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Article (Accepted version)  
(Refereed)

**Original citation:**

Tong, Amelia and Klecun, Ela (2004) Towards accommodating gender differences in multimedia communication. [IEEE transactions on professional communication](#), 47 (2). pp. 118-129. ISSN 0361-1434

DOI: [10.1109/TPC.2004.828221](#)

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# Towards Accommodating Gender Differences in Multimedia Communication

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**Abstract-- While there have been measurable improvements in the technical development of multimedia, research from a socio-technical viewpoint suggest that the benefits of multimedia technology, especially in fulfilling user requirements, do not always live up to initial promises. This paper aims to address one of the fundamental, but often much neglected areas in user requirements, i.e. gender-related issues. The paper identifies and discusses gender differences in multimedia communication and recommends how the differences could be treated. It proposes the model for accommodating gender differences in multimedia communication.**

**Index Terms-- Multimedia communication, gender differences, multimedia applications**

## I. INTRODUCTION

Multimedia plays an important part in the field of communication, as a facilitator for human-to-human connection and as an information provider. Users, as the ‘ultimate’ senders and receivers in the communication process, remain the central constituents of multimedia communication. Research in multimedia that focuses on user requirements has been relatively scarce compared to that on technical requirements [1]. Traditional communication development has been demand (i.e. user) led, since the pressure of much technological development was initiated by necessity. Multimedia communication development has mainly been technology led, as it continues to reap the benefits from vast improvements in technological developments over the past few decades. This may partially explain why initially user needs have been comparatively overlooked in multimedia communication development. Nonetheless, adapting to user requirements is equally important. The use of advanced technology will otherwise serve no more than ‘bells and whistles’ to multimedia applications. The case for addressing gender differences in user requirements is rooted in the context of supporting diversity in human communication. Gender is a primary dimension of

diversity; the immutable differences of sex exert an impact throughout each individual’s life [2]. The case for addressing user requirements in multimedia communication rests on the argument that multimedia communication changes interpersonal communication and the distribution of information in society. By investigating the social aspect of the diversity of communication, multimedia technology should have the potential to progress beyond those benefits provided by technology.

Whilst multimedia technology itself may be constructed as neutral, many observers have identified the use of such technology in communication as deeply gendered [3-6]. As gender specific issues gradually become a recognized area of academic research, literature on women, multimedia technology and culture has been particularly prolific in the past two decades. Research in this area began in the proceedings of conferences on women and computing. These conferences have provided opportunities for female practitioners from academia and industry to discuss gender-related issues. These conferences tend to take on a ‘feminist’ approach, which focuses on the fight for equality for women in the culture of technology. Such an approach can initially be divided into two main strands [7]. First, the ‘women into technology’ strand. This strand addresses the limited presence of women in technology and emphasizes education, training and equal opportunity initiatives to increase the number of women in the field. Second, there is the sociological and philosophical strand. This strand focuses on the nature of work involving technology and the links between technology and feminist history. A third strand of studies has now emerged as contemporary gender studies shift from the traditional concerns about women in the workplace towards the culture of computer ethics. Interests are focused on perspectives, attitudes and identities of women in ‘cyberspace’ and are often attached to studies of the Internet [1, 8].

Often considered as an opposing viewpoint to the feminist approach, the ‘humanistic’ approach investigates situations and developments as they affect the welfare of both genders, rather than addressing only that of women. The argument is that information technology is likely to affect all those who use it, although the consequences may be different for the different genders. The approach takes the view that both gender and technology should be considered as cultural processes that are not fixed, but capable of

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adaptation and transformation. It is with this notion that this paper discusses gender-related differences raised in multimedia communication and seeks to recommend ways of how these differences should be addressed. We argue that gender differences should be accommodated rather than made neutral in multimedia systems. Our contribution is a proposal for a new model for this accommodation of gender differences in multimedia applications development.

The rest of the paper is organized as follows. The next section identifies the gender-related differences and discusses their relationships with the essential elements in multimedia communication. The paper then discusses how these differences should be addressed, and describes the proposed model for accommodating gender differences in multimedia communication.

## II. GENDER-RELATED DIFFERENCES IN MULTIMEDIA COMMUNICATION

The gender differences identified in this section are based on observations, as described in the literature, of the ways in which gender issues are related to a variety of activities and abilities in a multimedia environment. It is no more possible to say that gender differences influence the developments in multimedia technology, than to say that multimedia technology developments cause identifiable gender differences. This is because in gender studies, no true experiments in the strictest sense can be carried out. In an experiment, as opposed to observation studies, the experimenter has “control over a possible cause in the difference in output” of the process [9]. Fundamentally, a true experiment requires a variable to be manipulated, or subjects to be randomly assigned to certain groups. These criteria cannot be satisfied in gender research, since researchers can neither manipulate people's sex, nor randomly assign people to male or female group. On this basis, gender research observations are mainly obtained from correlation studies, which may allow us to conclude that two variables are affecting each other, never that one causes the other.

With this distinction in mind, it should be noted that the discussion here is not driven by a conclusive experimental outcome, but is drawn from the correlation between the gender differences identified and the essential elements in multimedia communication. We define essential elements as those that have high impact across the different areas of multimedia applications. The areas of multimedia applications include education, e.g. multimedia tutoring systems; information services, e.g. public on-line databases; collaborative work environments, e.g. video conferencing; and entertainment, e.g. virtual reality. For the purposes of this paper we restrict our discussion to professional multimedia communication. Entertainment applications are therefore beyond the scope of this paper.

Based on the review of gender related studies, identifiable gender differences can be categorized here as interpersonal communication patterns, information retrieval interfaces, and empowerment. While the first two categories refer to human-to-human and computer mediated communication (CMC), empowerment refers to the context in which they take place. These differences and their correlation with the elements in multimedia communication were first presented and discussed at the 5<sup>th</sup> International Conference on Integrating Technology and Human Decisions in 1999. Figure 1 extends the ideas developed at the conference and introduced in a previous paper [10], and illustrates the correlation between the identified differences, the essential elements in multimedia communication and the causal relationships between them.

**Figure 1 near here.**

### A. Communication Pattern

This issue addresses gender differences in human-to-human communication. This difference is correlated to the interactivity element in multimedia communication. Interactivity can be defined as the degree of interaction to which participants in a communication process have control over and can exchange roles in a mutual discourse [11-13]. Interactivity in multimedia applications includes not only human-to-machine or machine-to-machine connections, but also most importantly human-to-human connections via multimedia technology. The link between communication patterns and interactivity in multimedia is most evident in collaborative work multimedia applications [14]. In multimedia communication interactivity is an essential element that emerges when the technology is employed across different categories of application [15]. In educational applications a high degree of interactivity between the system and the learner-user is necessary for learning to take place, otherwise multimedia communication may be no more than a one-way presentation of information in different media. In information services applications interactivity occurs when a user sends a message to the system expressing his/her needs for certain information. In order to perform as intended the system must first interpret the user's message, act on the message by looking for the information, and finally respond to the user's message by providing the information requested. Interactivity in multimedia communication is crucial in collaborative work applications. This is due to the cooperative nature of activities that multimedia technology aims to support.

To be able to illustrate how multimedia systems potentially alter communication patterns this section now discusses conventional communication. Empirical research has shown how the two genders differ in conventional communication patterns [16]. In verbal communication, men's voices tend to be deeper and louder than women's. They tend to be more authoritative, talk more, interrupt more, and change topics more often. Women tend towards the styles that

foster participation and communication. They self disclose more, use more personal references and emotional tone and language. In non-verbal communication, i.e. the type of body language used while communicating, women tend to perform gestures such as sitting or standing with their legs together, taking up as little space as possible. Men tend to exhibit the opposite behavior. In terms of eye contact, men are more likely to 'look people in the eye', while women are more likely to stare at those who are not looking at them and avert their gaze when speaking to others. The most influential members communicating in a group are men and women who adapt features of the communication styles of the other gender [17]; the most effective male communicators soften their speech and change topics less often abruptly than their male peers. The most effective female communicators use more third person pronouns. They refuse to be interrupted and they speak to the group as whole rather than to an individual person. This demonstrates that positive, inoffensive communication styles that are used by one gender can be effectively used by the other, indicating that effective communication can be a thoughtful and articulate process and no longer gender specific. The remainder of this section considers to what extent multimedia technology supports this type of communication.

Multimedia technology developments provide alternative communication channels at both the social, as well as the professional level. The Internet, and the use of electronic mail, is now a common form of multimedia communication. The way in which people 'converse' with others on email is different from other forms of communication. Long and formal messages may have the same form and style as their paper counterparts. Short requests and small pieces of information can be quite succinct when compared to direct personal interaction or with a telephone call. However, there is conflicting evidence as to what extent, if at all, these developments alter communication patterns with respect to gender differences [18, 19]. Being mainly text-based, email messages often lack the accompanying features such as voice inflection and body language. This might be seen as a positive note towards greater control by users over the display of their gender attribute in a social context. Although pseudonymity is not an option for professional communication, CMC (particularly email) may alleviate some of problems of face-to-face communication encountered by women. For example, Lind [14] conducted a study of face-to-face and virtual work teams (using email and file-sharing) and concluded that women appeared to be more satisfied with the virtual group experience that the men did. Lind hypothesizes that the lack of non-verbal cues and the structure of an email-enabled virtual group may have allowed for more equal group participation. While email may not be taking the place of traditional work meeting completely, passing information by this means might promote a more direct, less-gender specific approach to communication. However, there is some evidence that the use of computers to mediate communication leads to

more aggressive behaviors and the use of emotionally charged language [16, 20]. Furthermore, in a study of two electronic discussion groups, Herring [18] observed that male and female academic professionals did not participate equally in discussions. A small male minority dominated the discourse. Thus despite democratizing potentials of the technology, there is growing evidence that social relationships in electronic forums mirror many key aspects of face-to-face relationships [19].

Furthermore, multimedia technology such as video conferencing can preserve the non-verbal communication styles, even though such usage has not been as popularized as expected because of the costs. The technology itself can act as a barrier to direct personal communication, e.g. some may initially find it unnatural to speak to an image on the screen. If the feminist interpretation of the world's view on women is adopted, one may worry that such communication can be dominated by men, following the notion that women are more likely to be intimidated by technology [21]. Studies have shown that visual cues engender a strong sense of social presence [22]. An analysis of a professional Web site for teachers that features 'virtual classroom visits', i.e. video clips of teachers teaching, and the asynchronous forums for discussing the videos, uncovered unintentional bias in the representation of gender [23]. Although there are more female than male teachers, females were underrepresented in video clips. This bias was reflected in asymmetries in participation by males and females in the discussions. Although, no females had their videos refused (i.e. less females submitted their video clips to the web site), Herring [23] argues that designers of CMC systems should take gender into account when developing such multimodal interfaces, and more actively encourage female participation, as well as giving them more prominent position. Beyond this, very few studies, if any, have been conducted to raise any gender issues in the context of video conferencing. This is an area that needs further research.

### *B. Communication Interface*

This issue addresses gender differences in human to computer communication. This difference is related to both the information retrieval and the information presentation elements, and is emphasized in all areas of multimedia applications.

#### *1) Information retrieval*

Information retrieval, in short, is the process of matching queries posed by users to the (traditionally text-based) documents available in a given search space [24]. A high level of interactivity between the user who poses the queries, and the agent which carries out the match is therefore essential for effective information retrieval. In traditional text-based information retrieval an index is created from a set of documents (i.e. the given search space) to which queries are applied by users to satisfy their information needs. Effectiveness in satisfying these information needs is often measured by the agent's ability to

retrieve all relevant documents from the search space, and the agent's ability to return only the relevant documents.

In educational applications student-directed activities are advocated as a means to move away from passive textbook and lecture activities [25]. Many multimedia tutoring systems provide opportunities for learners to explore tutorial content non-linearly. Learners are encouraged to find out information for themselves [26], e.g. by formulating their own queries and posing them to the multimedia tutoring system. Information retrieval in this application can take the form of allowing the learner-user to choose a topic to learn in the domain, and the multimedia tutor subsequently retrieving the appropriate material related to the topic requested by the user. It can also take the form of letting the learner-user ask different questions about the domain, and the multimedia tutor retrieving relevant information to answer the user's questions. Adaptive information retrieval is essential for the success of information services dealing with the diversity of needs of the information seekers [27]. In collaborative work applications information retrieval takes place when team members search for and manipulate information in distributed databases.

There are two basic types of multimedia retrieval methods: retrieval via databases, and retrieval via links. In databases, the user has to choose appropriate search terms and the system then looks for these terms, either in the title of the document (not necessarily text only), in the index list, or in the content of the document. This method is highly structured. However, it is often difficult to find and process the right terms. The links method relies on connections between two documents, which have been created by the author of the documents. This method is comparatively unstructured, undirected and often follows intuition [28]. Intuition can be perceived as having an immediate insight to arrive at a true, or at least a highly plausible view, without consciously stepping through evidence or logical sequences. In links retrievals, however, going through large and unstructured volumes of documents must include some sensible approach. In the course of her research Turkle [29] found that women and men have different attitude to using computers. She labels feminine style of computer usage, as 'soft' mastery, which she depicts as bottom-up or bricolage, akin to intuitive and holistic style of 'non-Western' science. Correspondingly, 'hard' mastery (preferred by more males than females) is more rule-driven, and based, for example, on the analytical style of 'Western' philosophers. This implies that female users may benefit from a different retrieval route and in turn a different retrieval interface to male users. However, these findings are not conclusive. For example, a study of 28 university students has shown that both genders used similar searching techniques [28]. Even if we all agree that significant gender differences in cognitive abilities exist, this does not essentially imply different interfaces for different genders, as an interface should be constructed to be useful to different users and environments

[30]. Specialized interfaces for specialized users only are neither practical nor efficient in system development. Furthermore, as Pohl [28] argues such specialization may in itself be gender stereotyping and restrict women's participation and usage of the Internet. Thus, this paper addresses the issue of providing effective means of retrieval for both genders.

## 2) *Information Presentation*

For information retrieval activities to serve their purpose, they need to be supported by the delivery of the retrieved content to the information seeker. One of the factors affecting the effectiveness of such delivery is how the information is presented in terms of form, i.e. the medium used [31]. Research in information visualization has been examining the effectiveness of the different forms of visual presentation of information, ranging from comparing user preference and performance with tables and graphs (different formats) [32], to investigating the effectiveness of reading music from an 'animated' screen versus paper (different media) [33]. Current research has shown an increasing interest in the usability of the various means of display. This interest has, in part, been fostered by increases in capacity and the ease of inclusion of the different media in a computing system [34].

Information presentation plays a significant role in all applications of multimedia communication. Findings from educational psychology indicate that people learn more efficiently and better retain what they have learnt if the learning process involves more than one medium, and that interactive multimedia systems support 'learning by doing' activities [35-37]. For example, text illustration may be made more effective by adding graphics, sound effects, or animation. However, excessive usage of multimedia may be distracting and may decrease the efficiency of learning [38]. Information presentation with the appropriate medium for individual learners is therefore crucial to the facilitation of teaching and learning in multimedia tutoring systems. Information presentation also has a profound impact in information services applications. Information presentation determines what is visually or audibly accessible and what is hidden. Therefore, it directly influences the physical access to information [13]. The form in which information is presented must match the needs of the information seeker, e.g. if he/she is unable to see, then visual display is an inappropriate presentation of information. Moreover, findings in behavior psychology in 'conditioned responses' indicate that an individual's information seeking behavior is caused and affected by the stimuli in the environment he/she is immersed in, which in turn is determined by how information is presented. In collaborative work applications, members in a team carrying out different tasks may require the same piece of information presented to them to aid their work. The form in which information is presented to the different members may vary according to the nature of their tasks. For example, the main team members of an operational unit in an air traffic control team

for a certain sector of traffic are the executive and the planning controllers. The executive controller, whose main responsibility is to maintain the separation standards within the sector, makes use of information presented visually and audibly. The planning controller, whose responsibility is to coordinate the traffic passing in and out of the sector, makes more use of the information presented in audio, which keeps him in contact with the controllers in adjacent sectors [39].

Multimedia information presentation faces more complex interface problem than text-based information retrieval systems. Apart from visualization and layout of multimedia documents, the most intriguing issue arises from the fact that non-textual information may mean different things to different users. As far as thinking and interpretation are concerned, there are basic differences that parallel the physical differences between men and women. Research on gender differences in cognitive abilities has shown significant differences in visual-spatial abilities [28]. These include spatial perception, mental rotation, spatial visualization, and spatio-temporal ability. Multimedia communication has transformed traditional discourse of graphics from two dimensional to four dimensional by including virtual reality. More considerations and studies in visual modeling for the two genders will help bring together the differences in perception, as well as efficiency in the different methods of communicating and constructing meaning [40].

A study by Passig and Levin [41], correlating gender and multimedia interface, suggests that the visual design of the multimedia interface, the way the information is presented and the ease of dialogue between the user and the system affect the user, both in terms of understanding the material and the desire to use it. A study by Gulz [42] suggests that interface preferences tend to correlate with style of thoughts as well as with gender. Thus, in the study when presented with two different interfaces for the same application more women (7) than men (3) preferred the person oriented version, while the spatially oriented version was chosen by more men (8) than women (4). Yet, elaborated spatial frameworks in software are more frequent than equally elaborated social frameworks [42]. Furthermore, there is a legacy in computer culture of masculine images of competition, sport and violence, and metaphors like workbenches, tool kits, drives and engines and so forth [43]. Such interfaces may discourage some females from embracing computers.

The significance of the correlation between gender differences and the combined effect of information retrieval and presentation is more pronounced in the education setting of multimedia applications. This is exhibited through the cognitive style of the learner [44]. In the past decade, learning theorists have suggested different learning styles that are gender-related [45]. Majority of the males, and some females exhibit autonomous, independent learning style, whereas majority of the females, and some males,

exhibit relational, interdependent style. In terms of knowledge and intellectual development, males prefer challenge and debate, individual activities, and the use of external evidence, while females tend towards inter-individual, collaborative activities. The gender differences in learning affect the way information should be retrieved and presented to the learner, which in turn affects the use of tutoring strategies in the educational discourse. This aspect, together with the content of the educational material, has extensive effects on tutoring strategy selection on educational multimedia applications [44], where multiple representations of the same content are possible.

So far this paper discussed gender differences in communication pattern and interface (including information seeking behavior, visualization and perception), and learning styles. The literature surveyed indicates that gender differences in cognitive styles and abilities do exist. These differences lead to the conclusion that women prefer different communication pattern and interface. However, these differences cannot be seen as simple dichotomies but rather as positioned on a continuous scale. Furthermore, this paper argues that technology and gender are not fixed and given but are dynamic forces that interact with each other [28, 46, 47]. This means that that gender differences are not only inherent (physiological) but are socially constructed and thus need to be considered in their social context. The next section discusses this context in relation to multimedia communication and women's empowerment.

### *C. Empowerment*

Rather than being specifically related to any elements or any multimedia applications, this difference is raised initially as a consequence of the ease of access to the type and amount of information through multimedia communication [10]. Gender studies on empowerment by multimedia communication have been undertaken in three different perspectives. The first perspective entails global cultural studies of female in developing countries, and investigations on how these female are empowered as a result of having access to multimedia communication [48]. The second perspective adopts a feminist approach and examines the relationship between multimedia communication and female's self-development, e.g. gaining more confidence, sense of acceptance, and feeling more as part of a group through women electronic bulletin boards [49]. The third perspective approaches the issue from an organization behavioral viewpoint, and examines opportunities for a change of power and work structure between the two genders [50]. It is beyond the scope of this paper to address the first two perspectives of empowerment. Instead, it will adopt the third perspective and explore this difference under the organization collaborative work setting of multimedia applications.

The combination of demographic, organizational, social and technical factors evolved from the advancement of multimedia communication cause the nature of work

relationship to undergo radical changes. The lower level workers have now been ‘empowered’ with more responsibility due to the availability of information. A telesales personnel, for example, who originally was only in charge of sales is now ‘empowered’ to deal with accounts as well, with the availability of the customers’ account detail on the computer screen. The traditional, usually male managers can no longer rely on status and authority to influence activities, but need to empower teams, possibly lower ranks and female dominated, to make their own decisions [10]. However, the traditional view of the gendered roles still stands, even though the roles may not be as hierarchical and rigid as they once were. The predictions prevailed in Europe in the 1970s and 1980s that females were less prepared than males to accommodate changes due to technological innovations, and that female would remain technology-illiterate, to the extent to which they would be excluded from decision making at work [51]. A recent study in gender, work and organization [52] shows that although females today are definitely not technology-blind, little progress has been made in terms of their involvement in decision making. Furthermore, a study by Robertson et al. [53] concludes that women in computing (in academia and industry) continue to be segregated both horizontally and vertically, i.e. they are associated with ‘softer’ aspects of the profession (e.g. sales or marketing), and are underrepresented in higher posts.

Some argue the reason for this bias is that females do not utilize technology as aggressively as males [54]. On the one hand, research has indeed suggested that men tend to disempower in order to gain submissive control, whereas women prefer to empower others through negotiation in order to achieve consensual power [55]. From this viewpoint, multimedia communication may potentially reinforce and magnify stereotypical gendered behavior rather than create a balance for both genders. On the other hand, there are also reports indicating that women have been increasingly taking advantage of multimedia communication to “become their own bosses” by setting up their own businesses [56], especially in the information-intensive service providing sector.

Taking less of a feminist viewpoint, it is clear from the literature in the work process, technology studies and organizational studies domains, that information has nonetheless been unevenly allocated in organizations, not merely restricted in the ‘gendered’ nature. ‘Knowledge’ has been identified as a political device used by some groups to secure protection of their employment, high pay and status, and to exclude others [50]. Gender-related difference in this respect appears to have a larger impact on female workers, not only because of the original personal traits differences of the genders, but the subsequent differences in terms of the nature of the jobs they do, and the way in which these jobs are organized [50]. More studies need to be carried out before one can answer the question of how multimedia communication can be utilized to help to distribute

information and to facilitate social and work-related networks to compromise the difference of the genders.

### III. THE MODEL FOR ACCOMMODATING GENDER DIFFERENCES IN MULTIMEDIA COMMUNICATION

The previous section has identified and discussed the significance of gender-related differences in multimedia communication. This section makes recommendations on how these differences should be treated and proposes the model for accommodating gender differences in multimedia communication. This model is contrasted with different approaches adopted in the past.

The section begins by illustrating in Figure 2 the ideas from traditional gender studies and approaches for addressing gender differences that draw on them. Figure 2 does not represent a coherent model, as such a model does not exist. Its aim is merely to serve as a reference point from which our model (illustrated in figure 3) can be grounded.

#### Figure 2 near here

Both, the approaches depicted in Figure 2 and our model are based on the assumption that gender differences in multimedia communication exist. Where they differ is in the recommendations for treating them. Thus the other approaches recommend the narrowing or neutralizing of gender differences. This has led, for example, to calls for developing different interfaces or systems and web sites focused on women’s needs [47]. Alternatively, adaptive intelligent interfaces, are proposed as having potential to meet different needs of different user groups [27, 57]. In terms of empowerment, feminist scholars focus exclusively on the needs of women and fight for equality between genders.

Our model for accommodating gender differences in multimedia communication, shown in figure 3, provides a novel and alternative viewpoint in the treatment of the differences identified. As opposed to that of traditional gender studies, the model recommends that the differences, although significant and consequential, need not always to be narrowed or neutralized.

The model supports ideas from research in related disciplines such as cultural, cognitive and organizational studies, and draws upon solutions which are directed towards recognizing and accommodating, rather than to narrowing and eliminating the differences. The model builds on exploratory studies in the use of multimedia systems by different genders. For example, Passig and Levin [58] after examining the differences of satisfaction with multimedia learning interfaces between boys and girls, suggest that careful design of multimedia interface can make the use of multimedia content appealing and satisfying to both genders. Spilker and Sorensen [47], analyzing how

gender is constructed in multimedia form and content, report on two multimedia products that have been designed in order to attract female users. The first one, JenteROM – according to the article’s authors – is based on a construction of women as quiet, knowledge seeking but technically less competent users. The second product – HjemmeNett – is based on an assumption that women are seeking trust, broad access, flexibility and individualism. HjemmeNett embodies a belief that there is no need to gender the design of the web service to attract feminine users but at the same time it does not assume that technology is neutral or without gender. It promotes an approach that takes gender into consideration while trying to create masculine as well as feminine spaces. It is such a perspective that the model presented in this paper seeks to develop. Figure 3 illustrates the model, which consists of the identified differences, the recommendations, and the rationale that supports the recommendations. The remainder of this section discusses the recommendations.

**Figure 3 near here.**

#### *A. Realization and Acceptance of Differences*

The gender differences in communication patterns arise from the differences in how males and females tend to express themselves in a conventional way. As opposed to studies, which propose to close the gap by utilizing multimedia technology to neutralize gender interaction, the model advocates the recognition of the gender differences in communication pattern. Its view is that in multimedia communication, existing conventional differences may inevitably be preserved, and that new differences may eventually emerge. Attempting to use technology to neutralize gender may bring about the adverse effect of stereotypical gendered behavior being reinforced and magnified [59]. The issue here is the need to accommodate the differences, by addressing these differences and adapting multimedia technology usage for both genders. This idea is, to some extent, reflected in user interfaces that provide structured and unstructured retrieval methods. However, the model presented here is concerned not just with retrieval methods but also with communication patterns and interfaces. Problems in inter-gender communication are somewhat in line with the stumbling blocks in intercultural communication, which has been identified as [60]: (a) assumed similarity (e.g. an assumption that norms, beliefs and behavior patterns are shared amongst the participants), (b) language (problems arising from language misinterpretations), (c) nonverbal misinterpretations, (d) preconceptions and stereotypes (e.g. stereotyping genders or races), (e) tendency to evaluate (e.g. making comparisons), and (f) high anxiety. The first five points are most relevant to the recommendation being made here. On the one hand, by learning not to assume that males and females should be the same, this model emphasizes sensitivity to the fact that male and female values and goals may differ, and generally their verbal and nonverbal language will vary as well. On

the other hand, awareness of preconceptions and stereotypes which portray the other gender as ‘different’ can help to avoid such stereotypes. For example, although there are differences in multimedia communication pattern in both genders, it is not appropriate to assume that all males exhibit the commonly described interruptive behavior, or that all females are intimidated by technology. Instead of being annoyed by e.g. ‘aggressive’ communication style, it should be recognized that it is a style, which as much part of a gender’s identity, as a religion is part of a culture. The task is to improve awareness and respect, rather than evaluation [61].

#### *B. Creation of Metaphors for User Adaptation*

Communication interface differences, i.e. gender differences in human to computer interaction, arise from the cognitive differences in perception, interpretation, learning styles, information seeking and processing behavior between the genders. The model recommends that these differences should be stressed when designing interfaces for multimedia information retrieval and navigational environments. Although a wealth of studies on cognitive differences between genders has existed for decades, it is only recently when research such as navigating in information spaces and visualization of abstraction arose, that cognitive modeling has become associated with user navigation and information seeking activities.

As opposed to advocating an interface that would adapt to the cognitive differences of the genders when interacting with multimedia applications, the model recommends the design of mechanisms for multimedia applications that would allow the different genders to adapt to the applications themselves. This recommendation is not a result of skepticism towards the concept of adaptive intelligent interfaces, but more as an echo to the recommendation of stereotyping avoidance discussed in the previous recommendation. Interests in the cognitive state of the user have underpinned research on the models systems have of users. Research aimed at developing systems that accommodate models of the gender of users to adapt their interface to gender differences may run into the problem of simply including a selection of stereotypical behavior, which are then selected as most appropriate by the system to match the user [62]. Rather than implanting stereotypes of users into systems for adaptive interfaces, an alternative strategy would be to allow the system to tell the user about itself, such that the user could adapt to the interface of the system. This concept intuitively seems to contradict the now widely accepted idea that it is the technology which should adapt to people, not vice versa. This is not the case; the approach advocated here reinforces the importance of user requirements and the need for technology to be designed to suit users, but acknowledging that gender differences exist, it proposes how these can be accommodated, without designing different systems for different genders.



This approach has been acknowledged by others [57, 62]. Cognitive studies have revealed that people do adapt to the interfaces they use. They do so by making an analogy of the interface as a metaphor of something they are familiar with [63]. The key in this context is for multimedia application interface designers to consider the types of metaphors that can be created by each gender from the interface, and the ease of the creation of these metaphors for each gender. This approach differs from designing interfaces that contain cognitive characteristics of both genders and letting the users pick for themselves. What is recommended here is an attempt to articulate ultimately the user's reflexive response, rather than raising the user's conscious actions. This may also help users to avoid consciously assuming stereotypical gendered behavior when interacting in multimedia environments. This approach encourages the designers to cater for user requirements that are not immediately obvious or made explicit.

The two recommendations above suggest that the gender differences observed should be accommodated rather than neutralized. This stems from the humanistic standpoint taken in this research. The nature of these recommendations is distinguished from that of the "non-sexist" approach [64]. Non-sexism believes that differences arise from individuality and uniqueness, and therefore may not address directly, if at all, the issue of equality. It is therefore perceived by some as playing down the importance of gender.

### C. Organizational Learning

Issues in gender related differences surrounding empowerment evolve from the advancement of multimedia communication that causes the nature of work relationship to undergo radical changes. The empowerment dimension of the model presented here is important because communication and information retrieval do not take place in a vacuum. Wider issues need to be considered if we intend to accommodate gender differences in multimedia communication. As Robertson et al. [53] suggest gender relations of power within organizations are reproduced through processes of communication, through networks of gendered relationships and through wider legitimizing structures.

The review carried out for this research has shown that there is a bias against females for 'powerful' jobs. Empowerment is a multi-dimensional issue and no single set of contingencies can be used to describe it. It does not merely involve the delegation or distribution of power. It involves how leaders lead, how individuals and peers react, and how work related processes are structured [65]. In coupling the utilization of multimedia technology with gender related difference in empowerment, this paper recommends the investigation in organizational culture, and the nurture of organizational learning, before considering the exploitation of technology in this context. We acknowledge, however,

that feminism offers a partial view, and that gender is only one (albeit very important) of variables that disadvantage one group in relation to another. Thus, we advocate a humanist approach. The true paradox of empowerment occurs when power and control are 'given away' or rather when people are given means to empower themselves. From the findings in this research, it appears that 'power' is pretty much still a male preserve. Power will not be distributed through the use of multimedia technology if there is no will to give it away. Organizations need to provide a culture that promotes trust and inclusion for both genders in a collaborative work environment. Organization with traditional, functional management cultures and dominated by masculine psycho-structure are not ready to cope with global diversity, the sharing of information to achieve complex goals and further self-development [65]. Without the ability to envisage changing business needs, organizational dynamics and social changes, the benefits of technological innovations will never be fully realized.

## IV. CONCLUDING REMARKS

This paper set out to address gender differences in multimedia communication. Firstly, the paper has illustrated that although no true experiments in the strictest sense can be conducted in gender-related issues, empirical research in many related disciplines such as education and psychology, have shown the significance of gender differences in multimedia communication. However, the majority of research focuses on the use of email, the Internet (including retrieving information from the Web, communicating via list servers and chat rooms, or playing Multi-User Dungeons). More research should be done in a business environment, and include studies of the influence of video conferencing on gender differences in communication. Secondly, the paper has put across a novel viewpoint in terms of how the differences should be treated. It asserts that the differences should be accommodated, and not necessarily neutralized. Thirdly, the model has contributed to multimedia development, by making a case for the emphasis of socio-technical issues in multimedia research. Multimedia communication is not a new topic, but up to now it has been mainly approached from a technological viewpoint. Gender-related differences are not the only issues that need addressing when analyzing user requirements in multimedia technology development. From the research undertaken in this paper, it is evident that social issues including ethics and culture should also be taken into account.

Future direction of work includes exploring further implications of the main recommendations proposed by the model, both individually and in synthesis. In view of the rich nature of gender issues and the extensive range of activities made possible through multimedia communication, it would be an oversimplification to rest on a small number of guidelines: rather, the guidelines are many and some are implicit in this paper. As with many

other existing tools and concepts for which no final evaluation is available, the value of the proposed model will only be established through use or disuse.

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## List of figures

Figure 1 The relationship between the essential elements and the gender differences identified in multimedia communication

Figure 2 Existing approaches for addressing gender differences in multimedia communication

Figure 3 The model for accommodating gender differences in multimedia communication

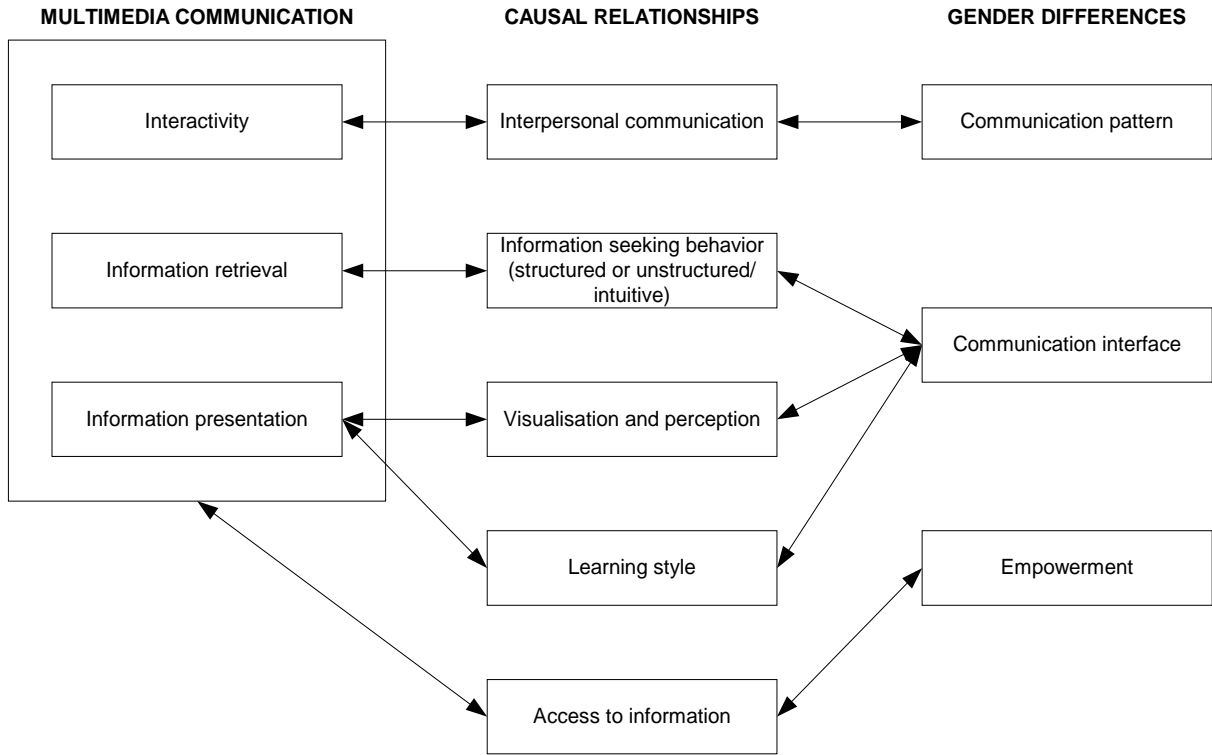
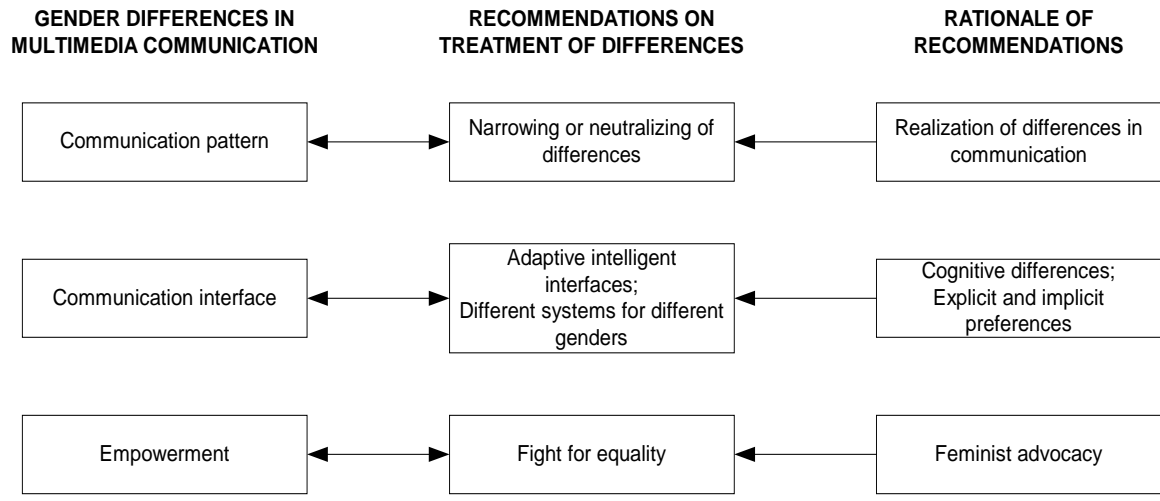
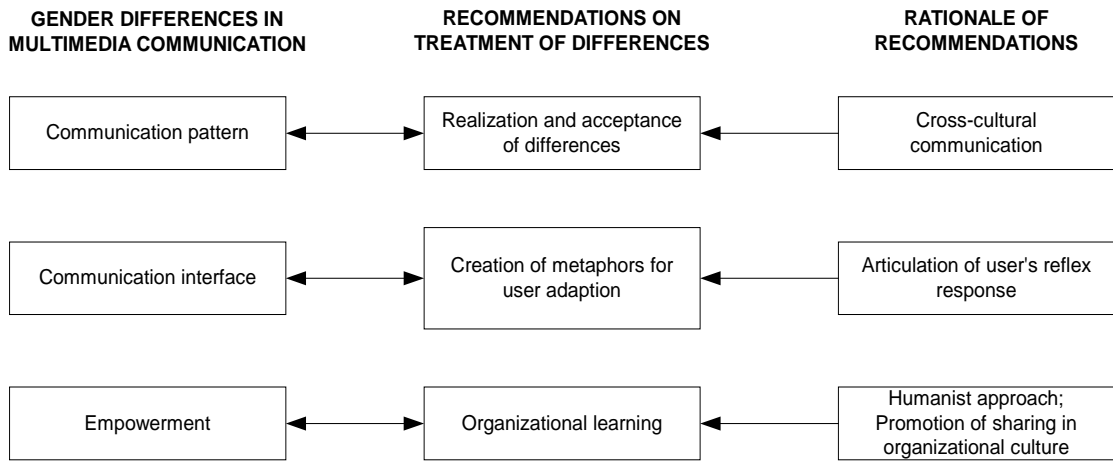


Figure 1



**Figure 2**



**Figure 3**