tradition and the interpersonal communication models of conversation (Rafaeli & Ariel, 2007). Like the focus in the basic communication models adopted from informatics by sociological and mass communication researchers, the focus of the message-based approach is on the information transmission process. However, while the other interactivity and interaction theories address the structure of the information transmission, the message-based approach "captures the substance of the communication process" (Rafaeli & Ariel, 2007, p. 83). As a result, the interactive exchange approach goes beyond viewing responsiveness in terms of feedback or the two-way directionality of communicative exchanges and, rather, defines it in terms of the semantic relatedness of the exchanges. By conceptualising interactivity as a process but focusing on the meaning rather the structure of exchanges, the message-based approach also extends the underlying sociological concept of interpersonal interaction on which it relies.

Rafaeli (1988) was the first to offer a well-grounded theoretical framework and operationalisation model within the above approach. Bretz (1983) originally introduced the idea of third-order relatedness, which Rafaeli (1988) later applied to the conceptualisation of computer-mediated interactivity. Rafaeli (1988) defined 'interactivity' as "an expression of the extent that in a given series of communication exchanges, any third (or later) transmission (or message) is related to the degree to which previous exchanges referred to even earlier transmissions" (p. 111). Based on this definition, Rafaeli (1988) identified three levels of interactivity: two-way (noninteractive), reactive (or quasi-interactive), and fully interactive (see Figure 10). He explained the differences between the individual levels as follows:

> Two-way communication is present as soon as messages flow bilaterally. Reactive settings require, in addition, that later messages refer to (or cohere with) earlier ones. Full interactivity (responsiveness) differs from reaction in the incorporation of reference to the content, nature, form, or just the presence of earlier reference. (p. 119)

Figure 10. Rafaeli's three levels of interactivity



Note. From "Interactivity: From new media to communication," by S. Rafaeli, 1988, p. 120. In R.P. Hawkins, J.M. Wieman, & S. Pingree (Eds.), *Advancing communication science: Merging mass and interpersonal processes* (pp. 110–34). Newbury Park, CA: Sage.

The above three levels of interactivity make up a single-dimensional interactivity continuum, with the two-way (noninteractive) communication on the lower end of the continuum and the fully interactive communication on the opposite end. Rafaeli (1988) admitted that a fully interactive communication remained an "ideal type" and might not be attainable either in the mediated communication or human interaction settings. At the same time, computer-based communication technologies could be completely noninteractive. In a later collaborative work, Rafaeli and Sudweeks (1997) refined the above model of interactivity to include one-way (noninteractive), two-way (or reactive), and fully interactive levels.

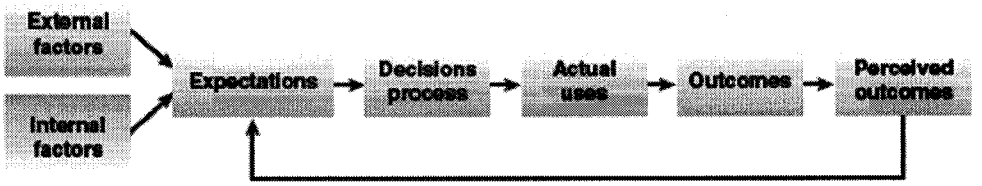
Rafaeli's (1998) theory affords a relatively easy and uniform application across various media types. Since it focuses on the meaning of communicative exchange and not the characteristics of a communication channel, differences between communication technologies do not pose any conceptual barriers to its broad application. Although most of Rafaeli's (1988) examples of interactivity were from the mass communication domain, he argued that "interactivity should apply to a wide range of communication settings: from the unmediated, face-to-face, and intimate to the relatively anonymous and mass mediated" (p. 111). Thus, interactivity is found in all communication media. What makes the new media unique in this respect is its "capacity of enabling high interactivity" (p. 119), which in the end may or may not be realised. In other words, "media and channels may set up upper bounds, remove barriers, or provide necessary conditions for interactivity levels" (pp. 119-200), but interactivity is not an inherent attribute of technology.

Ironically, the main advantage of Rafaeli's conceptualisation appears to be its most vulnerable point for criticism. The deliberate exclusion of a medium's structural and experiential aspects from the interactivity definition produced a model lacking a mechanism to explain the causal relationship between interactivity and its effects. As Rafaeli and Ariel (2007) pointed out, the interactive exchange model "does not relate to antecedents or implications of [the information exchange] process" (p. 83). Since the main interest in mediated interactivity as a concept is driven by the attempt to understand and predict its outcomes, Rafaeli's theory, in its current form, lacks the explanatory power to be a viable theoretical framework for the study of interactivity effects. Another criticism of the message-based approach is its failure to pay enough attention to the user-

system type of interaction. The operationalisation of the concept as the ratio of the total messages to the semantically related ones clearly emphasises the user-to-user types of exchanges. In addition, users may have different goals when interacting with the same media, and such goals may not be always directed towards the interactive exchange (Ha and James, 1998). Bucy and Tao (2007) also noted that "[e]mpirical evidence does not support the assumption that the exchange of messages equates with the exchange of meaning" (p. 650), and a higher number of messages may even lead to the opposite effect.

Despite the criticism, Rafaeli's (1988) conceptualisation of mediated interactivity remains one of the most cited theories in the interactivity literature. A number of empirical internet and interactivity studies (e.g., Schultz 1999, 2000; Sundar, Kalyanaraman, & Brown, 2003; Warnick et al., 2005) adapted Rafaeli's model, which has remained largely unchanged for nearly two decades. Recently, Rafaeli & Ariel (2007) offered an "interactivity analysis model" (see Figure 11) primarily intended to help future research "to be specific about articulating the part of the model chosen for focus" (p .84). In this model, external and internal factors make up the user's subjective attributes (or expectations), which are treated as antecedents of interactivity. The actual uses represent the measureable behavioural interactivity, the focus of the message-based approach. This model clearly distinguishes between objective measureable outcomes and perceived outcomes. Unfortunately, the authors provide only a cursory one-paragraph description of their model, which, nevertheless, may signal a shift in the focus of the message-based approach towards a more comprehensive conceptualisation incorporating interactivity effects study.

Figure 11. Rafaeli and Ariel's interactivity analysis model



Note. From "Assessing interactivity in computer-mediated research," by S. Rafaeli, & Y. Ariel, 2007, p. 84. In A.N. Joinson, K.Y.A. McKenna, T. Postmes, & U.-D. Reips (Eds.), *The Oxford handbook of internet psychology* (pp. 71-88). Oxford, England: Oxford University Press.

1.3 Perceptual Approach

The perceptual approach in interactivity studies originates from the mass media effects studies. It is based on the empirically supported assertion that a medium devoid of interactive features may be still perceived by users as 'interactive' (Newgahen, Cordes, & Levy, 1995). Other empirical studies showed the lack of correlation between the number of a medium's interactive features and the level of perceived interactivity (McMillan, 2000), thus suggesting that the user's perception may be a better measure of interactivity than other measures. The specific focus of the perceptual tradition on the relationship between computer-mediated interactivity and interactive media effects on users accounts for the particular interest and research support from the electronic advertising and marketing business sector. Perceived interactivity is usually viewed as an independent variable, and media effects as the dependable variable (Bucy & Tao, 2007).

Wu (1999) proposed that it was most productive to study interactivity from the user's perspective. While some approaches consider turning book pages as 'interactivity,' what really matters is whether the reader perceives the interactivity of the activity and to what extent. This proposition represents the premise of the perceptual approach. Wu also

subscribed to the view that interactive communication technologies are necessary to enable consumer action, but they alone do not guarantee that consumer will take action. In addition, Wu (1999) pointed out the commercial advantages of measuring perceived interactivity:

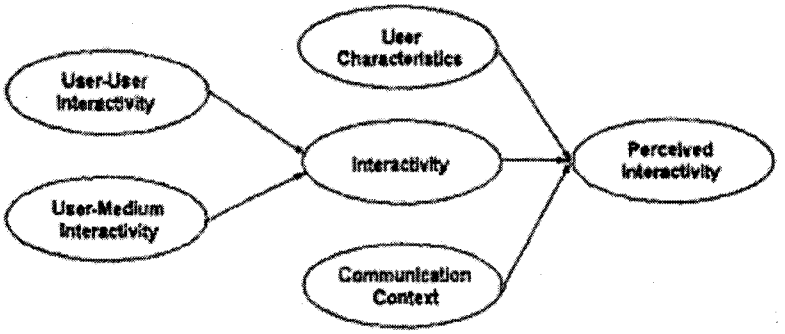
> [I]t is *perceived interactivity* by consumers of a Website, not its *actual interactivity* enabled by interactive technologies, that offers critical information for Web marketing. Perceived interactivity lies at the center of various interactions between consumers and advertisers, consumers and messages and among consumers themselves. (p. 3)

Wu's (1999) conceptual model of perceived interactivity consists of two main components: *navigation* and *responsiveness*. These two elements parallel the *user control* and *two-way communication* dimensions often found in other interactivity conceptualisations. *Navigation* is understood as ease of use and user control of the interaction, while *responsiveness* is operationalised in terms of the speed and the amount of change the system allows. Wu's own study of website attitudes by using this conceptualisation showed a positive relation between perceived interactivity and attitudes towards websites. As a result, the author argued that the perceptual approach was more promising than other approaches for studying computer-mediated interactivity and its outcomes, because of the observed positive relationship between the two. He further submitted that "perceived interactivity serves as a clear-cut variable which captures the essence of consumers' interactions in computer-mediated environments" (p. 16).

Lee (2000) offered a more elaborate and comprehensive model of perceived interactivity that incorporated structural interactivity and mediating factors. He established the premise for his conceptualisation by comparing computer-mediated interactivity to the concept of 'media richness'. Lee asserted that both are "technology-

oriented concepts but non-technological factors can influence them" (p. 337). He related user-medium and user-user interactivities to technology and assumed their effect to be relatively invariable across users. In this respect, he treated interactivity from the persepctive of the structural approach. Furthermore, Lee observed that such non-technological factors as the user's personal characteristics (e.g., familiarity with technology) and communication settings might become determinant factors in shaping perceived interactivity (see Figure 12).

Figure 12. Lee's interactivity model



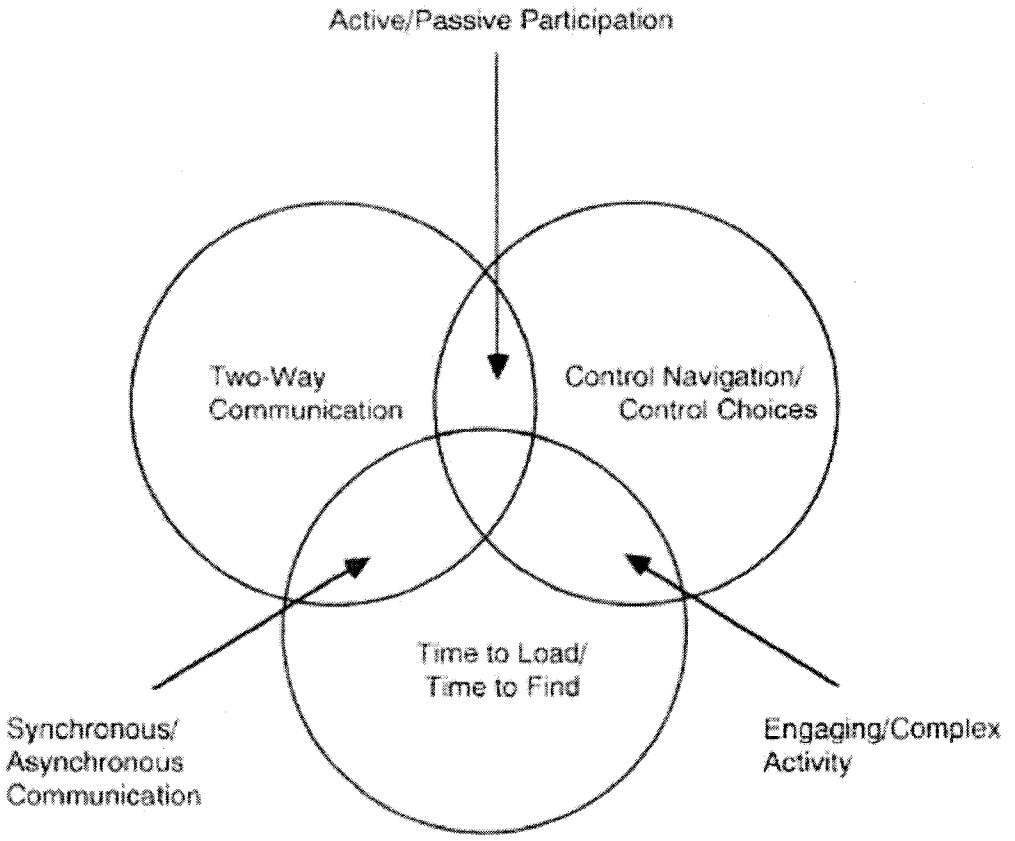
Note. From "*Interactivity: A new approach,*" by J.-S. Lee, 2000, p. 23. Paper presented at the Association for Education in Journalism and Mass Communication, Phoenix, AZ.

Using the above model, Lee proposed two distinct types of interactivity: structural and perceptual. He stressed that "measuring interactivity without considering user perception is incomplete" (p. 23), encouraging a holistic approach to studying the concept. Another novel aspect for perceptual studies was Lee's proposition about the existence of mediators of perceived interactivity: the user's personal characteristics and the properties of communication settings. According to the author, "the model emphasizes that what is important is not the objectively measurable interactivity but the relationship among the

variables depicted in the model" (pp. 24-25). Lee also made an interesting observation about the changeability of the user. He suggested that the time and novelty factors may affect users' perceptions of their interactions with the medium. When a new communication technology is introduced, it may create certain interactivity perceptions as a result of its novelty. However, as users become more experienced, their interactivity perceptions may change.

McMillan and Hwang (2002) offered an alternative conceptualisation which included three dimensions of perceived interactivity: *direction of communication*, *user control*, and *time*. The authors singled out these dimension on the basis that "they serves as umbrellas for many [interactivity] elements" (p. 30) found in the interactivity literature. McMillan and Hwang noted the difficulties arising from the overlapping of the above dimensions (see Figure 13). For example, the *time* and *control* dimensions are interrelated in that complexity of navigation may increase the time users spend interacting with the website while trying to orient themselves rather than engaging with the content. McMillan and Hwang's model is only incrementally different from Wu's conceptualisation in that the former introduces an additional *time* element. However, researchers' emphasis on the overlapping and interrelatedness of dimensions provides an additional level of conceptual depth important for operationalisation of the construct. Unfortunately, the authors provided only a very brief theoretical discussion as their main focus was on developing a perceived interactivity scale, which is discussed in the next chapter.

Figure 13. McMillan and Hwang's key dimensions of perceived interactivity



Note. From "Measures of perceived interactivity: An exploration of the role of direction of communication, user control, and time in shaping perceptions of interactivity," by S.J. McMillan, & J.-S. Hwang, 2002, p. 35, *Journal of Advertising, 31*(3), pp. 29-42.

The perceptual approach does not deny the existence of interactivity either in the communication medium's structure or in the message-exchange process. However, perceived interactivity theories tend to ignore structural and behavioural interactivities in their models (Lee (2000) is an exception) because of their arguably less importance for determining interactivity outcomes. Essentially, perceptual theories operate with the same interactivity dimensions as some structural approach conceptualisations. However, these dimensions are operationalized from the user's perspective. Because of the psychological nature of an individual's perceptions and some interactivity outcomes (e.g., attitudes

towards the product, product recall, purchasing decisions), perceived interactivity operationalisations heavily borrow from psychology. The contribution of psychological research is particularly relevant in such areas as cognition, motivation, and decision-making. Psychological methods of collecting, measuring, and analysing perceptual data provide ready solutions for perceptual empirical studies. In the last decade, the perceptual approach to interactivity studies emerged and has grown in popularity. In fact, Tremayne (2005) and Rafaeli and Ariel (2007) argued that, together with the message-based approach, the perceptual approach was beginning to dominate interactivity research.

1.4 Other Approaches

Not all interactivity scholars agree that the structural, message-centered, or perceptual approaches alone can provide a comprehensive theoretical framework for technology-mediated interactivity. Among these alternative views are the multi-dimensional and multi-type conceptualisations of interactivity. The following review is representative rather than comprehensive in its nature and is intended to show the general premise of each alternative approach.

1.4.1 Alternative multi-dimensional theories

Multi-dimensional conceptualisations view computer-mediated interactivity as a multifaceted concept with a number of inherent interactive properties, or dimensions. Interactivity dimensions are usually considered equally important and are defined as continuums. The differences between the various multi-dimensional interactivity theories

usually lie in the total number and types of such dimensions. Unlike the multi-dimensional theories presented within the structural approach (Durlak, 1987; Jensen 1998; Heeter, 1989; McMillan, 2000), the alternative multi-dimensional conceptualisations combine structural, message-based, and perceptual perspectives within the interactivity construct, at times even within the same dimensions.

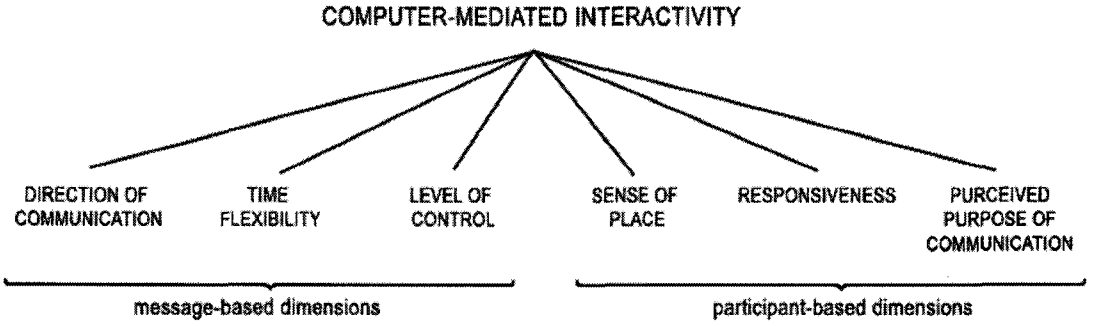
For example, Ha and James (1998) proposed their own multidimensional model of interactivity as a result of their dissatisfaction with all three dominant research approaches. Their classification of interactivity dimensions is driven by the observable differences in communication needs. They defined interactivity in terms of responsiveness, namely as "the extent to which the communicator and the audience respond to, or are willing to facilitate, each other's communication needs" (p. 461). This definition closely parallels the sociological perspective of interaction, which Jensen (1998) described as "the relationship between two or more people who, in a given situation, mutually adapt their behaviour and actions to each other" (p .188). Having analysed users' communication needs during their interactions with the Web, Ha and James isolated five dimensions which help fulfill such different needs: playfulness, choice, connectedness, information collection, and reciprocal communication. The *playfulness* dimension is described as the user's need for entertainment or psychological gratification in a communication process. The *choice* dimension is defined as both the availability of choice, objective and perceived, and the ease of navigation on a website. Interestingly, Ha and James also included the choice of "terminating communication" (p. 462) and personalization/customization options as elements of this dimension. *Connectedness* is understood as both a technological and perceptual attribute:

hyperlinking and the user's sense of telepresence or social presence. Ha and James treated the last two dimensions, *information collection* and *reciprocal communication*, as the communicator's communication needs. These two dimensions refer to gathering data about users and receiving their feedback about the content and products on the communicator's website. Clearly using the mass media studies terminology, the authors pointed out that the dimensions of *playfulness*, *choice* and *connectedness* represented "audience-oriented" interactivity while *information collection* and *reciprocal communication* were "source-oriented." Ha and James further noted that for an online business website, "the audience-oriented dimension of interactivity is bait to lead visitors to source-oriented interactivity" (p. 464). Although the above multidimensional interactivity model was designed and described by the authors in the context of business websites, and the Web as a communication medium, Ha and James asserted their model's applicability to the analysis of traditional media as well. However, they observed that the Web is the most efficient medium in achieving five-dimensional interactivity among other communication technologies.

Downes and McMillan (2000) arrived at their conceptualisation of computer-mediated interactivity through a qualitative study. They combined the analysis of CMC literature with a structured interview with 10 professionals in the field of interactive communication. The underlying themes in the interviews and interactivity concepts found in the literature formed the basis for Downes and McMillan's six-dimensional model of interactivity. The six interactivity dimensions identified were *direction of communication*, *time flexibility*, *sense of place*, *level of control*, *responsiveness*, and *perceived purpose of communication*. The first three dimensions are message-based, and the latter three are

participant-based (see Figure 14). All dimensions were operationalised as continuums. Interestingly, although Downes and McMillan did not openly adopt the perceived interactivity approach to their study, they discussed the above interactivity dimensions from the user's perspective. Essentially, the authors described each dimension by summarizing the opinions expressed by the interviewees, which revealed a lack of agreement among the study participants about certain components of the dimensions and their respective weight. For instance, there was no consensus as to whether the real-time aspect is important when considering whether computer-mediated communication is interactive. The authors asserted that varying levels of interactivity can be present. Interactivity of some computer-mediated environments may rank low on some dimensions and higher on the others. Downes and McMillan (2000) also made the important observation that "even when these dimensions have values on the low end of the continuum, individuals may still perceive that they are participating in interactive communication" (p. 173).

Figure 14. Downes and McMillan's (2000) interactivity conceptualisation

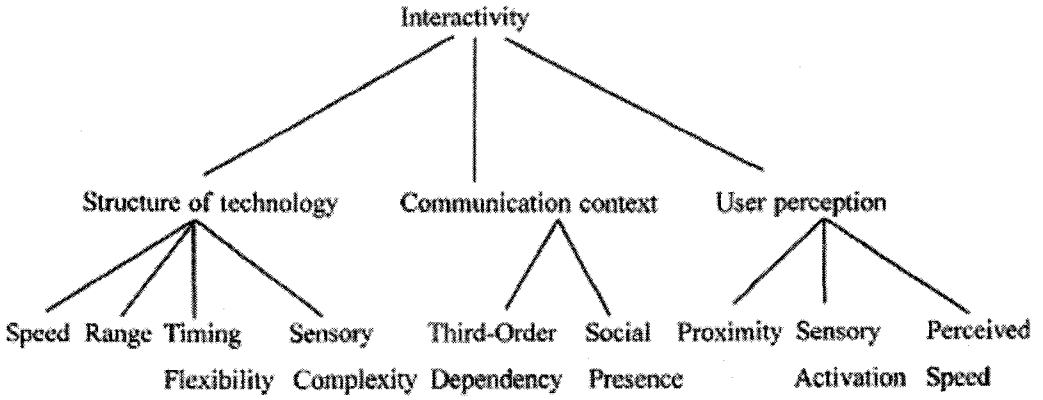


Source: author.

Kiousis (2002) approached the task of conceptualising interactivity differently than the above theorists. His method of a creating new multidimensional conceptualisation of interactivity was to unify all three dominant approaches (structural, message-based, and perceptual) into a single comprehensive theoretical framework. Kiousis identified three principal dimensions of interactivity—the technological structure of the medium, the communication context, and user perception—each one branching into several sub-dimensions (see Figure 15). Accordingly, Kiousis (2002) offered a "hybrid" definition of interactivity:

> Interactivity can be defined as the degree to which a communication technology can create a mediated environment in which participants can communicate (one-to-one, one-to-many, and many-to-many), both synchronously and asynchronously, and participate in reciprocal message exchanges (third-order dependency). With regard to human users, it additionally refers to their ability to perceive the experience as a simulation of interpersonal communication and increase their awareness of telepresence. (p. 372)

Figure 15. Kiousis' multi-dimensional models of interactivity



Note. From "Interactivity: A concept explication," by S. Kiousis, 2002, p. 378, *New Media & Society 4*(3), pp. 355-383.

Not surprisingly, Kiousis also relied on the work of others in defining and operationalizing the individual sub-dimensions of interactivity. For example, among the

structural sub-dimensions, he borrowed the *speed* and *range* concepts from Steuer's (1992) article on telepresence. He understood the *timing* sub-dimension in terms of the medium's capability to enable synchronous and/or asynchronous communication, as described by Downes and McMillan (2000). Durlak's (1987) idea of sensory richness or, in other words, the system's ability to activate the five senses informed Kiousis' understanding of the *sensory complexity* dimension. Among the communication context sub-dimensions, *third-order dependency* represented Rafaeli's model of interactivity, while *social presence* had been previously well defined and operationalised in communication studies (e.g., Rice and Williams, 1984). Within the user perception dimension, the *proximity* sub-dimension represented the user's perceived "closeness" to other communication participants. The *sensory activation* measured the user's assessment of what senses were engaged during the interaction process. The *perceived speed* assessed how fast, in the user's opinion, the system allowed the transmission of communication.

Of the above three main dimensions, Kiousis considered technological structure interactivity to be the most stable. On the other hand, he deemed communication context interactivity to be the most changeable. However, he believed that all three principal dimensions are equally important. Kiousis argued that his interactivity model had the following two advantages. First, it could be applied across all communication media. Second, this framework allowed for studying computer-mediated interactivity as "a variable that [could] be examined along its individual dimensions or as a single, composite variable" (p. 378-379). Last, Kiousis was the only author I found in the CMC literature who explicitly considered machine-to-machine interaction to be part of

computer-mediated interactivity. Admitting the highly disputable nature of such conception, Kiousis explained his rationale by the similarity of the information transmission process in machine-to-machine interactions to that in other traditional mediated communication types, including the interchangeability of roles as senders and receivers. He further added that "the fact that so many conceptions of interactivity are closely tied to technology makes incorporating machine-to-machine exchanges natural" (p. 373).

The multi-dimensional approach tries to take the best from the other interactivity research approaches and fill in the perceived gaps in their theorizing. In doing so, theorists move away from simplicity to complexity in their conceptualisations. All three above theories (Ha & James, 1998; Downes & McMillan, 2000; Kiousis, 2002) offer rather complex tree-like conceptualisations with numerous interactivity dimensions and sub-dimensions, which make their practicality questionable. However, the main criticism of the multi-dimensional approach is its mixing of structural and perception variables within the same dimensions. For example, the dimension of *time* can be defined as both the transmission speed of the medium and as the speed of interaction perceived by the user. Defining speed even in only structural terms is quite challenging because of the constant advancements in communication technologies. Clearly, the choice of the definition in this case will have significant implications for research outcomes. In addition, one can question the ability of the multi-dimensional approach to produce an interactivity theory applicable across all communication media, since multi-dimensional conceptualisations, in particular the early ones, tend to be based on the attributes or dimensions which distinguish new media from the other media types.

1.4.2 Multi-type theories

The fundamental premise of multi-type conceptualisations of interactivity (Aoki, 2000; McMillan, 2006; Szuprowicz, 1995) is that a difference exists between user-to-media and user-to-user interactivity. For this reason, structural definitions are not applicable to user-to-user interactivity, and message-centered definitions are unsuitable for measuring user-to-media interactivity. Moreover, the failure of interactivity researchers to differentiate between these two types of computer-mediated interaction resulted in the absence of "agreed and coherent definitions/dimensions of interactivity today" (Lee, 2000, p. 12). Multi-type theorists direct their specific criticism at the multi-dimensional interactivity models which tend to mix separate interactivity types within the same dimensions. For this reason, I put these two approaches into separate sub-categories of alternative approaches to interactivity research.

Szuprowicz (1995) pioneered the multi-type approach, addressing computer-mediated interactivity in the context of multimedia applications and networking. He used the concept of 'multimedia information flows' to identify the following three types of interactivity: user-to-documents, user-to-computer, and user-to-user. The user-to-document interactivity represents user access to information at any desired time. This type of interactivity may include an option to download and store data locally on the user's computer but limits the extent to which users can modify the content. Szuprowicz submitted that the user-to-computer interactivity is "more sophisticated" (p. 16) than the user-to-document type and is primarily observed in GUIs. He further pointed out that it

was not a time-sensitive type of interactivity. The user-to-user interactivity, however, must occur in real time to be more interactive.

Generally speaking, Szuprowicz's explication of interactivity levels is rather brief and too focused on the discussion of such technical aspects as the networking infrastructure, bandwidth and other technology required to implement interactive applications. Some of his examples of interactive applications representative of each type are also questionable. For instance, Szuprowicz used 'email' to exemplify the user-to-document type of interactivity and not the user-to-user type. Other scholars (Jensen, 1998; Lee, 2000) pointed out the lack of clear distinction between 'user-to-documents' and 'user-to-computer' types of interactivity. Despite the above criticism, Szuprowicz's definition of computer-mediated interactivity as a multi-type concept is worth noting. For example, Jensen (1998) observed:

> [W]hat Szuprowicz calls, 'user-to-user' interaction is related to the sociological concept of interaction, 'user-to-computer' interaction is related to the informatic concept of interaction, while 'user-to-documents' interaction has an affinity to the interaction concepts used by communication studies. (p. 196)

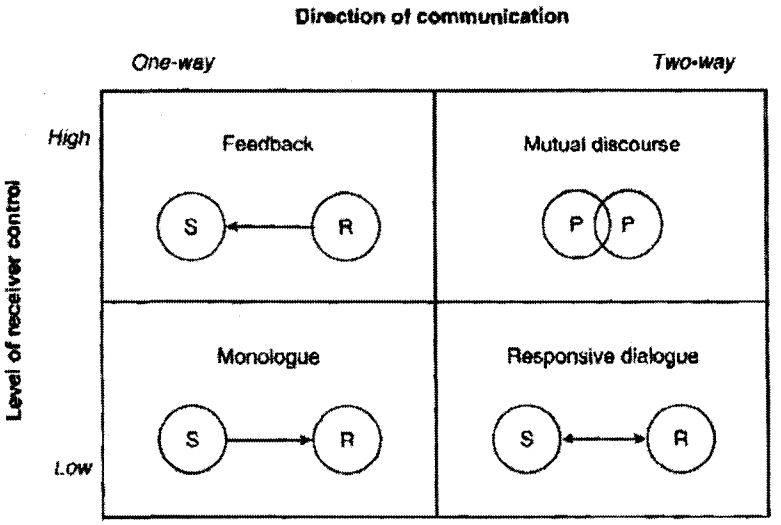
Szuprowicz's ideas found their way into some later interactivity studies (Aoki, 2000; McMillan, 2006; Stromer-Galley, 2000, 2004).

Building on Szuprowicz's three interactivity types, McMillan (2006) offered arguably the most elaborate *multi-type* conceptualisation of interactivity to-date. Based on the review of the primary literature on interactivity in new media, McMillan concluded that the three-type categorisation of interactivity—user-to-user, user-to-document and user-to-system—is the best way of "organizing and making sense of the many different perspectives and definitions of interactivity" (p. 221). She further

observed that "this three-part construct parallels historical developments in the concept of interactivity that predated new media" (p. 209).

In her discussion of user-to-user interactivity, McMillan submitted that much of human interaction research was applicable to the user-to-user interaction in mediated communication environments. She identified the two central interactivity dimensions of computer-mediated communication—*direction of communication* and *user control*—based on the CMC literature (Downes & McMillan, 2000; McMillan, 2000). McMillan juxtaposed the above two dimensions in a two-dimensional matrix to produce four models of user-to-user interactivity: *monologue*, *feedback*, *responsive dialogue*, and *mutual discourse* (see Figure 16). The *monologue* model represented one-way, sender-controlled communication. The *feedback* model was essentially a monologue model with some feedback tools added to allow for two-way communication. The *responsive dialogue* model corresponded to Rafaeli's (1988) responsive interactivity concept where later messages should relate to earlier ones to be more interactive. Finally, the *mutual discourse* model "gives more egalitarian control to all participants so that sender and receiver roles become indistinguishable" (p. 213).

Figure 16. McMillan's four models of user-to-user interactivity



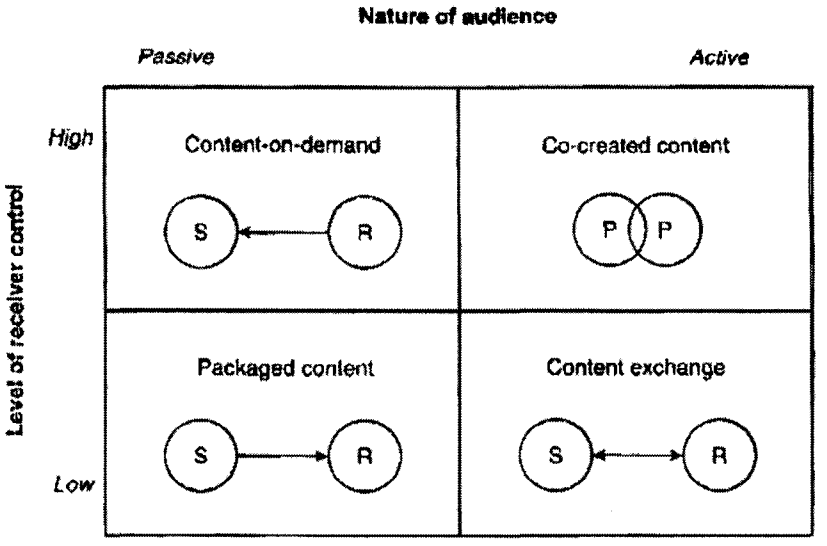
S = sender, R = receiver, P = participant (sender/receiver roles are interchangeable)

Note. From "Exploring models of interactivity from multiple research traditions," by S.J. McMillan, 2006, p. 213. In L.A. Lievrouw & S. Livingstone (Eds.), *The handbook of new media, updated student edition* (pp. 205-229). Newbury Park, CA: Sage Publications.

User-to-document interactivity, in McMillan's interpretation, goes beyond user interaction with provided media content and includes interaction with the content creators as well as the active participation of users in the creation of content. In this regard, McMillan observed that "new forms of interaction with documents are also emerging in new media as evidenced in areas such as active navigation of Web sites and active participation in creation of interactive fiction" (p. 213). She further noted the emerging theme in the CMC literature about the audience being an "active co-creator" of content. McMillan's user-to-document models are based on the same two interactivity dimensions as those in the user-to-user type. However, the *communication direction* dimension is now renamed as *nature of audience* and represents the concept of 'active / passive audience.' The resulting four models of user-to-document interactivity are *packages*

content, *content-on-demand*, *content exchange*, and *co-created content* (see Figure 17). The *packaged content* model describes the current mass communication practices where "creators package content and deliver it to relatively passive audiences" (p. 217). In the *content-on-demand* model, the audience is more active and can customize content but cannot create it. The *content exchange* model allows everyone to be both sender and receiver of the content. In the *co-created content*, everyone takes part in creating the content.

Figure 17. McMillan's four models of user-to-document interactivity



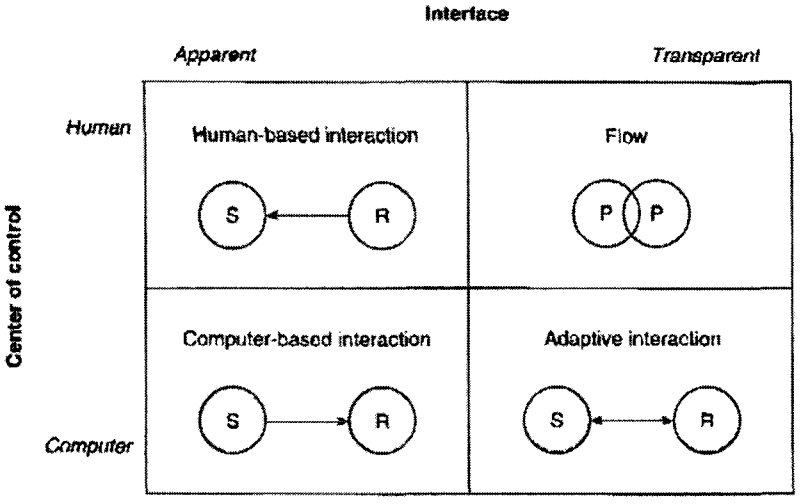
S = sender, R = receiver, P = participant (sender/receiver roles are interchangeable)

Note. From "Exploring models of interactivity from multiple research traditions," by S.J. McMillan, 2006, p. 216. In L.A. Lievrouw & S. Livingstone (Eds.), *The handbook of new media, updated student edition* (pp. 205-229). Newbury Park, CA: Sage Publications.

User interaction with media content or other users takes place through the interaction with a computer or other communication system. McMillan maintained that this third type of interactivity—user-to-system—was equally important to new media studies. The two central aspects in the user-system interaction are 'who has the control of

communication' and 'how transparent system's presence is to the user'. Thus, McMillan employed the *control centre* and *interface* dimensions to produce four models of user-to-system interactivity: *computer-based interaction, human-based interaction, adaptive interaction,* and *flow* (see Figure 18). McMillan observed that the above two dimensions parallel the *communication direction* and *user control* used in the two previous classifications. In the *computer-based interaction* model, the computer provides information to the user, who has to respond to it. The *human-based interaction* model allows the user to retrieve or manipulate information by using the provided system tools. In the *adaptive interaction* model, the system remains in control of the interaction but adapts itself to the user characteristics or needs. In the *flow* interaction, the medium virtually disappears in the user's perception as, for instance, in virtual reality.

Figure 18. McMillan's four models of user-to-system interactivity



S = sender, R = receiver, P = participant (sender/receiver roles are interchangeable)

Note. From "Exploring models of interactivity from multiple research traditions," by S.J. McMillan, 2006, p. 220. In L.A. Lievrouw & S. Livingstone (Eds.), *The handbook of new media, updated student edition* (pp. 205-229). Newbury Park, CA: Sage Publications.

McMillan (2006) stressed the need to recognize computer-mediated interactivity as a "multifaceted concept that resides in the users, the documents and the systems that facilitate interactive communication" (p. 221). Like Rafaeli and Ariel (2007), McMillan (2006) stressed the importance for interactivity researchers to be absolutely clear about which type(s) of interactivity they are dealing with. McMillan further drew specific attention to the defining role of the "control locus" in all three types of interactivity. She also warned that the above three classifications should not be regarded as "mutually exclusive or all-inclusive" (p. 221) and that some interactivity forms may transcend several categories or fail to match any suggested model.

The multi-type theories of interactivity offer an interesting alternative approach to the study of interactivity. As well, this approach has one added value. The multi-type classification of interactivity types does not conflict with the basic premise of location-based interactivity approaches. Therefore, it can be successfully applied within structural, message-based, or perceptual conceptualisations to refine the categorisation of interactivity elements. Another point of interest is the debatable inclusion of the user-to-system type of interactivity. Considering the broad diffusion of new types of user interfaces (touch-, gesture-, voice and motion-operated) in such consumer electronic devices as GPS navigation devices, iPhone, Nintendo Wii and others in recent years, I expect to see a renewed research interest in the user-to-system interactivity. Overall, the multi-type approach offers a theoretical framework with the potential to further advance interactivity studies.

1.5 Discussion

The above, representative rather than exhaustive, literature review nevertheless shows the multitude and complexity of the theoretical approaches to and the proposed models of computer-mediated interactivity. The interest in the subject from various disciplines attests to the diversity and differences in interactivity definitions. Most theories seem to agree upon, however, that computer-mediated interactivity is a complex, multifaceted construct. Other than this agreement, the definitions have fundamental differences which are hotly debated in the interactivity literature and are briefly discussed below.

The first point of argument is the assertion or rejection of a "conversational ideal" as a measurement reference of interactivity. The concept of face-to-face, or, rather, interpersonal communication is held by some researchers (Bretz, 1983; Durlak, 1987; Heeter, 1989; Williams, Rice, & Rogers, 1988) to be the ultimate form of interaction against which interactive media should be measured. According to this view, conversational media are more interactive than other media types. Other authors either find the conversational ideal to be "problematic" and "simplistic" (Rafaeli, 1988, p. 117) or reject it completely (Bucy, 2004b). Interestingly, Rafaeli's own process-focused definition of interactivity is based on "interpersonal communication models of conversation" (Rafaeli & Ariel, 2007, p. 82).

The logical extension of the above "conversationality" debate involves the separation or fusion of the *interaction* and *interactivity* concepts. The majority of interactivity literature seems to use these two terms synonymously. In fact, a strong view in the interactivity studies holds that communication technologies simply extend the

natural human communication, albeit adding a few additional properties such as asynchronicity to the communication exchange. On the other side, some interactivity researchers (Bucy, 2004b; Jensen, 1998; Newhagen, 2004) insist on applying a conceptual separation between *interaction* in its sociological, technologically non-mediated form and *interactivity* as interaction in technological communication environments. The above *interaction-vs-interactivity* debate has far-reaching implications for the nature of interactivity theorizing and definitions. For instance, limiting the scope of the interactivity concept exclusively to communication technologies and, more specifically, to new media alone, would make it impossible to produce a broad, universal interactivity conceptualisation which would embrace all media types. Arguably, this outcome would make the task of defining and operationalizing interactivity much easier than this task is currently. However, to base an interactivity theory on the properties of one or only a few media types would make such conceptualisation vulnerable to the test of time and the ever-increasing pace of technological advancements. The current convergence of traditional media within new media and the failure of older communication theories to apply to new media phenomena may serve as a warning sign.

The review of the earlier theories of computer-mediated interactivity demonstrates their largely exploratory nature and simplistic models. These theories have a persistent tendency to produce typologies and classifications of interactivity types (Aoki, 2000; Durlak, 1987; Jensen, 1998; Rogers, 1986; Steuer, 1992), but only a few theories go as far as to suggest ways to operationalize interactivity properties or dimensions. Most early theoretical models tend to focus on interactivity only, as defined by an author, failing to explain the relationship between the technological, experiential

and outcome aspects of interactivity. Later theories (Bucy & Tao, 2007; Lee, 2000; Rafaeli & Ariel, 2007) attempt to address this drawback in interactivity conceptualisation.

Basically, all theoretical models of interactivity can be reduced to three main approaches: structural, process-oriented, and perceptual or experiential. Multi-dimensional and multi-type definitions essentially represent a hybrid approach. Early structural definitions (Durlak, 1987; Rogers, 1986), which "hardwired" their classifications and typologies in specific communication technologies, have shown that this way of conceptualisation is not time- and technology-proof. In addition, a number of empirical studies McMillan, 2000; Newhagen, Codes, & Levy, 1995) were limited by the absence of a direct correlation between the number of interactive features in the medium and the perceived levels of interactivity. These problems limit capability of the existing structural interactivity models to explain the relationship between interactivity and its effects and call for more theorisation about the possible mediating factors. On the other hand, structural conceptualisations are much easier to operationalize and less costly to implement, two aspects which certainly appeal to interactivity designers and programmers.

The process-oriented approach, pioneered by Rafaeli (1988) in CMC studies, offers a technology-independent and, therefore, a universal conceptualisation of mediated interactivity. According to this view, technology enables interactivity but does not realize it. Interactivity is actualized in message exchanges and is measured by the semantic relatedness of the messages. Like structural definitions, the process-oriented definition of interactivity allows for easier operationalisation and implementation, since exchanged messages can be easily recorded by the system. The criticism of this approach includes its

lack of attention to human-system interaction and its assumption that communication participants are always interested in an exchange, even through users may pursue different goals while interacting with the same media. Bucy and Tao (2007) also pointed out the existence of empirical evidence that "the exchange of messages does not equate with the exchange of meaning" (p. 650) and that a simple increase in the number of messages may lead to the opposite effect.

The perceptual approach takes a radically different approach to mediated interactivity by placing this concept into the subjective experiences of the user. Here, user perceptions are the measure of interactivity. In fact, the user's subjective opinion about the level of interactivity matters more than the actual interactivity. This approach is popular because it offers more promise than the other approaches for explaining the relationships between the perceived interactivity and interactivity effects, since both phenomena are related to the user's cognitive, affective and behavioural processes. As well, the advertising and marketing industry's interest in and support of the experiential approach have enhanced its popularity. The criticism of the perceptual approach stresses its failure to include the structural characteristics of interactive technologies or media stimuli, which are needed to enable interactivity in the first place, into causal explanations of interactivity outcome.

The above limitations of the three main theoretical approaches to mediated interactivity prompted some scholars to propose alternative conceptualisations, which combine technological and user dimensions in their definition. Such conceptualisations, included under the multi-dimensional category of interactivity theories, tend to identify and classify interactivity components or dimensions. Essentially, multi-dimensional

theories propose tree-like interactivity models where each dimension is usually represented by a separate interactivity continuum. Dimensions may include further sub-dimensions or components and need an individual way of operationalisation. The main criticisms of the multi-dimensional approach focus on the blending of technological and perceptual properties within the same dimensions, the overlapping of some dimensions, and the moving away from simplicity and clarity towards complexity and impracticality. Since multi-dimensional conceptualisations tend to identify the attributes or dimensions that distinguish new media from other media types, one can also argue about the capability of this approach to produce an interactivity theory which would apply across all communication media.

This literature review shows the evolution of interactivity conceptualisations from single- or two-dimensional typologies based on technology or media type to more elaborate, inclusive models which try to explain relationships between types of interactivity and its effects. Nearly three decades of scholarly debate have produced a number of definitions and theoretical models, which greatly vary in their focus and scope. As the evolution of new media and communication technologies continues, so does the search for a comprehensive, clear and measurable definition of interactivity. Nevertheless, the latest theorisations (Bucy & Tao, 2007; Lee, 2000; Rafaeli & Ariel, 2007) offer a higher level of conceptualisation and a promise to explain the relationship between interactivity types and outcomes.

CHAPTER 2

FROM THEORY TO PRACTICE

Computer-mediated interactivity studies pursue a very practical goal: to understand the cause-and-effect relationship between interactivity and its outcomes and, consequently, to predict or provide them by manipulating certain variables. With practical objectives in mind, the application of a theoretical conceptualisation is both an essential element and real test of a theory's efficacy and practicality.

The process of translating a conceptual model into practical measures is known as "operationalisation." More specifically, "operationalisation is a set of instructions for how a researcher is going to measure the concepts and test the theory" (Derksen & Gartrell, 2000, p. 2466). The starting point of any operationalisation is an operational definition, which is essentially an adaptation of a conceptual definition to accommodate the specific nature and objectives of a research project. Arguably, the most important and challenging part of an operationalisation process is defining a "unit of measurement" (Rafaeli & Ariel, 2007, p. 73):

> Forming operational measures is one of the more challenging phases in carrying out an empirical study because the items need to be discernible enough to be measured, yet also need to encompass the actual concept that the researchers are attempting to quantify. (Kiousis, 2002, p. 375)

The nature and properties of a selected "unit of measurement" determine the range of the methodological choices available to a researcher. When combined with the multitude of existing interactivity theories, unique objectives and settings of individual empirical projects, and other factors, operationalisation becomes a very complex process.

The role of operationalisation in interactivity research may go beyond that of a mere testing tool for a theory. While some researchers (Rafaeli & Ariel, 2007) maintain

that operationalisations "do not necessarily resolve the conceptual fog" but simply "follow, naturally, in the footsteps of divergent definitions" (p. 78), others argue that operationalisations "may also help broaden the concept's boundaries" (Kiousis, 2002, p. 367). The increasing number of empirical studies of mediating and moderating factors provide support for the latter argument. While some conceptual models (Bucy & Tao, 2007; Lee, 2000) suggest the important mediating role of certain communicative, social or personal factors on the effects and perceptions of interactivity, practitioners have tested a far broader range of possible mediators than those initially suggested by theorizers. The results of such experimental studies informed the re-conceptualisations of the earlier theories and improved the operationalisations of the later empirical studies.

So far, attempts at interactivity operationalisation have brought mixed results. A number of scholars have mentioned the lack of progress in developing workable practical measures of interactivity. For instance, Downes and McMillan (2000) observed that "the literature on interactivity includes many assumptions and some definitions but few tools for operationalizing the concept of interactivity in computer-mediated environments" (p. 157). Kiousis (2002) noted that to date, the operational definitions used in analyses have been "exceedingly scattered and incoherent" (p. 355). Lee (2000) argued that "part of the reason [that attempts to measure interactivity have showed little progress] is that the concept of interactivity is difficult to operationalize" (p. 331). My own review of the theoretical publications on interactivity discussed in the previous chapter showed that only a few articles offered actual operationalisations or any suggestions on to how measure computer-mediated interactivity.

Considering the "scattered" nature of existing operationalisations, arguably the best approach to finding a workable operationalisation is to evaluate the operational measures in empirical studies (Kiousis, 2002). By identifying common methodological patterns and comparing experimental settings and results, we can increase our understanding of the validity and reliability of individual methods. Awareness of the implications that methodological choices may have on project outcomes is essential for interactivity researchers and practitioner alike, since operational definitions and methods are often one of the reasons for the variability in experimental results. As Tremayne (2005) commented, "While one study can push us only so far towards a workable definition, collectively the results of these studies help guide us in the proper direction" (p. 62).

In this chapter, I review the three most dominant approaches to operationalising interactivity, and describe the methods specific to individual approaches as well as the commonalities among them, including their conceptual and methodological limitations. This review may help guide interactivity practitioners in making their own operationalisation choices. The operationalisations based on multidimensional and multi-type theories discussed in the previous chapter are excluded from my critical analysis below as they combine methodologies used by the structural, process-based and perceptual approaches.

2.1 Structural Interactivity Operationalisations

The simplicity of structural conceptualisations of interactivity allows for a relatively easy and straightforward operationalisation process. As shown in the previous

chapter, structural models assume that interactivity resides in the technological characteristics of a medium. Therefore, one should be able to measure the level of interactivity by measuring the interactive features and functions present in the medium: the higher the number of interactive features found in an application, the higher the assumed level of interactivity. Consequently, the higher interactivity of media is believed to result in more positive media effects. According to this approach, structural interactivity, which is also often referred to as "actual" (Wu, 2005) or "objective" (Lee, Lee, Kim, & Stout, 2004) interactivity, is regarded as being invariant across users since it is an attribute of technology. As a result, structural models operationally define interactivity as an independent variable and its outcomes (e.g., attitude formation, message recall, purchasing decisions) as dependent variables. The presence of an interactive feature, a media's capability for creating interactive content, or the potential for enabling other types of user interactions (Wu, 2005, p.47) can serve as a unit of measurement in structural operationalisations. For example, McMillan, Hwang, and Lee (2003) defined structural interactivity as a combination of interactive features and "creative strategies" (p.400). In this case, the expression "creative strategies" refers to the interactivity potential of an advertising message. While an informational message presents plain facts about an advertised product, transformational advertising tries to connect the product to the psychological side of consumer experience. The latter message strategy is believed to create a higher degree of consumer-message interactivity. In another example, the potential to promote *offline* interaction between the users and creators of websites seemed to be the reason behind a puzzling decision to define such obviously non-interactive features as toll-free phone numbers (Ha & James, 1998;

McMillan, 2000) and the contact information of state legislators (Ferber, Foltz, & Pugliese, 2005a) as interactive features.

Surprisingly, few feature-based empirical studies go beyond operationalizing interactivity in terms of the simple quantity of interactive features. The usual approach is to define specific operational types or dimensions of interactivity and compile lists of the interactive features representative of each one. Earlier structuralist studies (Ha & James, 1998; Massey & Levy, 1999; McMillan, 1999), which focused on building typologies of interactive features, usually serve as a starting point for developing such project-specific lists of analysed interactive items. For instance, in her study of health-related websites, McMillan (1999) took Heeter's six dimensions of interactivity and operationalised them with nine of her own (see Appendix 2). She evaluated the interactivity levels of the analysed websites by the presence/absence of pre-defined interactivity variables. In another study, Ha and James (1998) followed a similar approach to assess the levels of interactivity of the homepages of 110 business websites. These researchers identified five interactivity dimensions of their own (playfulness, choice, connectedness, information collection, and reciprocal communication) and merely counted the number of interactive features per dimension (see Appendix 3), without considering the differences in the quality of the interactive features. For instance, games and curiosity arousal devices, such as Q&A sections, were scored equally on an interactivity scale.

Over time, the operational lists of interactive features have become longer and more complex. While the above studies (Ha & James, 1998; McMillan, 1999) operationalised structural interactivity with fifteen interactivity criteria and nine interactivity variables, respectively, this number increased significantly in later empirical

studies. For instance, McMillan (2000) extended her previous operationalisation to include thirteen interactive features (see Appendix 4). Stout, Villegas and Kim (2001) used Ghose and Dou's (1998) six forms of interactive functions to develop nine dimensions and fifty-two interactivity items specific to their domain of study (see Appendix 5). This operationalisation was further elaborated by Lee et al. (2004), who operationalised interactivity in terms of the presence or absence of eighty-eight interactive tools (see Appendix 6). Operational lists of interactive features continue to grow, for earlier operationalisations always fall short of accommodating new interactivity technologies.

Technological innovations and researcher subjectivity may pose additional challenges for interactivity operationalisation. Which features should be considered interactive and which should not? For instance, Ha and James (1998) made the questionable decision to exclude sweepstakes from their list of "playfulness" interactive features because sweepstakes are "based on luck" (p.465). However, one may argue that sweepstakes meet Ha and James' own criteria of playfulness, which is to "attract attention of visitors and entice their participation during the visit" (p. 465). Moreover, a survey of the chief technology officers (CTO) of state legislatures' websites showed that CTOs' understanding of what an interactive feature is appeared to be "wide ranging and fairly inconsistent" (Ferber et al., 2005a, p. 90). In addition, Ferber et al. pointed out the differences among the researchers themselves in identifying website features as interactive or not, even when using clearly defined evaluation criteria.

Advancements in interactive technologies make quality-based operationalisations increasingly complex. When the quality of interactive tools is considered in

operationalisation, how can one decide which features are more interactive? Some features which were considered highly interactive two decades ago may no longer be perceived as such today. For example, email, navigation links, feedback, and other forms once considered highly interactive may not be perceived as such any more in the current age of social networking on the Internet. To complicate this issue even further, Teo, Oh, Liu and Wei (2003) found in their study of interactivity effects on web user attitude that the presence or absence of other interactive features affected user perception of interactivity feature usefulness. In the above study, 50% of users found hyperlinks useful when no other interactive features were present on a webpage. This number fell to 19% when a webpage contained a feedback form, FAQ section, and a search engine beside hyperlinks (see Table 1).

Table 1. Perceived Usefulness of Interactive Features

Interactive features found useful

Group	Features found useful by % of subjects in group
Low interactivity	Navigation links—50%
Medium interactivity	Navigation links—19% Feedback form—69%; FAQ—62%; Search engine—58%
High interactivity	Feedback form—33%; FAQ—75%; Search engine—58%; On-line forum—71%; Online chat—63%

Note. From "An empirical study of the effects of interactivity on web user attitude," by H.H. Teo, L.B. Oh, C. Liu, & K.K.Wei, 2003, *International Journal of Human-Computer Studies, 58*, p. 299.

It is hardly surprising, then, that Ferber et al. (2005b), like the authors of most structural experimental studies of interactivity, avoided including the quality dimension in their operationalisations:

> Our focus was not on the quality of the features but on their presence or absence. Although this obviously reduced the problem of subjective judgments, it also fails

> to account for the quality or usefulness of the features. A liability of this approach is that a site with a poor, albeit interactive, children's game received the same credit for interactivity as did a state with an obviously superior interactive exercise for kids. (p. 406)

For those researchers who do include the quality of interactive features in operational definitions, one distinct, albeit criticised approach is to rank interactive features based on a "conversational ideal" model (Durlak, 1987; Heeter, 1989; Jensen, 1998; Teo et al., 2003). According to this approach, the types of user interaction which approximate unmediated human face-to-face conversation closer are more interactive than other types. As a result, on their interactivity scale, Teo et al. (2003) rank 'chat' higher than 'forum,' and any kind of mediated user-to-users interactivity higher than user-to-system or user-to-message/document functionality (see Table 2).

Table 2. Three levels of experimental manipulation of structural interactivity

Experimental manipulations of interactivity

Interactivity level	Available features	Type of interactivity	Available control
Low	• Product information	• User–document interactivity	• Control of pace • Control of sequence
Medium	• ... • FAQ • Feedback form • Search engine	• ... • User–system interactivity • Machine interactivity	• ... • Control of media • Control of variables • Control of transaction
High	• ... • On-line guestbook • On-line forum • On-line chat	• ... • User–user Interactivity • Person interactivity	• ... • Control of simulation

"..." denotes elements that are same as those in the lower level.

> *Note.* From "An empirical study of the effects of interactivity on web user attitude," by H.H. Teo, L.B. Oh, C. Liu, & K.K.Wei, 2003, *International Journal of Human-Computer Studies, 58*, p. 291.

Content analysis is one solution, for evaluating the structural interactivity of websites. In fact, it was the only method used in all the reviewed feature-based empirical

studies, although this approach has some limitations. Since no automation tools are available for reliably recording interactive features on a website, all the coding work had to be done by trained staff. Because of the resulting subjectivity, all studies included reliability checks. The most common method of ensuring the reliability of measurements is to have several coders evaluate the same website and then use one of the reliability testing methods to compare the coding results. In case of disagreement, a primary researcher can make a final decision (Lee et al., 2004; McMillan, 1999), coders can reconcile and verify their findings (Ferber et al., 2005b), or an additional person can be called in to re-code a website (Stout et al., 2001). When the number of websites is too large to have each one coded by several people, other methods can be used. For example, Ha and James (1998) used pre-test and post-test reliability testing to assess the quality and uniformity of coding. All coders coded the same two pre-test and three post-test websites, while between the tests, each person coded an individual list of randomly selected sites.

Despite the convenience of an easy operationalisation process and readyily-available typologies of interactive features, feature-based operationalisations have been seriously criticised, largely because of the conceptual issues raised by structural interactivity theories in general. Perhaps the most criticized aspect of structural operationalisations is the neglect of mediating factors in interactivity effect studies. Contrary to the early structuralist views, several empirical studies have shown that the effects of structural interactivity on impression formation (Sundar, Kalyanaraman, & Brown, 2003), on attitude (Bucy, 2004c), on knowledge acquisition (Tremayne & Dunwoody, 2001) and on perceptions of interactivity (Lee et al., 2004) are not linear.

Nevertheless, only a few structural studies so far have attempted a deeper analysis of various personal user characteristics as antecedents or mediators of interactivity outcomes (Tremayne & Dunwoody, 2001; Sundar et al., 2003).

The critics also point out that structural studies do not investigate the extent to which interactive features are actually used by users and what importance individual features have for interactivity effects. Structural models with interactivity as an independent variable and its outcome in the form of perceptions, behaviours, or attitudes as dependent variables have been questioned by the results of McMillan's (2000) study, which showed that "large number of interactive features . . . have no impact on perceptions of interactivity" (p. 261). Further, McMillan et al. (2003) found that a single interactive feature on a website with the fewest interactive features accounted for the unusually high perceived interactivity and user attitude towards the site. Tremayne (2005) speculated that the relevance of the above interactive feature, a virtual tour of a hotel, and this feature's likelihood of being used more often than other interactive functions may account for the observed effect. If McMillan et al. (2003) recorded and analysed users' actual behavioural interactions with interactive functions and investigated the importance of individual features for users, more light may have been shed on the causal mechanisms of interactivity effects and the role of mediating factors.

The critics are also concerned that the preoccupation with content analysis and the frequency count of features in structural studies may actually be unwittingly restricting interactivity measures to user-medium interactivity. Rafaeli and Ariel (2007) argued that "if the chosen unit of measurement is a technological feature of the medium, it could not by itself indicate user-related effects" (pp. 78-79). Similarly, Lee (2000) noted that

"coding primarily based on technological features cannot capture all the aspects of interactivity because then it may be measuring only user-medium interactivity" (p. 332). Scholars and practitioners who use the structural approach in their interactivity research have to be aware of these conceptual, operational and methodological issues. The feature-based approach to interactivity studies offers a simple and convenient way of operationalizing and measuring interactivity. However, the above criticism and empirical evidence support Bucy and Tao's (2007) observation that "without modification, the structural approach cannot accurately explain how interactivity works or predict what interactivity does" (p. 653).

2.2 Process-Based Interactivity Operationalisations

Another approach for studying interactivity empirically is to view it as a property of a two-way communicative exchange. "Interpersonal communication models of conversation" are at the centre of this process-based (or message-centred) approach (Rafaeli & Ariel, 2007, p. 73). While earlier communication process theories have addressed the structure of information exchange, Rafaeli (1988) applied the concept of "responsiveness" to computer-mediated communication flow as an interactivity criterion. He defined responsiveness in terms of semantic relatedness or third-order dependency:

> Two-way communication is present as soon as messages flow bilaterally. Reactive settings require, in addition, that later messages refer to (or cohere with) earlier ones. Full interactivity (responsiveness) differs from reaction in the incorporation of reference to the content, nature, form, or just the presence of earlier reference. (p. 119)

Third-order dependency is a central concept in process-based operationalisations and serves as a unit of measurement. For example, in their study of group computer-mediated communication, Rafaeli and Sudweeks (1997) operationally defined interactivity with four variables, each one describing the direct or indirect semantic relatedness of a message to other messages in a conversation thread (see Appendix 7). The researchers then determined the degree of interactivity by calculating the percentage of all interactive messages among the total number of messages in a conversation thread. In a study of the relationships among interactivity, information processing, and learning, Tremayne and Dunwoody (2001) operationally defined "interactivity" as a "message-sending activity by a user (using either a keyboard or a mouse) that results in a corresponding (and responsive) change in screen content" (p. 161). According to this operationalisation, the initial opening of a webpage, the clicking on a link by a user, and the serving of another webpage constitute an instance of interactive communication. The higher the number of such interactivity instances, the higher the interactivity of a communication process.

Although Rafaeli's (1988) conceptualisation lies at the core of process-based operational definitions of interactivity, some experimental studies have used an implicit rather than explicit approach to interactivity operationalisation. Often, researchers choose to measure process-based interactivity either through structural interactive features (Schultz, 1999; Sundar et al., 2003) or user perceptions (Cho & Leckenby, 1999). For instance, in his study of interactivity on US newspaper websites, Schultz (1999) used to the content analyses of structural interactivity to measure user-to-user process-based interactivity. However, unlike structuralists and in line with Rafaeli's conceptualisation,

Schultz (1999) evaluated interactive tools in terms of their *potential* to "help establish reactive or possibly interactive communication process". For instance, an email link, an online poll, or a survey was deemed as a "reactive tool." A chatroom or forum, albeit also producing non-interactive and reactive exchanges, was considered "a powerful tool for interactive attempts" (Schultz, 1999). Sundar et al. (2003) adopted a somewhat similar implicit approach, using Rafaeli's responsiveness concept but operationally defining interactivity as hyperlinks alone. In a lab-controlled experiment, these researchers manipulated the presence and hierarchical depth of hyperlinks to simulate various levels of interactivity to match Rafaeli's non-interactive/reactive/interactive categorisation. For example, a webpage with "a single layer of related links" was considered medium-interactive, while one with "two hierarchical layers of related links" was deemed to have high interactivity (Sundar et al., 2003, p. 30). Unlike Sundar et al., Cho and Leckenby (1999) decided to measure process-based interactivity by using the user's perceptions. To evaluate the levels of user-message interactivity and instead of measuring actual behavioural data, these researchers used the user's self-reported *intention to interact* with target ads (see Appendix 8). However, Cho and Leckenby (1999) admitted to the methodological weakness of such operationalisation.

These implicit measures of process-based interactivity, most commonly found in quasi-experimental research, reveal some inherent limitations which the process-based approach imposes on empirical research. As Tremayne and Dunwoody (2001) pointed out, practical reasons force researchers to resort to indirect measures of interactivity:

> To focus on interactivity as a communicative process (as Rafaeli, 1988, advocated) requires access to the messages sent by both (or all) parties. This is easily done where such a record already exists, as it does for online discussion groups (Rafaeli and Sudweeks, 1997). But for much computer-mediated

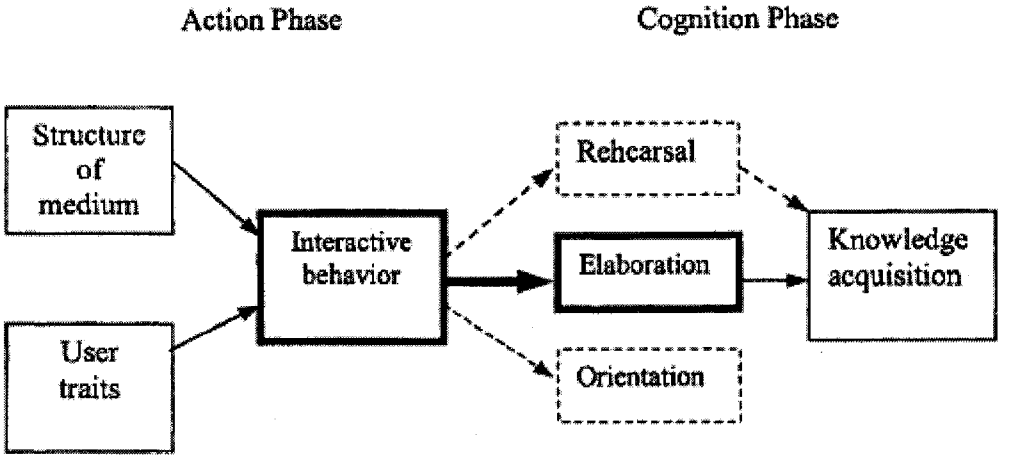
> communication, such a complete record of messages sent and received is hard to isolate. In many cases, information from users can be difficult to obtain for proprietary reasons. So, researchers have focused their attention on either end of the communication process using (in most cases) an implicit rather than explicit conceptualisation of interactivity. (p114)

In turn, the use of indirect methods of measuring process-based interactivity may compromise the validity of operationalisation. As Kiousis (2002) observed, "The researchers should also aim to improve validity by matching the operational definition with the conceptual definition" and one way of doing so is for measurements "to encompass the actual concept that the researchers are attempting to quantify" (p. 375). Similarly, Cho and Leckenby (1999) admitted that "mental measures (i.e., intention of interactivity) may not represent actual behavioural measures (i.e., real interactivity behaviour)". However, the above methodological and validity issues may not be the biggest criticism which process-based studies face.

One of the major concerns about the message-centred approach is its inability to explain the cause-and-effect mechanism behind interactivity outcomes: "Message-centered approaches . . . pay scant attention to media effects—the outcome of interaction—focusing instead on the quality of two-way message flows" (Bucy & Tao, 2007, p. 650). Rafaeli (1988), who pioneered the process-based interactivity approach in CMC studies, did not include interactivity outcomes in his initial and subsequently revised responsiveness model of interactivity (Rafaeli, 1988; Rafaeli & Sudweeks, 1997), but, instead, focused exclusively on an interaction process. The empirical studies based on Rafaeli's model, which are discussed in this thesis, have added valuable findings to the growing body of interactivity research but have failed to explicate the relationship between interactivity and its effects, except for providing mere observations of

correlations. Moreover, the restricted focus of some studies on user-to-document/user-to-system interactivity (Cho & Leckenby, 1999; Sundar et al., 2003) or user-to-user interactivity only (Rafaeli & Sudweeks, 1997), makes the extensibility of empirical findings to other types of interactivity questionable. An exception to the above is Tremayne and Dunwoody's study (2001), which provided a promising conceptual model of interactive information processing (see Figure 19). This model explains the relationship between interactivity, information processing and learning outcomes but is too domain-specific to be broadly applied in its current form.

Figure 19. Tremayne and Dunwoody's Information Processing Model

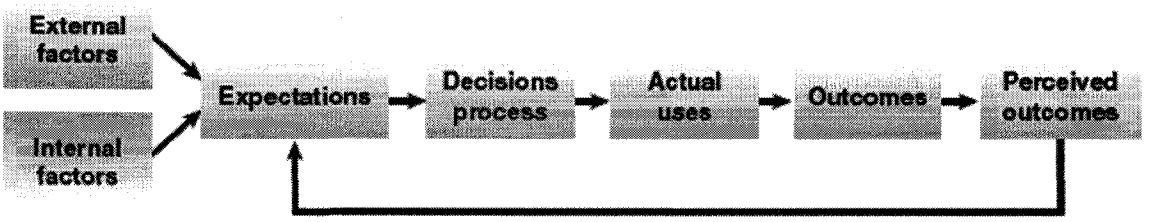


Note. From "Interactivity, information processing, and learning on the World Wide Web," by M. Tremayne, & S. Dunwoody, 2001, *Science Communication*, *23*(2), p. 120.

Recently, Rafaeli and Ariel (2007) recognised the largely curvilinear and "still enigmatic" nature of interactivity effects and offered an interactivity analysis model (p. 84). This model suggests a holistic conceptual view of interactivity and includes two types of interactivity outcomes: actual and perceived (see Figure 20). However, the

researchers' two-sentence description of interactivity effects shows that this conceptual model is still a work in progress.

Figure 20. Rafaeli and Ariel's Interactivity Analysis Model



Note. From "Assessing interactivity in computer-mediated research," by S. Rafaeli, & Y. Ariel, 2003, p. 84. In A.N. Joinson, K.Y.A. McKenna, T. Postmes, & U.D. Reips (Eds.), *The Oxford handbook of internet psychology* (pp. 71-88). Oxford, England: Oxford University Press.

Like the interactivity outcomes, structural interactivity has been omitted from the conceptual models in processed-base studies. Although researchers admit that structural elements are important for creating interactivity conditions and that some functions provide more interactive settings than the other (Schultz, 1999), the discussion of structural interactive features has not usually gone beyond this recognition. In process-based empirical studies, structural interactivity is used to manipulate the levels of interactivity while the measures of perceived interactivity are used as a manipulations check (Macias, 2003; Sundar et al., 2003). However, the relationship between the presence and nature of interactive functions and the levels of actual behavioural interactivity have not yet been examined. Hopefully, the inclusion of a "structure of medium" and "external factors" in Tremayne and Dunwoody's (2001) and Rafaeli and Ariel's (2007) interactivity models (see Figures 1 and 2) will prompt interest in this aspect in future research.

Like the findings in some feature-based empirical research, those in several process-based studies (Cho & Leckenby, 1999; Tremayne & Dunwoody, 2001) demonstrated the statistical significance of mediating factors for interactivity outcomes. Additionally, Tremayne and Dunwoody (2001) concluded that *several* mediators are likely to influence interactivity effects. These observations call for the investigation of a broader range of mediating factors, as well as their incorporation into conceptual models. Notably, some process-based studies did not consider mediating factors at all (Rafaeli & Sudweeks, 1997; Schultz, 1999). Other studies produced results opposite to those that had been hypothesised (Sundar et al., 2003).

For interaction designers, the biggest concern about the process-based approach is that it fails to explain how designers can increase behavioural user interactivity. The conceptual premise, which argues that structural features create only interactive conditions and that users may or may not fully exercise a feature's interactive potential, places control over behavioural interactivity into the hands of a user. The result effectively limits the options of interaction designers for the manipulation of structural interactive features only. Experimental findings suggest a higher number of interactive features combined with certain antecedents (i.e., user web experience) results in higher behavioural interactivity. However, higher behavioural interactivity does not always produce the desired outcomes for a user. The above findings only reiterate the results of feature-based studies and do little to advance the interaction design process.

Despite the above criticism, the message-centred approach holds some promise for communication studies in general and interactivity research in particular. First, it offers a model of measuring interactivity which is technology-independent and, thus,

applicable for interactivity analysis across different media and technologies. For instance, Rafaeli (1988) asserted that his message-based model of interactivity was consistent with the previous communication and mass media research as well as with the "social science tradition of studying interaction" (p. 121). Second, and more importantly for the subject-matter of this thesis, the process-based approach seems to pick up where the structural approach left off. Structural studies often ignore the quality of interactive tools in their operationalisations of interactivity. Rafaeli's conceptualisation of responsive and interactive communication allows the use of responsiveness as a technology- and user-independent criterion to add a quality dimension to feature-based operationalisations. Additionally, process-based studies may offer methods of recording, coding and analyzing user interactions with interactive features, something structural studies noticeably lack. Also, the process-based approach seems particularly suited for the study of user-to-user interactivity while the feature-based approach may be unwittingly measuring only user-medium interactivity (Lee, 2000, p. 332).

Despite some serious methodological limitations which the process-based approach may impose on web-based interactivity studies, it can help fill the conceptual and methodological gaps in the structural and perceptual approaches. However, for the process-based approach to be a viable operationalisation solution for interactivity practitioners, its conceptual model needs to incorporate structural interactivity, mediators, and interactivity outcomes in its analysis.

2.3 Perceived Interactivity Operationalisations

An alternative to the structural and message-centred approaches is the conceptualisation of computer-mediated interactivity as an experiential phenomenon. This approach treats interactivity as a psychological variable related to the user's subjective experience. Because of its psychological nature, perceived interactivity has been often compared to the phenomenon of para-social interaction observed in other media (Bucy & Tao, 2007; Rafaeli & Ariel, 2007; Sundar & Nass, 2000). Some evidence suggests that the non-interactive elements in computer-mediated communication, similar to para-social interaction, can elicit a sense of interactivity in a user's perception (Newhagen, Cordes, & Levy, 1995). Hoerner (1999) experimentally supported the above observation, concluding that user interaction with the structural elements of a website can create a para-social relation. The consequence of individual and highly subjective user perceptions is that the levels of perceived interactivity will always vary across users. In contrast, the structural approach considers interactivity to be invariant across users.

The number of perception-based empirical studies has been steadily increasing during the last decade. Tremayne (2005) argued that the perceptual approach, alongside with the message-centred one, is beginning to dominate empirical research. My own review of the interactivity literature supports this argument. The popularity of the perception-based approach in CMC studies can be explained by practical and scholarly reasons. First, most of today's experimental CMC research seems to be pre-occupied with improving marketing and advertising effectiveness through consumer-message or consumer-advertiser interactivity. As McMillan and Hwang (2002) pointed out, "[p]erceived interactivity is particularly important to advertising researchers whose goal

is often to 'get inside the head' of consumers and understand how and why they respond to commercial messages" (pp. 39-40). Second, perceived interactivity appears to be a better predictor of interactivity outcomes than the interactive features of a medium (McMillan et al., 2003).

Although the perceptual approach treats user perception of interactivity as measurable (Bucy & Tao, 2007, p. 653), each study operationally defines "perception" in its own way. For example, Wu (1999) defined perceived interactivity as "a two-component construct consisting of navigation and responsiveness" (p. 6). In a later study, Wu (2005) refined his operational definition of perceived interactivity as "a psychological state experienced by a site-visitor during the interaction process" and operationalised it along three dimensions:

> (1) perceived control over the (a) site navigation; (b) the pace or rhythm of the interaction; (c) the content being accessed,
> (2) perceived responsiveness from (a) the site-owner; (b) from the navigation cues and signs; (c) the persons online,
> (3) perceived personalisation of the site with regard to (a) acting as if it were a person; (b) acting as if it wants to know the site visitor; and (c) acting as if it understands the site visitor. (p. 48)

McMillan and Hwang (2002) developed their own scale of perceived interactivity with three dimensions: realtime communication (with sub-dimensions of two-way communication, concurrent communication, conversation, and interpersonal communication), no delay (or speed of the transaction with the computer), and engaging (measures of the variety of content, how well the website keeps the individual's attention, ease of navigation, and immediacy of response). Liu (2003) offered one more scale for measuring perceived interactivity, operationalising perceived interactivity with three dimensions of her own: active control, two-way communication, and synchronicity.

These dimensions overlap with some items in McMillan and Hwang's scale. As a general rule, all perception-based operationalisations, except for those of Wu (2005), tend to position perceived interactivity as an independent variable and interactivity outcomes as dependent variables.

Although researchers cannot directly observe perceived interactivity, it can be reliably measured, like most psychological phenomena, by using methods well-established in experimental psychology (Bucy, 2004b). The most common method of assessing perceived interactivity is through a post-test user survey or questionnaire. As discussed above, perceived interactivity is commonly operationalised by using multidimensional scales. A post-test survey or questionnaire usually contains a battery of Likert scale items measuring each dimension and subdimension of the operational definition separately (see Appendix 9 for Wu (1999), Appendix 10 for Wu (2005), Appendix 11 for McMillan and Hwang (2002), and Appendix 12 for Liu (2003)). Researchers can analyse the individual indices of a measurement scale separately or combine them to obtain a composite interactivity score.

Any perception-based experimental study that measures perceived interactivity but does not try to investigate the causal mechanism behind the observed perceptions would be short-sighted. What interactivity means to a user is key. Qualitative research methods, for example, in-depth interviews, appear to be best suited than for understanding the nature of perceived interactivity through the user's perspective (Liu & Shrum, 2002). Lee et al. (2004), in their comparative study of the structural and perceived interactivities in the websites of three computer manufactures, demonstrated an exemplary, creative way of using qualitative methods. To understand the underlying

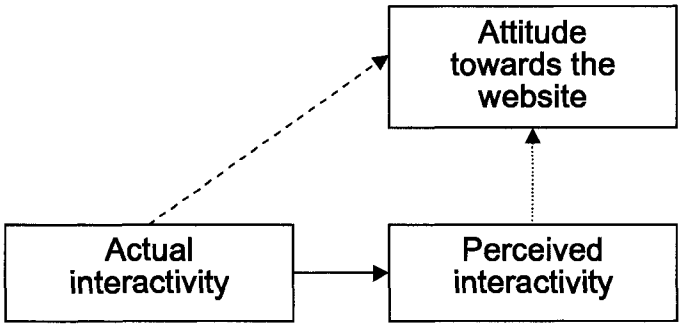
reasons for user perceptions of structural interactive features, these researchers combined an in-depth interview with techniques of discourse analysis. The one-on-one in-depth interview was semi-structured and, among other questions, contained open-ended interactivity-specific questions ("What is the most interactive about the site and why?" (p. 95) and "How interactive each website was to them?" (p. 102)) to elicit extended user responses. To facilitate better recall, the interview was conducted while playing back the user's captured surfing behaviour. Further, all interviews were transcribed to allow for a deeper level of analysis. By reviewing the transcripts, the researchers generated a list of the interactivity-related words and phrases (e.g., "click," "link to other pages," "feedback," and "personalized") which participants typically used in their answers. Some of these words and phrases (e.g., "to customize or personalize the computer," "build your own computer," and "select your option") were considered to be associated with higher levels of interactivity. The count of interactivity-related words and phrases was used in the further analysis of the interviews. The above example shows how direct and indirect, qualitative and quantitative methods can be combined in a creative way to help identify and comprehensively analyse a user's perceptual associations, which the researchers otherwise would not have considered.

Knowing the users' interpretation of interactivity only partly answers the question of why users perceive structural interactive features the way they do. Empirical research suggests that additional non-technological factors, not apparent to users themselves, may influence their perception of interactivity. There factors are personal user characteristics which act as mediators. A number of such mediators have been identified and studied in perception-based research. For example, involvement with the subject-matter was found

to be positively associated with perceived levels of interactivity (McMillan, 2000; McMillan et al., 2003; Wu, 1999). Jee and Lee (2002) concluded that user perception of interactivity is affected by the need for cognition and web skills. Lee (2000) argued that "users and non-users of technologies see interactivity differently" (p. 337). However, Chung and Zhao (2004) did not find support for the argument that computer skills or web familiarity was related to consumer's perceived interactivity. Despite the contradictory empirical results and lack of agreement about which personal characteristics affect user perception of interactivity, the perceptual approach scholars seem to agree that a broader range of possible mediating factors should be investigated. This conclusion parallels the above observations made for the structural and process-based approaches.

Similar to the message-centred approach, the perception-based conceptual and operational models are often criticised for their neglect of the structural attributes of a medium. Bucy and Tao (2007) noted that the perceptual approaches "generally fail to acknowledge that structural characteristics of information technology systems are required to evoke a sense of perceived interactivity in the first place—and should therefore be included in the statistical model as the manipulated independent variable" (pp. 653-654). However, only Wu (2005) among the reviewed perceptual studies included structural interactivity in a conceptual model (see Figure 21).

Figure 21.
Wu's Model of Mediating Role of Perceived Interactivity
in the Effect of Actual Interactivity on Attitude toward the Website



Note. Dashed lines mean that the effect might be insignificant when a mediator works

Note. From "The mediating role of perceived interactivity in the effect of actual interactivity on attitude toward the website," by G. Wu, 2005, *Journal of Interactive Advertising*, *5*(2), Retrieved September 4, 2007, from http://jiad.org/vol5/no2/wu/index.htm.

Critics of the perceptual approach have been concerned about the contamination of the interactivity concept by placing the concept within a user. As shown above, even web technology professionals widely range in their opinions about what constitutes an "interactive" feature (Ferber et al., 2005a). What can we say, then, about an average person's understanding of interactivity? Sundar (2004) argued that a user's perception of usability can be confused with interactivity. Similarly, Lee et al. (2004) observed that the users in their study viewed websites holistically:

> In response to all three questions concerning interactivity, information content and attractiveness of design, people seemed to maintain a holistic view of the site's characteristics. The objective criteria set up by the researchers did not seem to be clearly distinct from the consumer's perspective. In fact, the three constructs—interactivity, information content, and design elements—seemed to overlap with each other in many participants' minds. (p. 100)

Rafael and Ariel (2007) supported Sundar's argument and noted that "perception or experience cannot be regarded as interactivity itself" (pp. 82-83). In addition, user perception of interactivity may be changing along with innovations in interactive

technologies. What was perceived as "interactive" yesterday may not be perceived as such tomorrow.

Some researchers pointed out that the causal mechanisms behind user perceptions of interactivity could be better understood if perceptual studies measured the actual use of interactive functions. For instance, Chung and Zhao (2004) found that the actual interaction with interactive features (in this case, the user's clicking behaviour) and not the overall number of interactive features, was positively related to the level of perceived interactivity. Tremayne (2005) argued that "[b]ecause certain dependent variables (attitude toward site is one) can be influenced by both the perception of interactivity and by actual interaction with the content, causal mechanisms are best revealed by designs where each type of interactivity is measured" (p. 66).

However, some empirical studies have shown that measuring behavioural and perceptual interactivities alone, without including relevant personal user characteristics in the analysis, may not be enough to explain causal relationships. Lee et al. (2004) found no major differences in terms of structural interactivity, information content, and attractiveness of design in the websites of three major computer manufacturers although the user perceptions of the interactivity on these sites differed. Although the researchers captured the actual user interaction with the websites, they were unable to establish a definitive causal mechanism for interactivity perception. They suggested that, in order to explain the differences in perception, future research should look into personal user characteristics and personal relevance of interactive features as possible mediators. The importance of capturing all three of the above-mentioned measures is further supported by the empirical findings of Chung and Zhao (2004), who found that a consumer's

perceived interactivity was positively related to his or her surfing behaviour operationalised as clicking. In fact, 50.3% of the variance of the perception of the interactivity with the website could be explained by clicking behaviour. However, the level of user involvement, as a mediator, did not affect the total number of user clicks, but the types of click users made: subjects with high product involvement made more clicks on product-related links, while consumers in the low-involvement condition clicked more often on the links for non-product information.

In conclusion, the perceptual approach treats perceived interactivity as an independent variable and predictor of interactivity outcomes. Most perception-based empirical studies found a positive correlation between the user perception of interactivity and cognitive, behavioural and affective outcomes: "Whether or not interaction actually happens matters less than whether it was perceived to have happened" (Rafaeli & Ariel, 2007, p. 82). More than other approaches, the perceptual empirical studies have advanced the investigation of personal user characteristics as mediating factors,, but the range of the investigated mediators needs to be broadened. Like the process-based approach, the perceptual conceptual and operational models need to include structural interactivity in their analysis.

2.4 Discussion

The review of empirical interactivity research identified a broad range of operationalisation approaches. Although conceptual differences may be the main reason behind the variability and even the contradictions in empirical results, the way variables are defined and operationalised in individual studies seems to be a significant variability

factor as well. The above critical analysis of the various empirical approaches led to the following conclusions about the persistent patterns, problems and omissions in interactivity studies.

Regardless of the conceptual approach adopted, all controlled experimental studies manipulate interactivity by varying the number and quality of interactive features (Tremayne, 2005). However, some experimental researchers do not even include structural interactivity in their conceptual and operational models. Perceived interactivity is often used as a manipulation check to verify that experimental manipulations worked. Empirical findings in all three dominant approaches suggest the non-linear nature of the relationship between interactivity (regardless of how it is defined) and interactivity outcomes. The factors affecting interactivity outcomes are often referred to as either "antecedents" or "mediators," depending on the conceptual model used. So far, in interactivity research, such personal user characteristics as motivation, involvement, need for cognition, web skills, and technology experience have been studied as mediators. The results of these studies vary and are at times contradictory. However, the researchers agree that a broader range of mediators should be tested in future research.

The empirical researchers' suggestions for future studies point out the need for more sophisticated methods and deeper levels of analysis to establish the causal mechanisms for dependent variables. Behavioural interactivity, perceived interactivity, and interactivity outcomes can all be defined as dependent variables based on the adopted conceptual approach. For example, the forced exposure method often used in laboratory-controlled experiments has been criticised for its potential to distort causal relationships (Cho & Leckenby, 1999; Tremayne, 2005). The lack of analysis of actual user

interactions with interactive functions was noted for both the structural and perceptual approaches. McMillan et al.'s (2003) conclusions that not all structural features and not all subdimensions of perceived interactivity affect a user's attitude towards a website call for a deeper level of analysis.

A common pattern in operationalizing interactivity, in the structural and perceptual approaches in particular, is to define it as a variable with several dimensions or even subdimensions. Although researchers may disagree which dimensions make up the variable, such an approach to measuring interactivity can actually lead to a deeper analysis of causal relationships. Liu and Shrum (2002) argued that using multidimensional scales for measures allows researchers to isolate and analyse the effects of individual dimensions on interactivity outcomes which would otherwise be obscured:

> For example, if interactivity is treated as a sum of the three dimensions, important relations between a variable and a particular dimension may be obscured simply because the other two dimensions showed no relation with that variable. Similarly, when effects are noted, they may be attributed to a global concept of interactivity when only one or two dimensions of interactivity are driving the relations. (p. 60)

In turn, deeper analysis of individual dimensions and their relationships to interactivity outcomes can help pinpoint the specific interactive functions or perceptual variables that lead to the observed effects.

The conceptual models used in various operationalisation approaches seem to be incomplete (Bucy & Tao, 2007). Structural interactivity studies neglect the effect of mediating factors, while process-based and perceptual empirical research disregards structural interactivity. Recently, some scholars have attempted to embrace all three types of interactivity within a single comprehensive conceptual model (Bucy & Tao, 2007;

Rafaeli & Ariel, 2007; Wu, 2005). This direction is promising for future conceptual and empirical interactivity research and deserves more attention.

Any researcher or practitioner who embarks on a new interactivity study or design project should be aware of the above advantages and limitations of each operationalisation approach. The current limitations might be overcome by trying out new comprehensive conceptual models or combining methodologies from various approaches to observe the phenomenon of interactivity as completely as possible. In the following chapter, I will propose a holistic interactivity framework logically arising from the discussions in Chapter 1 and 2, and use it to discuss some fundamental conceptual issues which have not received proper attention in the current interactivity literature.

CHAPTER 3

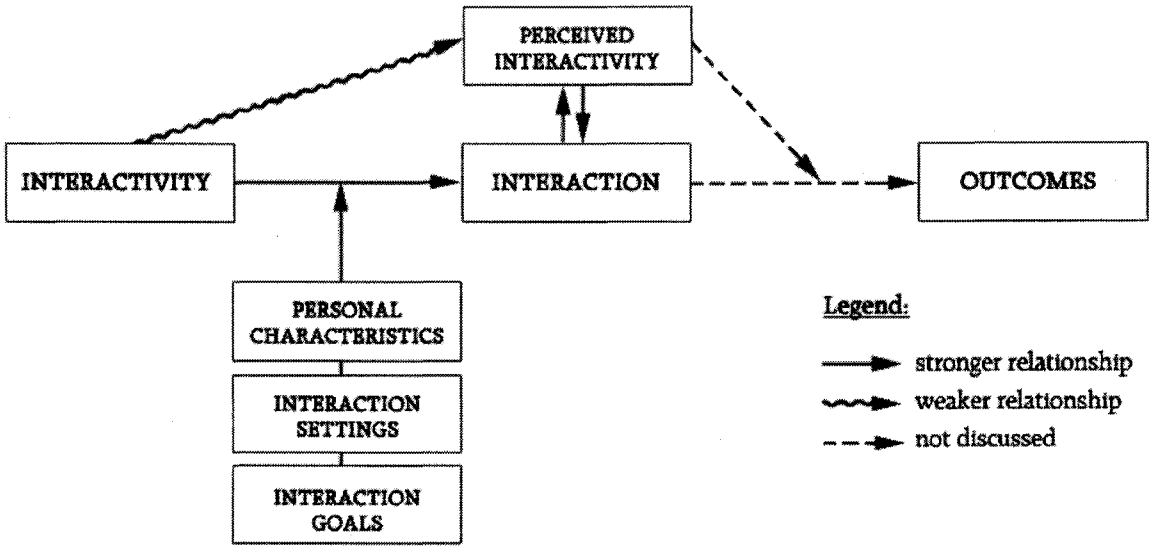
TOWARDS A NEW INTERACTIVITY FRAMEWORK

Over two decades of research about computer-mediated interactivity have advanced our knowledge about this central characteristic of the new media. Interactivity research has produced an extensive body of literature, a vibrant discussion, and new perspectives on the subject. The literature review in this thesis shows that researchers' emphasis has been on isolating and defining the concept for its effective study. As a result, the following three views of computer-mediated interactivity have emerged as dominant in the field: structural, process-based, and perceptual. Each approach places interactivity into a different location and conceptualises the construct from a different focal point. However, as previously discussed in this thesis, these individual approaches have significant gaps in their conceptual models and generally fail to provide a complete, holistic view of interactivity. Based on my critical analysis of interactivity literature, I have identified the following four fundamental conceptual issues that either have not received proper attention or deserve further elaboration:

1. Absence of a holistic conceptual view of technology-mediated interactivity.
2. Inconsistency and confusion in terminology.
3. Unexplained causal mechanisms between individual interactivity types.
4. The issue of the interactivity ideal.

As my contribution to interactivity studies and in an effort to advance the conceptual discussion, I propose a new interactivity framework (see Figure 22) which I use as a context for my discussion of the first three issues. I address the fourth conceptual issue separately from the framework.

Figure 22. Proposed new interactivity framework



3.1 Need for a Holistic Conceptual View

With the transition to effects study in interactivity research, a comprehensive interactivity framework is needed to provide a holistic view of the four main elements of the phenomenon: interactive attributes of media, interaction process, perceptions of interactivity, and interactivity outcomes. So far, researchers' focus on interactivity as an isolated construct has produced effective ways to build typologies and to categorize and measure this phenomenon, but these methods and scales have shown limited ability to explain causal relationships between interactivity and its effects. Additionally, the exclusion of interactivity outcomes from interactivity conceptualizations has two problematic consequences. First, it significantly limits the practicality of a model for research and design purposes. Second, any interactivity paradigm that ignores interactivity effects isolates interactivity from its larger context, namely its social impact, the single most important reason behind interactivity research. Since human-computer interaction has emerged "as a dominant cultural paradigm of our time" (Bardzell &

Bardzell, 2008, p, 2470), excluding interactivity effects from the conceptualisation of interactivity is a gross oversight. Although isolating interactivity to define and conceptualize it is a necessary important first step in theorizing the concept, we now need to move on from the argument about the true place of interactivity to building a new paradigm will incorporate the current findings about the phenomena and offer new directions for inquiry. A number of researchers (Tremayne, 2005; Wu, 2005), who concluded that the phenomenon of interactivity should be viewed holistically and should not be limited to measuring only one type of interactivity, have called for the development of such a paradigm. The interactivity literature reveals that interactivity is a phenomenon far more complex than individual approaches suggest (Richards, 2006). This conclusion calls for a new conceptual approach that will converge the disparate views into a new comprehensive interactivity paradigm.

For a new interactivity paradigm to be widely accepted, it needs to be built on a set of commonly accepted assumptions and principles. Despite the existence of conceptual differences, the "common ground" explicitly or implicitly shared by all interactivity approaches can be identified. The starting premise for a new framework is the assumption that all three types of interactivity (structural, process-based, and perceptual) are interrelated constructs, whose existence is hard to deny. For example, all empirical studies manipulate interactive conditions by changing the number and/or quality of interactive features, whether or not structural attributes of a medium are part of a conceptual model. Perceived interactivity can also be consistently found in the methodological setups of experimental studies, either as a manipulation check or an independent variable. Of course, excluding the actual interaction process from the

framework would be unthinkable. As well, we can assume that the purpose of a framework is to visualize the cause-and-effect relationships among its elements, in this case, the interactive features of a medium, the actual user interaction with these features, the user's perceptions of the interactivity level of the said features, and the interactivity's effects on the user. Positioning the above four elements in the same order that they are presented in Figure 22 is both logical and practical: logical, because interactive structures must exist prior to interaction, perception and outcomes; and practical, because this positioning parallels some of the interaction paradigms found in HCI and interaction design literature. For example, Norman's (1988) seven-step human-action paradigm defines three stages: goal formation, execution, and evaluation. The goal formation stage relies on the available functions in a system (what can I do by using the available functions?); the execution stage essentially describes an interaction process (how do I go about doing what I set out as my goal?); while the evaluation involves the perception and interpretation of the interaction results. A similar analogy can be drawn with the user analysis, design and evaluation phases of the user-centred interaction design process. The third assumption on which I build the proposed interactivity framework is the empirical observation consistent across all approaches: the relationship between interactivity, no matter how it is defined, and interactivity outcomes tends to be non-linear. This observation stresses the importance of third-order variables, or mediators, for explaining causal relationships. Any interactivity framework attempting to describe interactivity types and interactivity outcomes in terms of a cause-and-effect relationship will have to consider the use of mediating factors. To sum up, the proposed interactivity framework accepts the validity of all three types of interactivity, unifies and positions them in the

structure-interaction/perception-outcomes order, and explains their relationship in terms of mediator variables. In this framework, structural interactivity is viewed as an independent variable, and the degree of actual interaction and the user perception of interactivity are regarded as dependent variables.

The implications of a new formal framework of interactivity are twofold: conceptual and organisational. From the conceptual perspective, the holistic nature of the framework offers a higher level of theorizing about the phenomenon than was previously available. For instance, the traditional interaction paradigms offered in the HCI literature (e.g., Norman, 1988; Dix, Finlay, Abowd, & Beale, 1998) describe the human-computer interaction process per se, thus leaving unanswered the questions of why interactions occur in the first place and what their outcomes are. In addition, traditional human-computer conceptual models are often not helpful in the critique of technology-mediated human-human interactions (Bardzell & Bardzell, 2008). In this respect, I propose a framework that represents a higher level of abstraction which can also be useful in answering design questions of *who*, *why*, *where*, *when* and *how*. As such, it can be used to guide both scholarly inquiry and the design process. From the organisational viewpoint, a formal framework always "serves as a model for thinking," thereby helping to formulate a structured approach and direction to further theorizing and empirical study of interactivity (Heim, 2008, p. 3). As well, my proposed framework's comprehensive and unifying nature opens up new areas for inquiry, particularly at the points where previously separate conceptualizations come together. Moreover, formalizing interactivity types and their relations should provide reference points for researchers and

practitioners to be clear as to what type of interactivity they are investigating, a persistent problem stressed by a number of authors (Rafaeli & Ariel, 200; Tremayne, 2005).

3.2 Terminological Inconsistencies and Confusion

An increased interest in interactivity among researcher from various disciplines has produced a vibrant and stimulating discussion with a wide range of views on the subject. At the same time, this diversity has caused a major problem for the discourse: a non-uniform and often confusing terminology. My review of interactivity literature showed that such terms as *actual*, *objective*, *functional*, *structural*, *inherent*, *natural*, *physical*, *behavioural*, *interactivity-as-process*, *interactivity-as-product*, *message-exchange*, and *process-based* were often used to refer to the phenomenon. Some of this terminology is quite ambiguous without any context; other terminology (e.g., *functional*, *actual*, *physical* interactivity) has been used to describe two completely different types of interactivity (for example, compare Sohn & Lee (2005) and Tremayne (2005), Polaine (2000)). Although some common naming patterns have emerged (e.g., *perceived interactivity*), every interactivity theorist seems to coin a new term as a part of his or her conceptual contribution to the field. The result of the above is unnecessary terminological and conceptual complexity that impedes mutual understanding and discourse in general. As a result, many publications, especially those written by practitioners, discuss interactivity without clarifying what type of interactivity they are studying or designing for. For example, my review of IEEE papers, which are primarily presented by software engineers, shows that interactivity is often discussed in only one-two sentences and in

very general terms. For instance, Bajaj, Pascucci and Schikore's (1996) 8-page paper on visualization techniques mentions interactivity only once, in its title.

I believe that one reason for the terminological confusion is the evolving state of interactivity studies in general, hence the lack of standardised and broadly agreed-upon principles and terminology. While CMC and computer-supported cooperative work (CSCW) are still relatively young fields of inquiry and consequently may have unstable terminology, HCI, on the other hand, has been undergoing a transition in its approach to human-computer interaction by adopting a more human-centric perspective and more human-centric research methods than it had previously. Streitz (2008) described this transition in terms of the tension and struggle between programmers and interaction designers, with the latter recently influencing the domain of interface design. Steitz (2008) further stressed the increasing importance of the user-centred approach in HCI by reflecting on the past misconceptions and the need for new interaction paradigms:

> It became obvious to us that the phrase "human-*computer* interaction" could lead us in the wrong direction. Normal users are actually not very interested in interacting with computers. They are interested in interacting with *information* and with *people* in order to communicate and collaborate with them. Thus, the field we want to explore should be called "human-*information*" interaction and "human-*human* interaction and cooperation," terminology that implies that the computer should disappear from the scene. (pp. 56-57)

Likewise, Beaudouin-Lafon (2004) submitted that "HCI research is far from having solid (and falsifiable) theories of interaction" (p. 16). More recently, Bardzell and Bardzell (2008) drew attention to the same issue by asserting that:

> [E]ven now, and in spite of promising steps . . . , HCI lacks a rigorous discipline of interaction criticism, that is a stable vocabulary and set of critical practices that can be subjected to discussion and review. . . . By interaction criticism we mean rigorous, evidence-based interpretive analysis that explicates relationships among elements of an interface and the meanings, affects, moods, and intuitions they produce in the people that interact with them. (p. 2464)

I intend my new framework to contribute to the kind of rigorous analysis of interactivity that Steinz (2008) and Bardzell and Bardzell (2008) call for.

The diversity of definitions and the transitional state of some disciplines involved in the conceptualisation of interactivity as a technical and social phenomenon only partly account for the currently unstable interactivity vocabulary. I believe that another, more fundamental factor is also causing the current terminological inconsistencies. In my opinion, this main cause of the terminological confusion is the indiscriminate and interchangeable use of the terms *interactivity* and *interaction*. IEEE and ACM conference proceedings point out that interactivity, whether explicitly defined or not, is usually referred to either as a range of designed interactive system functions or as the property of the interaction process. In the latter meaning, it is often used interchangeably with the term *interaction*. As a result, many papers on interactivity have titles like "design for . . . interaction" and "design of . . . interactivity." For example, Adiele (2007) refers to interactivity within the context of a web community as "a communication *process* [italics added] that facilitates the exchange of messages in which each message is related to the previous messages exchanged" (p. 902). Adiele's definition is clearly borrowed from the Rafaeli's (1988) process-based conceptualisation, where he essentially equated *interaction* and *interactivity*. The failure to separate the concept of *interactivity* from *interaction* has led to the unnecessarily broad use of the former term, which has further diluted its meaning.

I see the logical solution to this problem as arbitrarily limiting the use of the term *interactivity* to a single phenomenon. *Interactivity*, as a derivative of *interaction*, historically has been used synonymously with the latter in media studies and informatics.

In new media studies, however, "the concept 'interactivity' or the combination 'interactive media' is most often used to characterize a certain trait of new media which differs from traditional media" (Jensen, 1998, p. 190). Therefore, the use of the term *interactivity* should be used only to refer exclusively to the interactive potential of a medium, application, or device determined by the number and quality of its designed or inherent interactive attributes, functions, or features. In other words, *structural interactivity*, as I referred to it previously, should be named *interactivity* proper. Since the process-based approach focuses on the communicative exchange or, in other words, on the communicative interaction, this type of interactivity should be referred to as what it really is—an interaction. What researchers measure in this case is the quality of the human-system or mediated human-human interaction defined by Rafaeli (1988) in terms of the responsiveness of message exchanges. Such a solution will eventually eliminate the use of the above confusing interactivity terminology as well as help clarify the term *perceived interactivity* by revealing which type of interactivity the users are perceiving. At the same time, the term *perceived interactivity* has firmly established itself in the literature and does not pose any terminological problems. The proposed new interactivity framework integrates the suggested terminological solution by using the terms *interactivity*, *interaction*, and *perceived interactivity* to refer to the three types of interactivity defined in the literature.

3.3. Mediators and Causal Mechanisms among Interactivity Types

One of the relatively unexplored areas of interactivity research remains the conceptualization of the relationships among (structural) interactivity, interaction, and

perceived interactivity. Theoretical work has focused on isolating interactivity as a concept and defining its dimensions. Empirical work, on the other hand, has been trying to establish patterns of correlation between individual interactivity types and interactivity outcomes, meanwhile overlooking the importance of conceptualizing and studying the causal relationships among interactivity types. The need to study the above grey area of interactivity research becomes particularly obvious when empirical studies fail to support a tested hypothesis.

Lee et al.'s (2004) study may serve as an example of where the above approach could have produced more insightful results than this study actually obtained. In this study, the researchers observed the differences in perceived interactivity among the study participants, who rated three computer manufacturers' websites with no major differences in the number of interactive features, information content, or attractiveness of design. The researchers failed to explain the difference in perceptions by using the collected data but hypothesized about the possible influence of third-order factors (e.g., the personal relevance of particular features) not included in the study design. Such mediating factors could have been tested if the researchers had included in the analysis the actual use of interactive functions on each website. The inclusion of actual interaction and third-order variables related to interaction could have provided a more complete picture of the process and suggested possible explanations. However, Lee et al. (2004) did not plan to explore the relationship between the two interactivity types in terms of cause and effect, not only methodologically but also conceptually,. The researchers employed sophisticated methods to measure the two interactivity types but did not propose any conceptual model of their relationship which the study could have tested. The research

question—*Do user perceptions of site interactivity, information content, and design correspond to objectively measured characteristics?*—set out to measure correlations rather than to uncover the causal mechanisms between the structural and perceived interactivities.

In another example, Wu (2005) tried to reconcile inconsistent findings regarding the effects of interactivity on communication outcomes such as attitude towards a website. He conducted a comparative analysis of 14 structural and perceived interactivity empirical studies. Structural studies showed inconsistencies in the relationship to interactivity outcomes ranging from positive to negative. On the other hand, perceived interactivity studies revealed a consistently positive contribution towards communication outcomes. On this basis, Wu (2005) argued about the mediating effect of perceived interactivity on structural interactivity and tested his hypothesis. The results suggested that mediation indeed takes place but did not explain *how* the mediation occurs.

With due credit to the above researchers for their input into interactivity research, their contribution could have been more significant if they had considered conceptualizing and testing the causal mechanism between the two interactivity types. Lee at al. (2004) and Wu (2005) could have contributed to a more accurate and holistic understanding of interactivity by attempting to answer, for example, what invokes user perception of interactivity, how mediation works, and whether any other factors are involved in mediation.

In addition to offering a new direction for theorizing, drawing attention to the causal mechanisms among interactivity types also has important implications for the practice of interaction design. For an interaction practitioner, today's diverse

operationalisations of different interactivity types offer elaborate methods for measuring the phenomenon and identifying potential problems. However, like usability testing, these new methods do not help to fix identified problems (Beaudouin-Lafon, 2004). To fix a problem, designers need to know the exact nature of the relationship between the involved parts of a system. Thus, if higher structural interactivity does not result in a higher degree of user interaction or higher user perception of interactivity, designers need to have a conceptual model that can point to the proper mediating factors involved in the observed irregularity. Unfortunately, with few exceptions (Bucy & Tao, 2007; Lee, 2000), interactivity research today does not offer a solid and tested conceptual model for this aspect of interactivity theory.

I argue that the relationships among (structural) interactivity, interaction, and perceived interactivity can be conceptually explained in terms of the mediating effect of third-order variables. This assumption follows from the empirical evidence that the relationship between individual interactivity types and communication outcomes is non-linear (Bucy, 2004c; Lee et al., 2004; Sundar et al., 2003; Tremayne & Dunwoody, 2001). A number of studies have empirically tested third-order variables with various success, sometimes producing contradictory results (e.g., compare Jee & Lee (2002) with Chung & Zhao (2004)). Although no general consensus exists about which third-order variables have a mediating effect and how mediation occurs (Bucy & Tao, 2007), some conceptual propositions and research findings may be pointing in the right direction for further theorizing. Based on my analysis of interactivity literature, I propose the following structure for the mediating factors in the relationships between interactivity elements and interactivity's outcomes. In the proposed framework (see Figure 22), I argue that actual

user interaction with interactive features is the primary mediator of interactivity effects. User perception of interactivity also performs mediation, but perceptions arise mainly as a result of the volume and quality of interaction. Below, I discuss these and other related aspects of the framework in more detail. Since this thesis focuses on the phenomenon of interactivity and not on its effects, I further discuss the mediating factors involved in the relationship between the following interactivity types: between (structural) interactivity and user interaction, on one hand, and user interaction and user perception of interactivity, on the other hand.

Empirical studies have shown that a high level of (structural) interactivity does not guarantee positive attitudinal, cognitive, or behavioural outcomes of user interaction with an interactive system. In fact, some studies observed the completely opposite effect (Bezjian-Avery, Calder, & Iacobucci, 1998; Richards, 2006). Moreover, McMillan et al. (2003) and Wu (2005) concluded that perceived interactivity is a better predictor of outcomes than the measure of (structural) interactivity. Researchers have suggested that the inconsistent findings in structural interactivity studies are due to disregarding the actual user interaction in conceptual models (Tremayne, 2005). For example, Sundar (2004) suggested that "interaction is an obvious behavioral consequence of interface interactivity" and that, therefore, "theorizing can proceed along the lines of determining the mechanism by which interactivity causes interaction, in terms of both nature and volume" (p. 386). We know from the usability studies that different users interact with different media differently by interacting with some functions and ignoring others. In fact, the usability 80/20 rule asserts that "20% of the product features are used 80% of the time" ("80/20 Rule," n.d.). Moreover, even the same user (with different interaction goals

and under different interaction conditions) is likely to have different interaction behaviours with the same media. For example, Sundar (2004) speculated that "certain forms or elements of interactive interfaces may be more successful than others in issuing calls to action" and that "certain individual-difference variables, including skill level, may help explain how those calls are interpreted differentially and why some calls result in greater interaction than others" (p. 387). Riffe, Lacy, and Fico (1998) pointed out that even one single feature can be critical for a message to be effectively communicated and processed. Surprisingly, early structural interactivity studies in particular did not include this mediating aspect into their operationalisations, but, instead assumed the holistic effect of (structural) interactivity on the user and communication outcomes.

A few researchers (Bucy & Tao, 2007; Lee, 2000; Wu, 2005) attempted to explain the above findings by the mediating role exercised by perceived interactivity on the effects of (structural) interactivity. Their approaches differ from the interactivity framework proposed here in that they assume the direct nature of the mediation of interactive structures by user perceptions. As a result, none of the above researchers included user interaction in their conceptual model or discussed it in any detail. This omission of interaction is quite surprising because Bucy & Tao (2007) themselves admit that "true interactivity effects cannot occur without actual use of interactive attributes" (p. 568). In contrast, my interactivity framework positions user interaction as the primary mediator.

I argue that the three groups of third-order variables—user interaction goals, interaction settings, and personal user characteristics—determine which interactive features users actually engage with and how they do so. Surprisingly, none of the above

conceptualisations consider user interaction goals among third-order variables. However, assuming that the user will interact with all features or use the application for one goal only would be simplistic. For instance, Eason (1987) pointed out to the interaction designers the existence of three groups of target users:

> Primary users are those persons who actually use the artifact; secondary users are those who will occasionally use the artifact or those who use it through intermediary; and tertiary users are persons who will be affected by the use of the an artifact or make decisions about its purchase. (p. 764)

Brey (2005) argued that human-computer interactions are characterised by two types of relationships: epistemic (involving cognition/information processing) and ontic (involving the simulation/extension of the environment). Historically, human-computer interactions were epistemic as computers were used for problem solving and information processing. Today, computers can simulate and extend social and physical environments. Using Brey's argument, one can identify two respective types of interaction goals: information-processing and entertainment. Any human activity involves some cognitive processing, but as Brey (2005) observed, "artistic drawings, adventure games and music are not meant to inform, but rather to please or entertain. These activities may involve cognitive activity (almost any activity does), but their principal goals are not cognitive" (p. 393).

Like the different initial sets of interaction goals, the following goal characteristics are also likely to affect the interaction process. First, a user does not always clearly formulate his or her goals prior to interaction. Interaction goals may change or appear during the interaction with the media as, for example, when an online-store visitor spontaneously decides to buy an item. Similarly, goals and tasks are usually not clearly defined at the very outset when a person is working on creative tasks by using

a computer system (Beaudouin-Lafon, 2006). In such cases, user interaction behaviour may be inclined towards more exploratory use behaviour. Second, not all interaction goals are communication-driven. Interestingly, Adiele (2007) reported in her study on web communities that the overwhelming majority of users were passive and that only 15% were active. Also, the goal of playing computer games, for example, is the engagement in the activity itself. In other words, interaction itself is the goal. In such a situation, the user is likely to be willingly looking for opportunities for more interaction, trying to enhance and extend this experience. The result will be a longer and more involved user interaction with a medium. In contrast, a person visiting a website for breaking news is unlikely to be particularly preoccupied with exploring opportunities for more interaction. To reflect the fact that human-computer interaction can take place without communicative intentions, I deliberately chose the terms *interaction goals* over *communication goals*. To sum up, I argue in my framework that interaction goals should be considered as a third-order mediating variable in the relationship between structural interactivity and interaction.

The physical and social environments in which human-computer or mediated human-human interaction takes place will also affect the nature of user interaction. Based on his experience of exhibiting natural interface objects, Valli (2007) observed the following:

> People interaction with technology-enhanced objects or spaces is not simply defined by the nature of the interface in a strict sense; persons are influenced by the physical and social situation they are in (i.e. presence of other people, outdoor or indoor environment, et cetera). . . . The way occasional users approach interactive artifacts in public spaces is very different from the relation between traditional users and personal computers. . . . Common people are ashamed of trying to interact with artifacts they don't master in front of other people looking at them. (p. 10)

Similarly, Heim (2008) pointed out that the "social environment affects the way people use computers" (p. 9). Some cognitive environments may be more demanding than others. For instance, a classroom environment is likely to put higher cognitive demands on the user than browsing the Internet at leisure. As new technologies blur the borders between digital and physical objects, as in the case of ubiquitous and pervasive computing, the mediating role of the interaction environment will only increase. Lee (2000) previously suggested *communication settings* as the mediator for interactivity outcomes. However, extending the above argument about the possibility of non-communicative interaction situations, I named this element of the interactivity framework as *interaction settings*. I consider interaction settings an important variable mediating the nature of and the user preference for the mode of interaction.

The personal characteristics of the user are the most commonly included third-order variables in operationalisations. Interactivity studies have tested a wide range of variables, from computer skills to political affiliations, with various success. As a result of the conspicuous omission of user interaction from the analysis in the structural and perceptual approaches, only limited empirical data are available to support the mediating role of certain personal characteristics on user interactions. However, the findings from structural and perceptual interactivity studies allow for hypothesizing about the user traits most likely to affect the quality of interaction. First, all user-related mediating variables can be categorised into two groups: cognitive and psychological. Among the cognitive user traits, such variables as need for cognition (Jee and Lee, 2002), cognitive abilities owing to age (Heim, 2008; Rauterberg, 1997; Said, 2004), computer skills (Lee, 2000) were reported to be influential. The psychological personal variables, which deserve

particular attention, are self-efficacy and involvement. Newhagen et al. (1995) defined *self-efficacy* as "a concept that describes an individual's sense of being able to cope with the system" (p. 165). Bucy & Tao (2007) suggested that self-efficacy as a person's "perception of task difficulty and control over outcomes" (p. 569) is important for the "activation and regulation of behaviour" and "subsequent influence on emotion and cognition" (p. 660). Moreover, several empirical studies (McMillan, 2000; McMillan et al., 2003; Wu, 1999) found that personal involvement with the subject matter strongly correlates with perceived interactivity. However, only one study (Chung and Zhao, 2004) looked at personal involvement's relation to interaction behaviour. This study concluded that the involvement level did not affect the volume of interaction (operationalized as the number of clicks) but, rather, affected the quality of interaction (more clicks on product-related links).

The interactivity literature points to the above personal user characteristics as the most likely ones to affect user interaction behaviour. The range of such variables can be bigger, and not all the identified variables can be applicable to a specific project. For example, cognitive abilities owing to age difference may not be relevant to some design situations. Nevertheless, I argue that personal user traits will affect the nature of user interaction with interactive media structures.

While the relationship between structural and perceived interactivities has received some attention in empirical studies, the relationship between interaction and user perception of interactivity has yet to be properly addressed. Thus, in her recommendations for future research, Tremayne (2005) suggests, "More experiments are needed that measure both functional interactivity and perceived interactivity. If functional

interactivity and perceptual interactivity are unique concepts, it is important to determine how and when the two are causally related and how and when they are not" (p. 67). In a study which showed the usefulness of measuring all three main elements of the interactivity framework, Chung and Zhao (2004) helped to clarify the above relationship. They found that consumers' perceived interactivity was positively related to their surfing behaviour operationalised as clicking. In fact, 50.3% of the variance of the perception of the interactivity with the website could be explained by clicking behaviour, in other words, by actual user interaction. One can conclude that the perceptual approach assumes that the user perceives structural interactivity, whereas the perceived interactivity scales (McMillan & Hwang, 2002; Wu, 2005) are measuring the dimensions (perceived control, speed, engagement, etc.) in which perception should normally occur during and as a result of actual interaction. Therefore, perceived interactivity appears not to be measuring the perception of interactive media functions directly but, rather, through the perception of the interaction with these functions.

To address this conceptual dilemma, one needs consider whether the perception of interactive features can occur prior to the actual interaction with them. For example, Wu (2005) defined *perceived interactivity* "as a psychological state by a site-visitor *during* [emphasis added] the interaction process" (p. 48). Bucy & Tao (2007) submitted that "interactivity influences media effects through the mechanism of perceived interactivity, which arises from engagement with interactive media but occurs prior to media effects" (p. 655). Sundar (2004) observed that "perceptual measures stress the 'experience of interactivity'" (p. 386). Thus, all three above studies imply that perceptions occur *during* or *as a result of* interaction. However, if we apply Gibson's (1979) or Norman's (1988)

concept of affordances to the above problem, we can arrive at a different conclusion. The affordances (i.e., the range of possible actions) of an interactive system can be reasonably assumed to be perceived by the user upon visual observation of its structure. Similarly, if the user has had experience interacting with either the same or a similar interactive object in the past, he or she may have an even stronger (not necessary more accurate) perception of the object's interactivity. Additionally, Lee (2000) observed that certain interactivity perceptions can be induced as a result of the feeling of novelty about a new technology. Therefore, one can conclude that interactivity perception may arise as the result of the direct observation of the interactive features present in a medium, without actual interaction.

However, exactly how strong can such a direct perception be, and what are the chances of its occurrence? Both the Internet and most interface designs of computer applications are text-heavy, relying on a textual form of interaction (hyperlinks, menus, button labels, operation manuals, etc.). Although text is normally a better clarifying device than, for instance, images, it requires more cognitive effort for interaction. Additionally, the success of communicating the affordances of an interactive object depends, to a great extent, on good design skills. The role of perceivable affordance will only increase in the design of interactive media as the digital objects leave the boundaries of the 2D computer screen and become more pervasive in physical spaces. However, the presence of perceived affordances in today's interfaces is very limited and, therefore, the direct perception of interactivity can be expected to be limited as well. I include this issue in the proposed framework by implying stronger coupling of perceptions with interactions than with interactive structures of a medium.

To further determine the relationship between interaction and perceived interactivity, one needs to consider the individual psychological factors contributing to the overall perception of interactivity. One such dimension that appears to contribute significantly to the perceptions of interactivity is the level of engagement.[2] McMillan et al. (2003) concluded that engagement was a better predictor of attitude to a website than other psychological dimensions in their perceived interactivity scale. Engagement has been the subject of many interactivity studies and is best described in terms of the psychological concept of *flow* (Nelson, 2007). Csikszentmihalyi (1975) introduced this concept in his optimal flow theory, where he defined it as "the state in which people are so involved in an activity that nothing else seems to matter; the experience is so enjoyable that people will do it even at great cost, for the sheer sake of doing it" (Csikszentmihalyi, 1990, p.4). Ghani and Deshpande (1994) applied this concept to a human-computer interaction in the workplace and found that the flow was "determined by the individual's sense of being in control and the level of challenge perceived in using computers" (p. 381). More importantly, however, Ghani and Deshpande (1994) concluded that "the consequences of experiencing flow" were "greater experimentation, browsing, and exploratory behaviors" (p. 383). This effect on the user behaviour, in turn, increased the extent and duration of computer use. Therefore, one can conclude that engagement has a reciprocal influence on the user's interaction with interactive features.

Along with the individual psychological factors and the reciprocity between interaction and user perceptions of interactivity, one should consider the effect of user emotions on interaction. Some scholars have pointed out the close association between

[2] Two different meanings are assigned to the term 'engagement' in the interactivity literature: (1) physical or cognitive interaction with interactive objects, and (2) a psychological state of immersion, excitement, connectedness, etc. arising as a result of interaction.

human emotions and behaviour. For example, Norman (2004) observed, "Emotions, we now know, change the way the human mind resolves problems—the emotional system changes how the cognitive system operates. . . . In other words, happy people are more effective in finding alternative solutions and, as a result, are tolerant of minor difficulties" (pp. 18-20). Jordan (2000) asserted that "[p]leasurability is not simply a property of a product but of the interaction between a product and a person" (p. 11). In addition, Jordan (1998) empirically confirmed that "pleasureable products were used more than they would be otherwise" (p. 29). The above arguments show that user emotions, either positive or negative, arising during the interaction with an interactive object have a direct reciprocal effect on the quality of user interaction with this object. However, emotions can also arise *prior* to the interaction with a product. Although Jordan (1998) concluded that "vast majority" (p. 26) of his respondents experienced emotions of pleasure/displeasure *during* the product use, "a significant minority also experienced these feelings *before* [emphasis added] and after use of the products" (p. 28). Interestingly, the prior emotions were overwhelmingly positive. The above observation provides additional support to my previous argument that user perceptions of interactivity may occur directly, without actual interaction with an interactive object. The fact that only a "significant minority" of the respondents experienced the emotional perception of a product either before or after using it further confirms my hypothesis about the rather limited nature of users' direct, non-mediated perception of interactivity features.

The above discussion of interaction and perceived interactivity relationship suggests that the mediating role of perceived interactivity appears to be more complex then previously suggested in some conceptualisations (Bucy & Tao, 2007; Lee, 2000; Wu,

2005). I argue that perceived interactivity is the result of both the interaction with interactive features and the direct perception, or expectations, of the interactivity level of features. However, I consider the connection between perceived interactivity and interaction to be stronger than that between perceived interactivity and the observed interactive structures. I also argue that a specific aspect of perceived interactivity, the level of engagement, has a reciprocal affect on the quality and volume of user interaction with a medium. This argument suggests that the mediation role of perceived interactivity is more complex than was previously believed and points out further directions for theorizing.

3.4 The Issue of 'Interactivity Ideal'

This last conceptual issue—the illusive interactivity ideal— does not directly arise from the proposed interactivity framework but is often raised in interactivity conceptualisations and discourse in general. It remains a heated topic of debate today and, therefore, needs to be addressed here. At the core of the debate is what should be held as the measure of full interactivity when assessing interactivity levels of interactive systems or individual interactive functions. Considering my proposed framework's focus on the mediating role of user interaction in the perception of (structural) interactivity, the question can be reformulated for its further analysis as follows: What kind of interaction should be considered as the model in the evaluation and design of interactive systems? To answer this question, the underlying differences in the various approaches to and definitions of *interaction* in relevant fields need to be analyzed. Many disciplines use the concept of *interaction*, each one assigning a different meaning to the phenomenon.

However, for the purpose of human-computer and computer-mediated human-human interaction, the concept of *interaction* as it is understood in sociology, communications studies, and HCI appears to be most relevant (McMillan, 2006).

In its sociological meaning, interpersonal interaction is described in terms of two or more agents who have to be located within each other's perceptual range, to share a minimum set of common knowledge and assumptions about the real world, to use symbolic communication, and to be aware of and influenced by their environment. The negotiation of meaning during an interaction is an essential part of the process. Interaction occurs "when each of at least two participants is aware of the presence of the other, and each has reason to believe the other is similarly aware" (Duncan, 1989, p. 325). Jensen (1998) observed that, according to the sociological notion of interaction, "it is possible to have communication without interaction (e.g., when. listening to the radio and/or watching TV) but not interaction without communication" (p. 188). This observation explains why interaction and communication became practically synonymous in sociological studies (McMillan, 2006).

Within the communication and mass media tradition, *interaction* has been interpreted differently. Defined as *para-social interaction* (Horton & Wohl, 1956), it refers to the illusion of a face-to-face interaction between audience and TV personalities. Even though a communication channel does not allow for two-way interaction and even though para-social interaction is a psychological state, para-social interaction with media resembles interaction in its sociological meaning. Other interpretations of interaction with media describe it as various processes and actions by viewers in response to media content (e.g., interpretation of messages, dissemination of information in social groups).

These conceptualizations of interaction contradict its sociological definition because a broadcast channel, as an agent in the interaction process, cannot be "aware" of viewers' reactions and cannot adjust its behaviour due to its inherent technological structure. As well, viewers cannot communicate their feedback to the media source in a responsive and effective manner. For these reasons, the sociological definition of interaction does not apply to human-media interaction.

HCI research traditionally describes the concept of *interaction* in terms of communication between a single user and a single computer system. HCI researchers often metaphorically refer to the human-computer communication as a *conversation* or *dialogue*. In computer science, the conversational model is closely associated with the human intelligence ideal (Rafaeli, 1988). For example, Turing's (1950) test uses the proximity to a human natural language conversation to test the intelligence of a computer system. Moreover, Human Factors research specifically seeks to improve human-computer interaction by understanding and applying human interaction principles to interface design. Although the current machine-human interaction often resembles two monologues rather than a dialogue (Norman, 2007), the conversational ideal remains the reference point for designing intelligent interactive systems. Thus, HCI follows the sociological definition of interpersonal interaction and the conversational ideal in particular. The discrepancy with the sociological notion of *interaction* in HCI is, however, caused by the central role of the concept of *control* in HCI research tradition. As Jensen (1998) noted, "the 'control' aspect clashes with [the sociological concept of interaction] since control can be seen as the opposite of mutuality, reciprocity and negotiation" (p. 190).

The differences in the various definitions of interaction in sociology, media studies, and HCI, reveal that only interaction with traditional media has significant differences from the traditional sociological formulation of interpersonal interaction. In contrast, today's new media do not have the technological restrictions of traditional mass media, which do not permit a two-way communicative exchange between media broadcasters and audience. Therefore, the notion of interaction in its traditionally sociological meaning could be applied to the new media if it were not for the argument about the existence of a technological mediation layer as opposed to the non-mediated character of face-to-face communication. This argument, however, can be countered by the proposition that all human communication is mediated. Even face-to-face interactions are mediated through human senses (Lievrouw and Finn, 1990). Moreover, individuals interacting with new media usually expect them to follow the common, socially accepted rules of interaction (Reeves & Nass, 1996). The Activity Theory in psychology, recently applied in CSCW to groupware software design, also supports this counter-argument. Activity theorists point out that interactions are always mediated by mediating artifacts which have both constructive/enabling and constraining/governing roles and which affect the nature of an interaction (Omicini, Ricci, and Viroli, 2006). Therefore, the differences among various kinds of interactions can be accounted for by the character and effect of the mediators, but the underlying concept of interaction always adheres to the same principles.

The above conclusion seems logical and, thus, paves the way for adopting an interpersonal interaction model as the ideal of interactivity. However, one contradictory issue remains unaddressed which deserves more elaboration then it has so far received in

the literature: the conflict between the nature of interpersonal interaction and the centrality of the control dimension in human-computer systems. In this thesis, my review of the interactivity literature in this thesis showed that researchers consider user control, together with the bi-directionality of communication, to be the primary dimension of interactivity, in both structural and perceptual conceptualizations of the construct. Empirical studies support the theoretical proposition that the higher the degree of user control (whether provided through interactive functions or simply by being perceived by the user), the higher the measured level of interactivity (structural or perceived) is likely to be. Consequently, designing a highly interactive system includes providing, among other features, a high, one-sided user control over the form and content of the mediated communication. In contrast, a non-mediated human interaction where one participant has dominant or total control over the conversation or actions of another participant would not be perceived by either participant or an observer as being *interactive*, in the sociological meaning of the term. However, this situation occurs in human-computer interaction: people love to be in the total control of their 'dialogues' with interactive systems. Interaction designers use the above knowledge to build interactive applications which, however, cannot be called *interactive* from the sociological perspective. The above conflict between user control and the principles of non-mediated human interaction is likely to occur only in human-system interactions. In technologically mediated human-human communication, all participants are likely to have similar control over the computer system, which gives them equal control in relation to each other. Thus, the overall system appears to have the balance of a natural conversation.

The above observation leads to the conclusion that, while the 'interpersonal interaction' ideal is suitable for the evaluation of human-human technologically-mediated interactions, it is not appropriate for assessing human-system interactions, at least in its unchanged sociological definition. Therefore, human-system interactivity needs a separate interactivity reference. Perhaps if the sociological definition of interaction were extended to accommodate the role of user control, the new definition could provide a suitable model of interactivity. McMillan's (2006) categorisation and discussion of interactivity types as user-to-system, user-to-document, and user-to-user may provide inspiration and a promising direction for such a re-conceptualisation. Nevertheless, mediated human-human and human-system interactivities appear to require different sets of 'interactivity ideals'. This conclusion implies that interactivity practitioners should not compare conversational interactive features directly against the features designed for interaction with a system or documents.

I believe that the proposed interactivity framework and the accompanying discussion of conceptual issues can help to advance interactivity studies by suggesting a more holistic approach to the concept and by drawing attention to some conceptual aspects requiring further theorizing.

CONCLUSIONS

Over two decades of academic interest in new media studies and in interactivity as their defining characteristic have produced a large body of literature. So far, researchers have focused on isolating and defining the concept of *interactivity* for its effective study. Most approaches to interactivity studies seem to agree that computer-mediated interactivity is a complex, multifaceted construct and that a sound definition of *interactivity* should be generalisable across all situations and technologies. Other than the above, the definitions and conceptualisations of interactivity have fundamental differences, and researchers have yet to agree on how the concept is best conceptualised. Among the various approaches to the study of computer-mediated interactivity, the following three have emerged as dominant: structural, process-based, and perceptual. Each approach places interactivity into a different location and conceptualises it from a different focal point.

The structural approach views interactivity as a technological property of the medium, which is invariant among users. This approach operationalises interactivity in terms of the number and, sometimes, quality of interactive features present in the medium. The early structural theories are exploratory and tend to produce typologies and classifications of interactivity types or interactive media. Such an approach has proven inefficient because it demands constant revisions due to continuous technological progress. Later structural theories conceptualise interactivity by using its dimensions and largely agree that *control* and *direction of communication* are the two most important dimensions. However, structural interactivity studies have produced inconsistent and, at times, contradictory results. The limited ability of structural models to explain the

relationship between interactive structures and interactivity effects points to the possible mediating effect of third-order variables. Despite the criticism of this approach, it often appeals to interactivity practitioners because it allows for relatively simplice and inexpensive models when operationalising structural interactivity.

The interactive exchange approach views interactivity as a medium-independent characteristic of communicative exchange. This approach operationalises interactivity in terms of the actual user behaviour, measuring interactivity as a ratio of semantically related exchanges to the total number of such exchanges. The focus on the communication process rather than communication technology makes this approach easily applicable across various media types, thus holding the promise of offering a universal conceptualisation of mediated interactivity.

Contrary to the structural and communicative exchange approaches, the perceptual approach focuses on interactivity as a subjective experience of the user. This approach also conceptualises the construct from the perspective of interactivity effects. Perceptual interactivity theorists do not deny the existence or validity of the previous two types of interactivity but neglect them in theorizing because they are viewed as less effective predictors of interactivity effects on the user. As a result, the perceptual conceptualisations often operate with the same dimensions as the structural conceptualizations do (e.g., *control* and *direction of communication*); however, they define these dimensions from the user's perspective. The strength of perceptual models is twofold. First, empirical studies suggest that perceived interactivity measures have a stronger correlation to interactivity outcomes than, at least, structural interactivity.

Second, perceptual conceptualisations usually include interactivity effects in their models, and thus address the issue of causal relationships, without looking only for correlation.

Despite significant advances in theorizing technology-mediated interactivity, the conceptual models used in the three operationalisation approaches seem incomplete. Structural interactivity studies neglect the mediating role of actual user interaction and user perceptions of interactivity. The interactive exchange theories neglect to explain the causal relationship between interactive media stimuli and user interaction. They have also yet to offer a clear model which would integrate interactivity outcomes. Perceived interactivity models position user perceptions as independent variable and interactivity outcomes as dependent, ignoring the role of interactive structures and actual user interaction with these structures in the formation of user perceptions. In other words, each approach tries to establish a correlation between its definition of interactivity and interactivity outcomes, often disregarding the antecedent or mediating roles of the other interactivity types. Recently, however, some scholars have attempted to offer a more holistic approach to interactivity by embracing various types of interactivity within a single comprehensive conceptual model (Bucy & Tao, 2007; Lee, 2000; Rafaeli & Ariel, 2007; Wu, 2005). This direction is promising for future conceptual and empirical interactivity research and deserves more scholarly attention.

The analysis of empirical studies confirms the above criticism and shows other conceptual gaps. The empirical findings in all three dominant approaches further stress the mediating role of third-order variables by revealing the non-linear nature of the relationship between interactivity (regardless of how it is defined) and interactivity outcomes. The third-order variables affecting interactivity outcomes are often referred to

as either "antecedents" or "mediators," depending on the conceptual model used. So far, empirical studies considered such personal user characteristics as motivation, involvement, need for cognition, web skills, and technology experience as possible mediators. The results of these studies vary and are at times contradictory. However, the researchers agree that a broader range of mediators should be tested in future research.

Empirical researchers have often identified a need for more sophisticated methods and deeper levels of analysis to establish the causal mechanisms for dependent variables. For example, McMillan's (2003) empirical findings that not all structural features and not all subdimensions of perceived interactivity affect the user's attitude towards a website demonstrate the level of complexity in attempts to establish cause-and-effect mechanisms. Current conceptual models, which consider a single type of interactivity as an independent variable and its outcomes as a dependent variable, neglect the interactions between individual interactivity types and, thus, are unlikely to offer the required deeper level of analysis.

As well, some methodological choices in empirical studies call for more scrutiny. Surprisingly few of the reviewed structural and perceptual studies included actual user interactions with interactive functions in their analysis of causal relationships. Considering the primary mediation role of user interaction, which I argue for in the proposed interactivity framework, such measures should be important for establishing causal mechanisms. Another recurring methodological pattern for all controlled experimental studies, regardless of the conceptual approach adopted, is to manipulate interactivity by varying the number and quality of interactive features. However, process-

based and perceptual studies leave out structural interactivity from their operational models and analysis.

To address some conceptual issues uncovered through the critical analysis of the literature and to identify new avenues of research that could advance interactivity studies, a new interactivity framework is proposed in this thesis. This framework assumes the validity of all three main types of interactivity, positions them in the structure-interaction-perception-outcomes order, and explains the causal relationships among them in terms of third-order variables. In this framework, structural interactivity is viewed as an independent variable and the degree of user interaction and user perception of interactivity as dependent variables. In contrast to the previous conceptual models, which ignore actual user interaction, the new framework places it at the centre of the conceptualisation. The new framework argues that the nature and degree of user interaction with interactive media are determined by a combination of personal user characteristics, interaction goals, and interactions settings. Also, the new framework suggests the important mediating role of actual interaction for the user's perception of (structural) interactivity. This framework responds to the need for a deeper level of analysis by theorizing causal mechanisms among interactivity types and interaction, by elaborating the nature of the mediations, and by providing a more holistic view of the phenomenon than has been offered previously. The proposed framework is not intended as a new theory but, rather, as a tool for taking a more structured, comprehensive approach to interactivity inquiry and for clarifying the ambiguous, generic use of the term *interactivity* by being more specific about exactly what aspects and types of interactivity researchers deal with in their studies.

Furthermore, this thesis draws attention to the terminological confusion and inconsistencies in the interactivity discourse created by the synonymous use of *interactivity* and *interaction*. The result is not only an unstable vocabulary, a common phenomenon for new emerging concepts, but also conceptual ambiguity as in the case of term *perceived interactivity* (i.e., is it structural or behavioural interactivity that is being perceived?). To address this terminological ambiguity, it is proposed to reserve *interactivity* to refer exclusively to the interactive potential of a system and to use *interaction* to refer to the quantity and quality of mediated user-system or user-user communicative exchanges. This terminological solution is reflected in the proposed interactivity framework.

Finally, this thesis revisits the debate about the interactivity 'ideal'. Contrary to the popular "conversational model" view, I argue that the definition of *interaction* in its sociological meaning is not applicable to user-system interaction. The central role of *control* in human-computer interaction contradicts the sociological definition of interaction. While the sociological approach remains suitable for the assessment of user-user mediated interaction, user-system interaction needs a separate interactivity reference. Therefore, the direct comparison of user-user interactive functions against user-system functions appears to be conceptually unsound.

The review and critical analysis of interactivity research in this thesis have shown the evolution of interactivity approaches and theories over the last two decades. However, conceptual leaps have been more difficult to achieve than technical ones, and more questions remain than answers. One promising direction of interactivity research which can help answer such questions is further investigation of the causal mechanisms among

interactivity types and interaction, with a focus on the effect of third-order variables. Such investigations may not only suggest explanations of the current inconsistencies and contradictions in some interactivity studies but may also help researchers to move beyond the current state of inquiry towards building a more holistic understanding of the phenomenon of interactivity.

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APPENDIX 1

Key Concepts and Definitions

Computer-mediated communication (CMC) refers to any form of human communication via networked computers. Depending on the definition of human communication, CMC can be defined narrowly or broadly. "At its narrowest, CMC refers to computer applications for direct human-to-human communication. This includes electronic mail, group conferencing systems and interactive 'chat' systems. At its broadest, CMC can encompass virtually all computer uses." (Berge & Collins, 1995, p.11)

Computer-mediated interactivity (or ***interactivity***). The CMC literature currently does not agree about the definition of computer-based interactivity. See Chapter 1 for a range of proposed definitions. Since this thesis focuses on interactions mediated by computers, I use the terms *interactivity* and *computer-mediated interactivity* interchangeably.

Interaction design is a relatively new applied design discipline with multidisciplinary roots. Löwgren (2008) points out the following two distinct perceptions and increasingly converging intellectual traditions within interaction design:

> One interpretation is to view interaction design as a design discipline, distinguished by its focus on the digital design materials: software, electronics and telecommunications. . . . As a design discipline, it is more closely affiliated with industrial design and architecture than with engineering and behavioral science. . . . The other interpretation of interaction design is to see it as an extension of human-computer interaction (HCI), a field originating in experimental psychology and computer science and tracing its roots to the 1970s. The main concern in HCI was always to assert instrumental qualities such as usability and usefulness of digital products and services, predominantly in work-related

or task-oriented use situations and typically with a focus on an individual user and his/her goals.

The Internet and ***the World Wide Web (WWW*** or just ***the web)***. In strictly technical terms, the *World Wide Web* is a subset of the *Internet* and cannot be equated to the latter. In reality, however, most authors do not distinguish between the above two notions since most information on the Internet is being accessed today by using a web browser and http protocol. In this thesis, the above two terms are used synonymously.

Involvement (and ***Engagement***). The term *involvement* has two different meanings in the academic interactivity literature: (1) interest in a subject matter, and (2) engagement as a psychological state of excitement, connectedness, etc. arising during the user's actual interaction with interactive features. To draw a clear distinction between the above two terms, I use the former meaning of *involvement* in my discussions.

Manipulation check is a methodological tool incorporated in an experimental study "designed to help the researcher evaluate the efficacy of the experimental manipulation and to verify that participants perceive the manipulation as the researcher intended" (Corsini, 2002, p. 568). For an experimental study to produce valid results, the manipulation of the variables should perceivable by the subjects of the study. When the empirical data do not support a researcher's hypotheses, the manipulation check becomes particularly important for interpreting the results ("Common Mistakes in Student Research," n.d.).

New media broadly refers to "technologies of telecommunication and computing, new user devices (e.g., a videodisc machine), and their practical application in office,

home, business, health or education environments" (Williams, Rice, & Rogers, 1988, p. xi). The use of this term has been criticized for its misleading nature and potential inability to withstand the test of time and ongoing technological progress (Rafaeli & Ariel, 2007). The term *digital media* appears to be better suited for this purpose. However, my analysis of the interactivity literature, both popular and academic, suggests that *new media* enjoys a much broader use than *digital media.* In this thesis, *new media* and *digital media* are used interchangeably.

Operationalization is the process of adapting a conceptual model to the practical purposes of a project and defining the units and methods of measurement. More specifically, Derksen and Gartrell (2000) define operationalisation as "a set of instructions for how a researcher is going to measure the concepts and test the theory" (p. 2466). Since each empirical project pursues its own goals, operationalisations are often project-specific. As a result, the operationalisations of the same conceptual model may differ.

Parasocial interaction is a phenomenon traditionally applied in mass media and communication studies to describe the one-sided relationship between the media personas and the audience. Horton and Wohl (1956) first introduced this concept by observing, "One of the most striking characteristics of the new mass media—radio, television, and the movies—is that they give the illusion of a face-to-face relationship with the performer" (p. 215). Later on, Rubin, Perse, and Powell (1985) revised the definition of *parasocial interaction* to extend the concept to include new media and re-defined it as "the interpersonal involvement of the media user with what he or she consumes" (p. 156).

APPENDIX 2

Scales and Variables of Interactivity (McMillan, 1999, p. 383)

Scale	*Variable*
Complexity of choice	Number of hotlinks from front page
	Search engine
Effort users exert	Menu on home page
	Menu on subsequent pages
	Hotlink to home page
Responsiveness	Has a feedback form
Monitoring of information	Has a hit counter
Ease of adding information	Bulletin board
Interpersonal communication	Newsgroup

APPENDIX 3

Dimensions and Variables of Interactivity
(Ha & James, 1998, p. 469)

1. Playfulness:
1) curiosity arousal devices (like Q&A),
2) games.

2. Choice:
1) choice of color,
2) choice of speed,
3) choice of language,
4) choice of other aspects of non-informational alternatives.

3. Connectedness (operationalized in terms of hyperlinks):
1) self-product related,
2) company related,
3) third-party related,
4) other information.

4. Information Collection:
1) presence of monitoring mechanism (e.g., visitor count, registration at web sites)

5. Reciprocal Communication:
1) email,
2) toll-free phone number,
3) order or purchase mechanisms
4) surveys or solicitation of information from visitors,
5) other devices through which consumers could respond to the web site owner or discuss with other consumers such as chat rooms.

Interactivity Dimension	Percentage of Sites
Choice	52.7
Playfulness	19.1
Connectedness:	
Integrated Hyperlinks (score 4 or 5)	37.0
Information Collection:	
Presence of monitoring mechanism	19.1
Reciprocal Communication:	
Presence of response mechanism	61.8
n=110	

APPENDIX 4

Interactivity Variables
(McMillan, 2000, p. 259)

Concept	Measures	Data Collection Tool(s)
Perceived interactivity	7-point agreement scale from 1=strongly disagree to 7=strongly agree Site: Is interactive Allows two-way communication Gives visitors control Requires user activity Creates a sense of "place" Is sensitive to time needs of users Source McMillan (1999a and 2000a)	Site-manager survey Trained-coder evaluation Untrained-coder evaluation
Interactive features	Site includes: E-mail link Toll free number Registration form Survey/comment form Order/purchase form Bulletin board (asynchronous) Chat room (synchronous) Search engine Viewer choice (e.g. language) Curiosity devices (e.g. Q&A) Games Hit counter Publication date Sources Ha and James (1998), Massey and Levy (1999), McMillan (1998)	Content analysis
Familiarity with a Web site	Three levels: Site managers = high Trained coders = moderate Untrained coders = low	NA

APPENDIX 5

Dimensions and Variables of Interactivity
(Stout, Villegas, & Kim, 2001, p. 725)

Table I. *Dimensions and their underlying variables*

Dimension	Description
Accessibility	Large text/graphics
	Frames
	Additional software
	Links to software
	Pull-down menus
	Text only
Navigation	Depth links
	External links
	Search engine
	Advanced search engine
	FAQ
	Site map
	Additional software
Time	Registration process
	Register to interaction
	Slowdown graphic
Personalized Content	.asp
	Personalized first page
	Personalized messages
Delivery of Message	Video
	Audio
	Push media
	VR
	Radio station
	Text only
Data Entry and Use	Calendars
	Personalized messages
	Input personal data
	View personal data
	Update personal data
	Participate in surveys
	Feedback
	Participants for research
Entertainment	Games computer
	Games others
	Light quizzes
	E-postcards
	Entertaining boards
	Links to entertaining sites
Promotions	Cross-promotions
	Special offers
	Sweepstakes
	On-line orders
Relationship	Registration process
	Registration for data
	Personalized messages
	Contact—webmaster
	Contact—health professional
	Contact—other web users
	Contact—professional moderator
	Newsletter
	Classes

APPENDIX 6

Dimensions and Variables of Interactivity
(Lee, Lee, Kim, & Stout, 2004, pp. 106-108)

Items Used To Code Computer Web Sites Interactivity

1) Accessibility

1. Does the Web site require a registration process when opening the site for the first time?
2. Does the Web site require a registration process to obtain data/documents/information?
3. Does the Web site require a registration process to interact with other users or the company (the site owner)?
4. Does the Web site require additional software to navigate or access data/documents/information?
5. Does the Web site provide links to the additional software to navigate or access data/documents/information? (e.g., Flash plug-ins, Acrobat reader)
6. Is the Web site designed based on a frame?
7. Does the Web site offer a text-only option for all pages?
8. Does the Web site offer options/instructions to enlarge texts or graphics?
9. Does the Web site offer information in language other than English?
10. Does the Web site offer glossary for the terms used in the site?

2) Navigation

11. Does the first page of the Web site fit in your computer monitor (so that you don't have to scroll down to see the entire page)?
12. Does the Web site have a menu or subject categories?
13. Is the menu or subject categories located:
13-a. On the top of the site
13-b. Left side of the site
13-c. Right side of the site
13-d. Bottom of the site
14. Does the Web site have pull-down menus?
15. Does the Web site offer a site map/outline/index?
16-a. Does the Web site offer a search engine?
16-b. Does the search engine offer advanced search options?
16-c. Does the search engine allow for misspelled words?
16-d. Is the search engine located:
16-d-1. On the top of the site
16-d-2. Left side of the site
16-d-3. Right side of the site
16-d-4. Bottom of the site
17-a. Does the Web site have any kind of help (e.g., request form, FAQ, Help)?

17-b. Is the help located:
17-b-1. On the top of the site
17-b-2. Left side of the site
17-b-3. Right side of the site
17-b-4. Bottom of the site
18. Does the Web site offer links to explore an issue deeper?
19. Does the Web site offer external links on a topic to explore the issue deeper?
20. Do you have to navigate one level of depth (one click) to get to a particular topic?
21. Does the Web site provide an internal link(s) to navigate in the same page/document?
22. Does a single topic/document divide into multiple pages?
23. Does the Web site change the color of visited links?
24. Does the Web site have dead links (e.g., Page Not Found)?
25. Does the Web site have links to pages under construction?
26. Does the Web site enable users to go back to the home page (the site's first page) with one click?

3) Relationship

27. Does the Web site end in ".asp" or a series of numbers or symbols?
28. Does the Web site offer the possibility of personalizing the first page?
29. Does the Web site recommend personalized options for the user?
30. Can you contact the Webmaster through:
30-a. Phone number
30-b. Fax
30-c. Mailing address
30-d. Anonymous email
30-e. Personalized email
30-f. Chat
30-g. Face time
30-h. Other (Specify)
31. Can you contact the company (the site owner including customer service) through:
31-a. Phone number
31-b. Fax
31-c. Mailing address
31-d. Anonymous email
31-e. Personalized email
31-f. Chat
31-g. Face time
31-h. Other (Specify)
32. Can you contact other Web user(s) through:
32-a. Message board
32-b. Mailing list
32-c. Chat
32-d. Newsgroup
32-e. Gooey

32-f. Other (Specify)
33. Does the Web site allow users to send its page(s) to other user(s)? (e.g., "Send this page to your friend.")
34. Does the Web site offer newsletter via email?
35-a. Does the Web site allow users to input personal information?
35-b. Does the Web site allow users to view personal information?
35-c. Does the Web site allow users to update personal information?
36. Does the Web site invite the users to participate in a survey(s)?
37. After completing the survey, does the Web site offer feedback (e.g., result of survey) other than "Thank you"?
38. Does the Web site offer a calendar making capability?
39. Does the Web site solicit participants for a research study?
40. Log off and log in again. After the second interaction, does the Web site welcome users with a personalized message?

4) Media Richness

41. Does the Web site present information using video?
42. Does the Web site present information using audio?
43. Does the Web site present information using 3D animation?
44. Does the Web site have Virtual Reality capability?
45. Does the Web site have push media?

5) Entertainment

46. Does the Web site have a radio-like capability?
47. Does the Web site have a TV-like capability?
48. Does the Web site offer games?
49. Are the games played against:
49-a. the computer
49-b. other players
50. Does the Web site have quizzes that are not taken seriously?
51. Does the Web site allow users to send e-post cards to other users?
52. Does the Web site allow users to post messages with entertainment purposes?
53. Does the Web site include a list of links to entertaining sites?

APPENDIX 7

Codebook: Long Description of Variables (Rafaeli & Sudweeks, 1997)

Var #	Var Label	Cols	Var Description
33	DEPEND1	53	Does the message contain any reference, directly or indirectly, to previous message(s) on this list (by name, general subject matter, or author)? (Reference can be verbatim AND/OR paraphrased. Code affirmative even if you've already coded YES for QUOTE1.) 1 - Not at all 2 - Yes, one message is referenced. 3 - Yes, more than one message is referenced. 4 - Yes, a SEQUENCE of messages is referenced.
34	DEPEND2	54-57	DEPEND2 Indicate the MSGNUM of the LAST message referenced. Use leading zeros (e.g. 0087). If you are unable to indicate the last MSGNUM, code: 0000 - If none is referenced. 9999 - If the last message referenced precedes the batch of messages you have.
35	DEPEND3	58	Does the message contain any reference, directly or indirectly, to the manner in which a previous message(s) related to those preceding it(them)? (i.e. is there any reference to how or whether earlier messages were RESPONSIVE, HELPFUL, ARGUMENTATIVE, QUICK, STUPID, NUMEROUS, etc..) (Note: for a positive response here, the current message should say something about how two or more earlier messages related to each other.) 1 - No 2 - Yes
36	DEPEND4	59	Does the message introduce a new topic? 1 - No, it's clearly part of an ongoing thread. 2 - Yes, with no reference to previous discussion. 3 - Yes, with reference to previous discussion.

APPENDIX 8

Measures of Interactivity, Antecedents & Consequences of Interactivity (Cho & Leckenby, 1999)

Variable	**Measures (Likert items with 5-point scale)**
Involvement	• I am interested in *credit card* in general. • *Credit Card* is important to me. • *Credit Card* is involving to me. • *Credit Card* is relevant to me. • I am going to use or apply for *credit card* in six months.
Perceived Message-Relatedness	• This ad satisfies what I expected from the banner ad. • This ad provides relevant news and information expected from the banner ad.
Perceived Message-Personalization	• This ad is personal and intimate to me. • This ad provides personalized news and information.
Interactivity	• I would click away from this site right away. • I would stay in this site for a while to look at the details. • I would click into deeper links to see more information. • I would search for additional information. • I would bookmark this site for future usage. • I would provide feedback for the advertiser. • I would be willing to provide my personal information for the advertiser so that the advertiser could have an ongoing relation with me.
Attitude toward the target ad	• I like this ad. • This ad is unpleasant. • This ad is involving. • This ad is annoying • This ad is informative. • This ad is boring. • This ad is good. • This ad is entertaining. • I would enjoy seeing this banner ad again.
Attitude toward the brand	• I like *American Airlines*. • *American Airlines* is satisfactory. • *American Airlines* is desirable.
Purchase intention	• I would fly with *American Airlines* if I were in the market for the brand.

APPENDIX 9

Items Measuring Perceived Interactivity (Wu, 1999, p. 11)

Table 1
Means for Items Measuring Perceived Interactivity

	Means	
	Hallmark (n=104)	American Greetings (n=104)
While I was on the site, I was always aware where I was	4.03	3.80
While I was on the site, I always knew where I was going	3.61	3.59
While I was on the site, I was always able to go where I thought I was going	3.60	3.69
The hyper-linked images and texts tell me exactly what to expect	3.73	3.62
The visual layout was like a roadmap during my exploration of the site	3.23	3.43
When I clicked on hyper-linked images or texts, I felt good about the instantaneous display of information	3.63	3.29
While I was on the site, I could quickly jump from one page to another	3.32	3.37
I felt I did not get much useful information simply because it had too much information**	2.84	3.49
I was delighted to be able to choose which link and when to click	3.77	3.68
I was pleased to express my feelings and opinions on the spot through email or feedback form	2.97	2.98

* 5-point Likert scales were used with 1=strongly disagree 5=strongly agree
** this item scores were reversed in the analysis

APPENDIX 10

Items Measuring Perceived Interactivity (Wu, 2005, p. 59)

The nine-item Likert scale for measuring perceived interactivity of websites (Wu 2000):

1. I was in control of my navigation through this Web site.
2. I had some control over the content of this Web site that I wanted to see.
3. I was in total control over the pace of my visit to this Web site.
4. I could communicate with the company directly for further questions about the company or its products if I wanted to.
5. The site had the ability to respond to my specific questions quickly and efficiently.
6. I could communicate in real time with other customers who shared my interest in this product category.
7. I just had a personal conversation with a sociable, knowledgeable and warm representative from the company.
8. The Web site was like talking back to me while I clicked through the website.
9. I perceive the Web site to be sensitive to my nutritional information needs.

Note: The scale ranged from Strongly Agree to Strongly Disagree.

APPENDIX 11

Items Measuring Perceived Interactivity (McMillan & Hwang, 2002, p. 37)

Factor Loadings of Perceived Interactivity

Items[a]	*Item Number*[b]	*Real-Time Conversation*	*No Delay*	*Engaging*
Enables two-way communication (com)	I_1	.879		
Enables concurrent communication (t/com)	I_2	.833		
Non concurrent communication (t/com)*	I_3	.826		
Is interactive (all)	I_4	.807		
Primarily one-way communication (com)*	I_5	.760		
Is interpersonal (com)	I_6	.758		
Enables conversation (com)	I_7	.721		
Loads fast (t1)	I_8		.936	
Loads slow (t1)*	I_9		.931	
Operates at high speed (t1)	I_{10}		.924	
Variety of content (con2)	I_{11}			.745
Keeps my attention (t/con)	I_{12}			.745
Easy to find my way through the site (con1)	I_{13}			.713
Unmanageable (con1)*	I_{14}			.640
Doesn't keep my attention (t/con)*	I_{15}			.621
Passive (com/con)*	I_{16}			.597
Immediate answers to questions (t2)	I_{17}			.578
Lacks content (con2)*	I_{18}			.534
Eigenvalue		6.205	2.635	1.975
% of variance		34.471	14.640	10.970

Notes: Extraction method was principal component analysis. Rotation method was direct oblimin with kaiser normalization (pattern matrix). Only loadings of .45 or higher are shown.

*Phrase recoded for analysis.

[a]Phrases are coded to indicate which dimension they were designed to measure: com=communication, con1=control of navigation, con2=control of choices, t1=time to load, t2=time to find information, com/con=overlap of communication and control, t/com=overlap of time and communication, t/con=overlap of time and control, and all=overlap of all items.

[b]Item numbers are assigned to coordinate with Figure 2.

APPENDIX 12

Items of Perceived Interactivity Scale
(Liu, 2003, p.210)

Items
Active control
I felt that I had a lot of control over my visiting experiences at this website.
While I was on the website, I could choose freely what I wanted to see.
While surfing the website, I had absolutely no control over what I can do on the site.*
While surfing the website, my actions decided the kind of experiences I got.
Two-way communication
The website is effective in gathering visitors' feedback.
This website facilitates two-way communication between the visitors and the site.
It is difficult to offer feedback to the website.*
The website makes me feel it wants to listen to its visitors.
The website does not at all encourage visitors to talk back.*
The website gives visitors the opportunity to talk back.
Synchronicity
The website processed my input very quickly.
Getting information from the website is very fast.
I was able to obtain the information I want without any delay.
When I clicked on the links, I felt I was getting instantaneous information.
The website was very slow in responding to my requests.*

**These items are reverse scaled.*