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Contexts of research on organizational computer-mediated communication

A recursive review

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Although social science research on computer-mediated communication (CMC) first appeared in the early 1970s, new papers still lament the lack of theory or the paucity of empirical research on CMC. Much CMC research *is* weak in one or both. However, these complaints are right-thinking but ill-informed. Possibly most CMC researchers believe these claims because the CMC literature appears in such a wide range of scattered (and often new) journals and books in numerous disciplines (see Rice and Boan, 1985), and thus remains largely unknown to members of any one discipline. However, considerable published CMC research exists (including numerous reviews), and relevant extant theories abound (whether applied from other areas or developed within CMC studies).

Rather than providing yet another review, this chapter takes a different, recursive approach. This chapter does *not* consider context in the sense of unique or holistic aspects of organizational settings (see other chapters in this volume) – that is, from the perspective of the actual participants, whether users, managers, designer or vendors. Nor does it consider the contextualizing influences of the researcher's institution, funding sources, academic discipline, academic/practitioner orientation, evaluation goals, journal characteristics and editorial policy – that is, from the perspective of individual researchers (see, for example, Kulka 1981; and Rice, 1989). Rather, this review recursively summarizes and organizes material from published CMC reviews (consisting of theories, models, propositions, critiques or empirical results, while ignoring almost all specific CMC studies) – that is, from the perspective of what actually appears in print and is thus potentially accessible to other researchers.

Further, this review considers, when appropriate, studies of computing and information systems in general because the boundaries between computing, information systems and computer-mediated communication systems are inherently ambiguous, and, as systems and applications become more integrated, more so. For example, a computer bulletin board may be considered and used as a database information system, involving a variety of storage, retrieval and display aspects, as users 'post' information for others to refer to when desired. However, it may also be considered and used as a computer

conferencing system where users engage in on-going, multiple-topic conversations, representing a lively social forum.

Throughout, by 'research contexts', I mean the meta-theoretic assumptions, models, frameworks and proposition sets, processes and phases, levels of analysis, system characteristics, contingency models, methodological and evaluation criteria or prior sets of empirical results that have emerged from prior CMC research, and that may suggest contexts for designing, conducting and interpreting future research. The section headed 'An example: diffusion and adoption of CMC systems' provides a brief illustration of how these research contexts might be used in studies of CMC diffusion.

Meta-theories

As is true in all fields, meta-theoretical considerations provide pervasive contexts for CMC research. Thus, one set of contexts for organizational CMC research is the paradigmatic assumptions underlying the theories, methods, foci and policy implications of both research and practice.

Several reviews explicitly contrast technical versus political assumptions. Kling (1980) argued that social analyses of computing may be categorized into two broad theoretical perspectives. *Systems rationalism* presumes rational design and use of systems, and includes variations such as technical rationalism, structural analysis and human relations (see, for example, Rice, 1986). *Segmented institutionalism* presumes social conflict over control and interpretation of computing, and includes variations such as interactionism, organizational politics and class politics. In a similar vein, Slack (1984) emphasized the intricate embeddedness of technology and the social order, rejecting the notion of technology as rationalist, objective or independent. Thus, one must relate the technologies to the organizational structures and the historical processes whereby the technologies were imagined, sought, created/obtained, implemented and interpreted – either as *expressive* of a social essence (such as Ellul's 'technique' (1964), or capitalist relations), or as overdetermined by their *structural* contexts (such as economic and ideological forces).

Several meta-theoretical reviews emphasize how different conceptualizations of computing might affect social policy and organizational and public action and thus contribute to the unequal distribution of the costs and benefits of computerization. Mowshowitz (1981) identified five positions – *technicism* (some technicist researchers are statists and some corporatists), *progressive individualism* (reformists, pragmatists and populists), *elitism* (technical and managerial variants), *pluralism* and *radical criticism* (determinists or devolutionists) – underlying such research. Three sources of bias – *technical* (such as computing or methodological expertise), *political* (such as organizational affiliations) and *philosophical* (such as faith in centralization or regulation) – motivate these positions. Iacono and Kling (1988) proposed a related framework, where one dimension identifies two extreme perspectives – the *tool* and the *institution* perspective – and the other dimension identifies three areas of analytical focus *historical* (past decisions' influence on future actions), *political* (control over access to resources) and *social* (issues such as staff skills, patterns of control and discipline). Rule and Attewell (1989: 228) developed a similar set of distinctions that focused on how computerization has been conceptualized in research and policy: 'as a force for broad rationalization of social practice, responding to enduring needs for more cost-effective, responsive, "rational" practices' or as 'a response to interests quite different from those it is ostensibly instituted to serve, either interests generated by the technology itself or ones concealed by the pervasive mystique of that technology.'

Hirschheim (1985: ch. 6) identified different underlying epistemological (positivist or anti-positivist) and ontological (realism or nominalism) stances in office automation research, and organized such studies into three different perspectives about impacts: optimist, pessimist or pluralist. In the extreme, optimists typically have a realist ontology and a positivist epistemology, applying objective analysis within the context of a functionalist paradigm; technology is seen as a tool crafted by humans. Pessimists, on the other hand, tend to presume nominalism, anti-positivism, interpretivism and subjectivism; technology is seen as a controller of machine-like humans. For example, concerning communication issues, the optimist literature tends to conclude that systems facilitate positive results such as more communication or greater access to a wider diversity of others. The pessimist position notes that more communication generates overload and much organizational communication is not appropriate for text-based computer-mediated communication systems. In the end, however, Hirschheim argued for a pluralist perspective, a mixture of the extremes, and presumed that technology is a malleable agent (not necessarily neutral), which humans must decide how to develop and apply (not often, unfortunately, wisely).

Theories, models, typologies and propositions

Propositional reviews and models

Some reviews present overall models of relationships involving CMC or information systems, and use them to generate specific propositions, and testable hypotheses. Others organize prior research directly into propositional inventories and derive models from those propositions. Naturally each is a limited model of the complex context of any organizational implementation and use of CMC, but each provides rationales which may then be used to guide or inform subsequent research.

Some models relating to communication technology are not about specific impacts, *per se*, but about how those impacts come about. For instance, Rogers (1986; 164) suggested that impacts of an innovation in general may be

categorized in three ways: desirable/undesirable, direct/indirect and anticipated/unanticipated. He proposed that the attributes of desirable, direct and anticipated tend to cluster together, as do undesirable, indirect and unanticipated. Further, direct and desirable impacts (such as increased office effectiveness) may in turn lead to indirect, undesirable and unanticipated impacts (such as changes in work relationships – a first-order indirect impact – and later to loss of status or employment – a second-order indicted impact). The less visible and expected, and thus less assessed or managed, impacts tend to be the more negative ones. Sproull and Kiesler (1991) make a similar argument.

However, most models and propositions are about potential or empirically identified relationships and impacts. As early as 1974, Katzman's assessment of new communication technologies speculated that more information would be available to all audience members, but there would be a greater increase for the information rich (possibly leading to information overload) than for the information poor. Paradoxically, even while efforts might be made to close this knowledge gap, new communication systems would arrive to generate new gaps, partially due to lack of access to the innovations, insufficient knowledge on how to use the systems or to irrelevance/inappropriateness of the new systems to the values and needs of the information poor.

Danzinger's (1986) review of computing impacts in political contexts identified four broad categories of impacts of computing on social units: (1) influences on the *capabilities* of the social unit to manage its symbolic and material environments in order to attain goals; (2) *interactions* among units such as political systems, politicians, citizens and administrators; (3) the cognitive, affective and evaluative *orientations* the unit has or employs in establishing preferences and in making choices; and (4) the distribution of *values* experienced by the unit. For example, one 'values' proposition is similar to Katzman's notion of knowledge gaps, that 'computing has primarily reinforced the relative power of those already advantaged in the distribution of power and influence' (1986: 196). Kraemer and Dutton's (1991) extensive empirically-based propositions of management information systems (MIS) research cover areas such as environmental influences outside or inside the organization, users, development process and staff, and operations, patterns of implementation and adoption, and numerous organizational impacts. Swanson (1987) summarized research to develop propositions about ten *determinants* (such as environmental conditions, task characteristics and rational objectives) and fourteen *effects* of an organization's use of information systems (such as differentiation, power and job routinization).

Kaplan (1990a) developed four primary propositions about the *informational*, *perceptual* and *expressive* implications of communication technology: (1) adoption of new media will lead to further synthesis of oral and literate modes of thought and discourse; (2) decentralization of production and editorial control lead to greater content diversity and more highly differentiated audiences; (3) the process of forming codes of communication will be more fluid and dynamic in an age of decentralized and interactive mass media; and (4) new media will broaden the base of artistic literacy and enhance opportunities for personal expression. While these seem highly optimistic, Kaplan did note potential negative rhetorical implications of some of these. For instance, because of the greater diversity and increased codes in new media, authority may be diffused, and consensus may be based on more narrow and targeted interests, and information will be increasingly privatized. In a complementary vein, Zmud (1990) discussed how new systems can be used strategically to manipulate information. Zmud's general propositional model is that (1) individuals are likely to relinquish individual responsibilities for information processing, and become increasingly (2) dependent on and (3) confident in artefacts as information sources, while (4) strategic information behaviours will be more likely to occur indirectly through these artifacts, (5) so that their perpetrators will be harder to identify, thus (6) such behaviours will generally increase because of wider networks, reduced costs, and re-routability of misrepresented messages. Kaplan's and Zmud's propositions tap into potential relationships hardly considered by MIS or CMC research, so represent a rich propositional context for research design and evaluation.

Two propositional reviews, by Olson and Lucas, and Huber, stand out as most thoughtful and useful in terms of identifying potential relationships and research contexts involving organizational communication/information systems.

Olson and Lucas (1982) grounded their review, model and propositions concerning office automation in the general warning that most research and implementation strategies fail to take into consideration the full context and potential long-term implications (especially communication-related) of organizational systems. The three primary system influences are communication functions, personal applications, and text management. These have differing effects on amount and nature of communication, nature and organization of work and work product. Management processes may be influenced as they mediate communication and work. Changes in work and work product will influence employee attitudes, while changes in communication and work will influence interpersonal relations, interdepartmental relations and larger organizational structures and processes. Several specific propositions are associated with each of these specific relations. For example, changes in the nature of work due to capabilities and applications of systems may affect workers' identity within the organization, or their status and job satisfaction.

Huber (1990) developed a general model of effects of advanced information technologies on organization design, intelligence and decision-making. This model generates fourteen specific propositions grouped into four categories of effects: at the *sub-unit* level, at the *organizational* level, concerning organizational *memory*, and concerning organizational *intelligence* and decision-making. For example, more individuals will be involved as sources of information, but fewer will be involved in the formal decision-making.

Some models of new media effects are specifically communication-oriented. Culnan and Markus (1987) proposed that *organizational variables* (such as

information processing needs, structure, implementation choices) influence *communication structures* (networks, direction of flows, roles) which then constrain or facilitate *communication processes* (filtering, accuracy, overload, interpretation), leading to various *communication outcomes* (group relations, communication performance, etc.). They particularly note that influences identified by implementation research on more general organizational computing and organizational information systems are generally missing in CMC research. Huseman and Miles (1988) presented an 'integrative model of information systems and organizational communication, derived from a four-category typology of systems (noted below in the section on systems characteristics). They organized thirteen proposed effects of systems into three broad categories: (1) *flow* of communication (serial, upward, small group, downward, horizontal), (2) perceptual *congruence* (shared interpretations, matching of tasks and media richness), and (3) communication *load* (rate and complexity, overload, screening). CMC systems play an important role in more macro-level conceptualizations of organizational information systems, especially in what Hammer and Mangurian (1987) called communications-intensive information systems. By cross-categorizing three areas of basic *potential impacts* of such systems (time, geography and relationships) with three basic potential *evaluation criteria* (efficiency, effectiveness and innovation), the authors identified nine categories of interactions that managers and researchers could consider. For example, in the relationships/innovation category, the extent to which external organizations become more interdependent and co-operative could be considered.

Some propositional inventories are associated with specific models of the relationships among various variables, influences and outcomes. Two such models are concerned with the process of media choice (especially new media). Fulk *et al.* (1990) based their model on the meta-theoretical assumptions of interpretivism, that organizational members socially construct their shared realities. They argued that many prior studies of new media presumed that the choice process was explicitly rational, thus requiring media and task characteristics to be objective and enduring. Their interpretivist perspective leads to the argument that some attitudes towards, and choice of, new media (which are especially ambiguous and whose evaluation and use are perhaps particularly susceptible to social norms) are likely to be influenced by features of the media and tasks, one's experience and skills with the media and tasks, as well as various forms of social influence. In turn, these evaluations of media and tasks, along with situational factors (such as individual differences and facilitating or constraining conditions), should influence one's use of media, especially new media (see Rice, 1992a, and Rice and Aydin, 1991, for related conceptual reviews and critiques).

Sitkin *et al.* (1992) pursued an alternative focus, developing a model of media choice that focuses on the importance of symbolic communication in organizations. First, they argued (as did Rice, 1987), that media can be conceptualized both as channels for content as well as the content themselves of other processes, substituting instead the functions of media as channels of symbolic meaning or as symbols themselves. Their model proposes that media choice is directly influenced by the *data-carrying capacity* of media, the *symbolic value* and the *symbol-carrying capacity* of media, and *communication capability constraints* (such as communicator, recipient and organizational characteristics). Second, normative contingencies (such as norms and expectations) both directly influence the symbol-carrying capacity of media, as well as moderate the symbol-capacity/media choice relation. Task contingencies (characteristics of the task and the message) similarly mediate the data-capacity/media choice relation. Finally, communication constraints mediate the influence of task and normative contingencies. This model seems promising conceptually because of its integration of symbolic and denotative aspects, the inclusion of receiver characteristics and its emphasis on moderating and interaction relationships.

Other propositional models focus specifically on a few aspects of organizations and new media. For example, Hauser and Byrd (1990) developed a model of the role of CMC in affecting interdepartmental relationships. Propositions include that CMC will increase overall organizational network connectedness, intradepartmental connectedness, inter- and intradepartmental messages and informal task-related cliques, but more so under conditions of task-related uncertainty, task variety and task interdependence. DeSanctis and Gallupe (1987) used their typology of group decision support systems (GDSS) (summarized below) to propose some central research topics, such as the flow of members' interaction, effects of GDSS use on power and influence and trade-offs between performance and satisfaction.

Phases and processes

Another research context for understanding organizational CMC is the phases or processes inherent in the phenomenon under study. However, most studies treat media choice and use as static occurrences, rather than as part of one or more on-going processes.

Taking a macro-perspective, Rockart and Scott-Morton (1984) provided an early discussion of altering an organization's value-added/distribution chain through information/communication technology. The value-added chain consists of the necessary phases, often performed by different organizations, in converting raw materials into products or services purchased and used by consumers (which may be other organizations). Thus, the authors argue that these phases (for example, purchasing, receiving, warehousing, manufacturing, packaging, distribution, selling) represent separate opportunities for strategic implementation and use of computer systems. Cross-categorizing the value-added chain phase by strategic moves (such as horizontal or vertical integration, mergers, shared resources, etc.) or relevant actors (such as rivals, suppliers, customers, etc.) has been useful in identifying potential forms of information/communication systems (see, for example, Wiseman, 1988). Kramer and Dutton (1991: 45) summarize some other MIS phasic models.

Computer systems may also be conceived of as supporting different communication *processes*. Under *transmission*, Chesebro and Bonsall (1989) reviewed a wide range of research, such as whether or not CMC can support social as well as task relationships, or whether or not CMC represents a new cultural system (both because it removes spatial and temporal moorings and because it represents new social assumptions and norms). Under *expression*, they considered four contexts of expressive computer use: videogames (affecting family relationships and antisocial behaviours), word processing (influencing productivity, extent of revisions and concepts of writing), teletext and videotex (altering home/work boundaries and raising issues of privacy), and telework (concerning work flexibility, isolation and at-work visibility). Finally, under *human-computer congruence*, they considered communication-oriented applications such as individualized educational programs (raising questions about individual-oriented learning and unequal access to systems) and data searches (altering scope and ways of retrieving and associating information and challenging the status of experts).

In an attempt to explore the notion, opposed by Daft *et al.*'s media richness theory (see the section on system characteristics), that CMC could facilitate innovation, Rice (1987) distinguished between two conceptualizations of CMC (as new *channels* for innovative information, as well as the *content* themselves of innovation processes) and three stages of organizational information processing (*input*, *conversion*, and *output*). He organized a broad range of theories and research into the six resulting categories. This framework might help clarify what might appear as inconsistencies in prior research, by showing that similar research may in fact relate to different media conceptualizations and different organizational processing phases. For example, this framework provided the context for developing propositions about how CMC systems could be used in organizational crises, with respect to CMC as both channels and content, during the identifying, management, and learning phases of crisis management (Rice, 1990b).

Some models are explicitly dynamic and processual. Saunders and Jones's (1990) model of use of sources and media during information acquisition and decision-making identified three main *decisional phases* (identification, development and selection), and various *components of information acquisition* (based on information richness, accessibility and internal/external criteria). Suggested interactions between these phases and components lead to six propositions, such as that new media are more likely to be used when decision-makers are working on several priority decisions at once.

Hesse *et al.*'s (1988) transactional model presented a unique set of concepts to analyse how four explicit aspects of time may be involved in CMC at three levels of social and psychological processes (individual, dyad, and group) and two environmental dimensions (social and physical). These aspects of time include synchronous or asynchronous *temporal scale*, recurrent or non-recurrent *temporal sequences*, objective or subjective *temporal pace*, and the *temporal salience* of past, present or future orientations. For example, an individual may benefit from asynchronous CMC due to the flexibility of participating in different communication cycles, but may suffer from misunderstood expectations about acceptable cyclic intervals for replies.

One of the most fully developed and theoretical process models of CMC is Poole and DeSanctis's (1990) theory of adaptive structuration. Their focus is on the on-going group processes involved in 'appropriating' GDSS technology. That is, there is no direct 'effect' of technology; indeed, the form and application of technology are the 'dependent variables' influenced by choices that group members make. Technologies *do* represent types of systems as well as various features from which groups may choose and apply. Developing their theory from group decision-making studies, GDSS information exchange processes and broad sociological structuration theory, Poole and DeSanctis identified very specific components, group phases and levels of interaction in this on-going process.

Also arguing that technology, individuals and social structure all constrain yet influence each through structurational processes, Contractor and Eisenberg (1990) proposed a recursive process model relating organizational communication networks and CMC. Aspects of *involvement in networks* at different levels (see the section below on levels of analysis) help construct social information that in turn influences both *perceptions* of new media as well as patterns of *media use*. In turn, these perceptions and uses then develop into social structures that generate social information about and change in involvement in these networks. Rice (1992b) merged this general network/structuration argument with the input-conversion-output framework noted above (Rice, 1987) to organize a broad review of network analysis research on CMC systems. Additional contextual aspects of such research identified in this review were *forms of data*, *time period* of study, network *level of analysis* and conceptualization of *network structure* (positional or relational).

Levels of analysis

Particularly because multiple adopters are required for implementing organizational systems, and because CMC systems may involve communication among participants across organizational and national boundaries, CMC research should explicitly consider appropriate and multiple levels of analysis.

Danzinger (1986) identified two primary levels of analysis in research on uses of computing in public settings for allocating public values and resources: *individuals* (involving various roles) and *collectivities* (from small groups to international organizations). Swanson (1987), because of his interest in MIS and organizational theories, structured his review of organizational information systems research according to three levels (*individual*, *organization* and *market*) and two foci (determinants and effects of system use). Contractor and Eisenberg (1990) proposed that three levels of network interaction – *individual*, *dyadic* and

group – are needed to understand the structuration processes inherent in use and evaluation of new organizational media. Er (1989) grouped evidence on the impacts of computing and information systems in organizations into four levels of analysis: *individuals* (ergonomics, attitudes and behaviour), *groups* (industrial relations and technological changes, impact on top management, expert power of computer professionals), *organizations* (intraorganizational power, organizational structures) and *society*. These are the same levels used by Kerr and Hiltz (1982) in organizing their textual meta-analyses of results primarily from computer conferencing systems provided by a set of experts. However, Kerr and Hiltz identified three general types of potential consequences as well – cognitive, affective and behavioural – providing twelve categories of research evidence. Both Kraemer and Dutton (1991) and Kerr and Hiltz found few studies at the societal level of analysis.

Rice (1989: 441) used the term 'domains' instead of levels of analysis, referring to 'the levels of complexity, relationship, or organization at which the communication process takes place'. Domains include *individuals*, *dyads*, *roles*, *groups*, *organizations* and *institutions*, and *societal relations*. Taking a similar approach, Rice and Bair (1984) argued that five organizational levels each represent incomparable phenomena with distinct criteria and goals for evaluating CMC systems: *organizational mission* (such as goals), *functions* (such as marketing), *processing* (such as interpersonal communication), *activities* (such as scheduled meetings) and *actions* (such as leaving a message).

The levels-of-analysis approach provides a useful context for organizing various literatures and research results. However, the concept of level of analysis also represents a more fundamental issue: where does the adoption, use and implications of particular new media such as CMC primarily take place? Gutek *et al.* (1984) argued that in many cases the most appropriate level of analysis is the work unit or office, because this represents both underlying conceptualizations of office systems (Ellis and Nutt, 1980) and the setting of many organizationally relevant human and work behaviours. Also, more traditional aspects of level, such as position in the organizational hierarchy, must be considered as important contexts for CMC use and outcomes. For example, Rice and Shook's (1990a) meta-analysis of research on managerial use of media showed strong support for expected effects of a user's job level, except for CMC, where in some organizations managers were more likely to use CMC than lower-level individuals.

Finally, emphasizing the 'fact' of *different* levels of analysis might obscure the more important awareness that *multiple* levels of influences exist. For example, Rice (1991) studied how organizational policies, work group structure and communication, and types of use moderate each other's influence on outcomes associated with word processing. Another example is Rice and Shook's (1990b) study of the influence of supervisors' and co-workers' use of voice messaging and innovativeness on individual respondent's use and evaluation of voice messaging, compared to just individual-level influences.

Types and characteristics of CMC systems

The ambiguous and changing referent

Because all media are at one point 'new' in the eyes of the beholder (Rice & associates, 1984), their properties must necessarily be changing, uncertain, sometimes unique. Indeed, Acker (1989) argues that new communication systems *should* be designed in ways that recognize that neither design nor use is ever 'finished', incorporating inherent adaptability and variation in system characteristics. Most sobering in this respect is Schement and Stout's (1989) 'time-line of information technology'. They summarize the continuing evolution of information technology according to three axes (contributions to conceptual developments, information acquisition devices and information manipulation devices), and two dimensions (technologies of symbol manipulation and of sensory extension), showing areas of convergence between the two dimensions over time. Thus, in order to compare results within even a short time-period, or to infer that results might be applicable to other situations, some general systems characteristics must be identifiable. There are many typologies of media in general, and CMC media in particular, in at least four broad categories: *technical and social*, *conceptual*, *perceptual* and *linguistic*.

Technical and social characteristics

Kerr and Hiltz (1982) proposed seventeen interface characteristics and nineteen broad CMC system features – many of them social rather than technical, *per se* – for consideration. Paisley and Chen (1982), adapting Bretz's (1973) approach, identified three basic dimensions of features of computer media: *presentation* features (such as motion and music), *input and command* features (such as keyboards, menus or commands), and *content* features (such as types of files). Miller and Vallee (1980) proposed six classes of attributes needed formally to describe CMC systems – *channels*, *networks*, *messages*, *nodes*, *operations* and *protocols* – and identified specific aspects of each that are relevant for human communication through CMC systems.

The research on groupware or computer-supported collaborative work media may well be the best-organized and comprehensive of any CMC medium to date, partially because it represents the first multi-featured mediated support for groups (Rice, 1984), and because of the important and complex issues involved in understanding and supporting groups. There are already many compilations of descriptions of and research about such systems.[1]

Ellis *et al.* (1991: 40) provided two sets of two-dimensional typologies of groupware: one based on the extent to which a system involves common tasks or *a shared environment*, and one based on the extent to which a system involves the *same time or place*. The authors used these two typologies to describe several applications of groupware: message systems, multi-user editors, group decision support systems (GDSS), computer conferencing, intelligent agents and co-

ordination systems. One of the more widely accepted typologies of GDSS distinguishes between Level 1, 2 and 3 systems (DeSanctis and Gallupe, 1987). *Level 1 systems* (databases, e-mail, anonymous contributions to preference listings, etc.) improve group decision processes by facilitating the exchange of information among group members. *Level 3 systems* provide machine-induced patterns in group communication. Kraemer and Pinsonneault (1990) grouped these two levels into what they call group communication support systems (GCSS). *Level 2 systems* (modelling tools, risk analysis, multi-attribute utility methods) provide decision modelling and group decision techniques that reduce uncertainty and noise in the process, and represent what they consider to be group decision support systems. Huseman and Miles (1988) suggested a possible *Level 4 GDSS*, where artificial intelligence modules may simulate group members, such as through expert databases and associated decision rules which may play active roles in decision-making. Dennis *et al.* (1988) suggested a six-category typology of GDSS, according to the *form of user processing* (sequential or parallel) and the *nature of system support* (for facilitator, participants or both).

Conceptual characteristics

Some system 'characteristics' are really more abstract conceptualizations of underlying properties, role or functions. These hold some promise for identifying enduring and comparable system characteristics.

Kaplan (1990a) arrayed new media along two dimensions: extent of *interactivity* and *centrality of control*. For example, traditional broadcast television has centralized production and editorial control, but low interactivity; Citizens' Band radio has decentralized control of content and high interactivity. In a similar but more generic approach, Bordewijk and van Kaam (1982) and McQuail (1986) proposed two fundamental dimensions of communicative activities: *source of information* (individual or system) and *source of control* of timing and choice of information (individual or system). As Rice (1989) shows, this typology places nearly all CMC systems into the individual source/individual control quadrant, which the other authors call 'conversation'. (The remaining quadrants are system/individual, called 'consultation'; individual/system, 'registration'; and system/system, 'allocation'.)

Some conceptual typologies focus more on the functional characteristics of media with respect to how they support and augment communication or office processes. Ellis and Nutt (1980) suggested that office activities may be conceptualized as sets of (1) (ordered) activities resulting from requests for service; (2) people performing procedures and communicating with one another; (3) communication media and the association interactions; or (4) a large database involving users and data. Using such formal typologies of media, some prototype office information systems embed sequences of activities or interactions along with procedures in their software.

Huber (1982) presented a more general typology of organizational information/communication system functions, identifying four kinds of

message processes: *routing* (focused distribution), *summarizing* (representing meaning while reducing number or size of messages), *delaying* (establishing priorities and controlling timing of message), and *modifying* (controlling distortion, format, sender–receiver conflicts). His review identified organizational, task and psychological processes that influence these four primary functions. Zmud (1990: 97) took a similarly generic but more conceptually elegant approach, considering organizations as 'communication systems consisting of interconnected networks of processing nodes and information buffers'. Types of processing nodes include *sensors*, *filters*, *routers*, *carriers*, *interpreters*, *learners* and *modifiers*. Other components of an information system include messages (which operate on the processor nodes as well as being conveyed through them), schema (underlying representation and rationales) and message flows.

Durlak (1987) proposed a typology for interactive media by arraying three major *designer goals* (simulating face-to-face communication, maintaining the illusion through immediacy and mind amplification via new possibilities for communication) with four *system components* (hardware, software, tools and people). Further, Durlak identified a variety of issues and attributes for each of the four components as well as their three boundaries. For example, hardware could facilitate 'maintaining the illusion' to the extent it was powerful enough, software could simulate face-to-face communication to the extent that it involved meaningful metaphors or was transparent, and the boundary between the two consisted of issues such as support for dialogue.

Huseman and Miles's (1988) typology of organizational systems is, in contrast, fairly overt. Their typology distinguishes *sender*(s), *receiver*(s), essential *system type* (electronic messaging, executive presentation system, executive information system, group decision support system), *primary purpose* and the *technology's role*. For example, when multiple senders provide information to a single receiver whose purpose is to monitor information, then an executive information system could be applied to gather, filter, synthesize, organize and store information. Note that Huber's functions could be integrated with this typology for a richer understanding of both purpose and role.

Based on a review of prior characterizations of both traditional and new media, Rice (1987) suggested that media vary on at least four primary dimensions: *constraints* (i.e. the extent to which users must know the address of their recipients, users can index, retrieve or reprocess the content, etc.), *bandwidth* (i.e. social bandwidth such as social presence or information richness, and technical bandwidth such as range of frequency per time unit), *interactivity* (i.e. speed and nature of feedback) and *network flows* (i.e. one-to-one, one-to-many, many-to-many). Other characteristics might include channel redundancy, privacy and familiarity (Williams & Rice, 1983). This broad framework complements Culnan and Markus's (1987) criticism that much CMC research (especially critical research) assumes that face-to-face communication is an ideal or complete form, and that new media are comparatively deficient in various ways. Rather, all media vary on a wide variety of dimensions, revealing that

face-to-face may suffer by comparison, say in imposing too many constraints, restricting interaction or limiting network flows.

Heeter (1989) critiqued many prior media characterizations as depending on the perceptions of the users, thus requiring assessments for every study. Instead, she suggested two encompassing characteristics: function and channel (or mode). The three basic media *functions* are information retrieval, messaging and information processing. While most media systems fulfil only one of these major functions (Heeter categorizes forty-six of fifty-three media into unique functions), newer media (such as interactive videodisk) tend to support multiple functions. Types of *channel* include full motion, still image, graphic, text, full sound and limited sound. Ciampa (1989) took Bretz's and Heeter's approaches to an extremely detailed conclusion. He described two classes of media with four major divisions: *immediate* (private, public) and *mediate* (extension, storage), with three to six specific media forms in each category, and a wide array of compound forms within and across categories and classes. For example, telephony is a form of the mediate/extension category, while interactive videodisk is a compound form of a mediate/storage medium, involving audio and movie forms.

Markus (1984) distinguished organizational information systems on the conceptual basis of what *organizational functions* they perform and what *features* are likely to interact with organizational attributes. The five generic types include *operational*, *monitoring and control*, *performance*, *communication* and *interorganizational* systems. For example, the most important interactions involving features of communication systems and organizations have to do with space/time implications, network patterns and mode, leading to likely impacts such as telework, changing diversity and status of communication contacts, and possible misunderstandings in online communications.

Nass and Mason (1990) rejected what they saw as the two common approaches to contextualizing media, that of object-centred research (which emphasizes the uniqueness, innovativeness and specificity of the medium) and of social-actor-centred studies (which emphasize individual, group or organizational variables such as behaviours and attitudes). Instead, they proposed two fundamental dimensions of technology characteristics, each including ten to fifteen specific variables: *technology as box* variables (such as analog/digital, programmability and size) and *technology as task* variables (such as focus of control, type of input and synchroneity). Nass and Mason argue that only by identifying such variables can both the 'object' and the 'social actor' be properly contextualized in CMC studies.

Perceived characteristics

Several studies have empirically identified different perceived media dimensions. Zmud *et al.* (1990), based on a wide-ranging literature review and their multi-dimensional scaling of respondents' comparisons among a variety of media, concluded that *quality* and *feedback* were the two primary dimensions of perceived media characteristics. Another simple typology of new media is the extent to which they are *interactive*, they allow or create *de-massified audiences* (in terms of the diversity of audiences they can reach, the diversity of content they can provide to each user and the extent of choice the user has), and they provide *asynchronous communication* (Rogers, 1986: 68). Lea (1991) found that the principal dimensions concerning evaluation of media (letter, note, face-to-face, telephone, speech, thinking aloud, poem and CMC) generated by respondents, rather than by researchers, included *asynchroneity* (preparation/transmission time, transmission time/reception time and reception time/response time), spontaneity (planned, formal), *inconsequentiality* (purposefulness or directedness of the communication), *emotional quality* (emotional, personal) and *technology-mediation*. For example, CMC was perceived by the respondents to be closest to note- and letter-writing with respect to asynchronous writing, closest to face-to-face and telephone concerning spontaneity, and similar to note-writing in its relative impersonalness and low emotionality.

Two foundations for much new media research is the extent to which a medium conveys the 'social presence' of the participants (Rice, 1984; Short *et al.*, 1976) or 'rich information' (Daft and Lengel, 1986; Trevino *el al.*, 1987). Social presence indicates the extent to which the participants psychologically perceive the presence of the other; attributes of a medium then include warmth, appropriateness for a variety of communication tasks, personalness, familiarity and so forth. Rice and Love (1987) summarize a number of studies that measure CMC systems' social presence.

The bases for information richness theory are the joint assumptions that organizations attempt to manage meaning, and they interpret their environments through processing information. The two primary information processing requirements are amount and analysability, leading to differing needs for uncertainty and equivocality reduction. Uncertainty is the lack of information which is potentially knowable once it is accessed; equivocality is ambiguity or multiple, conflicting goals, implying the lack of even pre-determined facts or meanings, and requiring interpretation, intuition and experience. Thus, media with different attributes for reducing uncertainty or equivocality will be differentially appropriate for various information processing requirements. Daft and Lengel arrayed some traditional communication channels along a unidimensional continuum that supposedly reflects the joint influence of four of these attributes: *speed of feedback*, *channel mode* (visual, audio or mixed), *personalness* and *language forms* (body, natural, numeric). Their initial ranking, from richest to leanest medium, was face-to-face, telephone, personal written, formal written and formal numeric (similar to Short *et al.*'s 1976 ranking of media on a social presence scale). Later extensions of this theory emphasized the importance of symbolic interactions and social constructions of reality in communication processes, the proper level of analysis as the interaction episode rather than individuals or tasks, and the potential importance of awareness by individuals of these media differences in the process of choosing media (Trevino *et al.*, 1990). Sitkin *et al.* (1992) expanded the media ranking to include electronic mail and videoconferencing media and the attribute of communica-

tion target (personal or impersonal). They also proposed that the weighting of media characteristics in determining richness was, from greater to lesser, feedback, channel, source, language and target. Rice *et al.* (1992) reviewed extant empirical rankings of media according to information richness and related measures, and Fulk and Boyd (1991: 410–11) reviewed supportive and opposing evidence for media richness theory.

Implicit in both these characterizations of media is the presumption that mediated communication filters out various cues available in face-to-face channels. Kiesler *et al.* (1984) proposed that communication opportunities provide social context cues (influenced by geographic, organizational and situational contexts), which are interpreted and subsequently influence communication behaviour and the nature of information exchange. Thus, text-based, asynchronous and geographically dispersed interactions through CMC reduce many social cues (especially dynamic, interactive ones), leading to a variety of consequences such as disinhibition and loss of social regulation.

Culnan and Markus (1987) identified three types of information or cues supposed to be filtered or diminished: regulation of interaction, perception of communication partners and awareness of social context. However, as did Rice (1987), they rejected the fundamental presumption that face-to-face is the ideal communication compared to which other media are more or less deficient, arguing that this ignores the capabilities of new media for augmented, complementary and fundamentally different forms of communication (see also Rice and Steinfield, 1992). They suggested, for example, that new media provide new ways of addressing (public postings, distribution lists), new ways of storing and retrieving communication (providing indexable transcripts and computer-monitored usage data), and new ways of controlling access and participation. Independently of this critique, Trevino *et al.* (1990) extended the information richness arguments by providing evidence that channels differ in the extent to which they overcome situational constraints, convey ambiguous information and provide symbolic cues. Lea's (1991) study of respondents' comparative assessments of media indicated that people do not generally focus on rationalist aspects of CMC such as speed, efficiency or productivity, but rather spontaneously discuss more symbolic and interactionist perspectives, providing user-oriented support for Kling's (1980) second set of assumptions, and rejection of the task-versus-socioemotional distinction inherent in media richness and social presence theories.

Kydd and Ferry (1991) utilized the information richness framework and reviews of empirical research to distinguish four classes of computer-supported co-operative work media, based on the proposed ability of each to reduce uncertainty (high/low) or equivocality (high/low) in group work. So, for example, electronic mail systems should be appropriate for work groups under conditions of low uncertainty and equivocality, because little additional information or social interaction is necessary. However, under conditions of high uncertainty and equivocality, multi-media tools that could provide rich information would be necessary.

Linguistic characteristics and images

A different but powerful aspect of CMC characterization is the very use of language itself: in the content of CMC messages, in communication about CMC and in the very structure and practices of discourse involving CMC. For example, Hiemstra (1983) showed that office workers applied or developed metaphors involving 'magic', 'toy' and 'moving object' to newly implemented office systems, representing eight underlying evaluative dimensions, such as potent/impotent or mysterious/obvious. Some of the surface-level terms clustered around three aspects of 'cause–effect relationships', including what such systems were supposed to do, actually lead to and might lead to. Such terms, metaphors and dimensions were associated in respondents' minds with old and new work roles and technologies, thus influencing their attitudes towards, and use of, office systems. Kaplan (1990b) identified five metaphors frequently used to describe new communication technologies (lever, web, machine in the garden, synthesis of old and new values, and revolution), and found that general-interest magazines were more likely to use the 'lever' or 'synthesis' visual metaphors almost exclusively, while more technology-interest magazines were more likely also to use the 'revolution' visual metaphor and, to a lesser extent, the 'web' metaphor. It appears that the general population has access to fewer and perhaps less complex such metaphors, due to the goals of commercial advertising; while telecommunication policy players use some of these metaphors for overcoming resistance to certain technological and market developments (such as touting optical fibre as a 'social web').

Poster (1990) went much further: applying analytical strategies adapted from Baudrillard, Foucault, Derrida and Lyotard, he argued that (1) the separation of physical object/proximity from the communication process, and (2) the self-referential nature of much language about the abstract notions of computing, information and data, both work to reconfigure or mystify many commonly-held social and institutional relations (such as between message and context, database and knowledge, ads and reality, etc.). For example, he concludes a discussion of CMC by arguing that:

> With its dispersal of the subject in nonlinear spatio-temporality, its immateriality, it disruption of stable identity, computer writing institutes a factory of postmodern subjectivity, a machine for constituting non-identical subjects, an inscription of an other of Western culture into its most cherished manifestation. (p. 128).

Contingency, interaction and fit

CMC research needs to develop more models and analyses involving moderating, contingent and interaction influences, better to represent varieties of underlying assumptions and apparent complexities of organizational CMC.

For example, Hiltz (1988) used Kling's meta-theoretic typology to summarize prior research on likely influences on productivity associated with

use of CMC systems, resulting in a 'systems contingency theory'. She argued that various effects should be contingent on implementation contexts, and on interactions among the various sets of influences. As noted above, Markus (1984) developed an 'interaction theory', which argues that certain identifiable features of the five generic types of information/communication systems interact with identifiable features of the organizational context. To the extent that the sets of features are well matched, a defined set of positive outcomes is possible; if not, a defined set of negative outcomes is possible. Note that social presence and information richness theories essentially propose interaction effects between communication/information processing requirements (such as tasks), situational contexts (such as temporal dispersion or symbolic norms) and communication channel attributes (such as richness or social presence). Rice, *et al.* (1992) operationalized this fundamental proposition in a variety of ways to show that simple analyses of media–task 'fit' obscure critical assumptions about whether media effects are symmetric (equal but opposite for opposite media) or not and non-monotonic (positive outcomes for good fit, negative outcomes for poor fit) or not; apparently, the effects are neither.

Research approaches and evaluation criteria

Some reviews have focused on the assumptions, approaches of the constructs, methodologies or research designs used in studying new organizational systems, rather than on system design, implementation perspectives or actual study results.

For example, Ives *et al.* (1980) reviewed five prior MIS research models, noting paradigmatic assumptions and particular gaps (such as focusing on only some aspects such as system use but not implementation, or failing to identify specific hypotheses or specific dependent variables). They then developed a comprehensive framework for MIS research involving *environment characteristics* (external, organizational, development, operations and user environments), *process variables* (development, operation, use processes) and *subsystem characteristics* (content, presentation form and timing of presentation). Over half of 331 MIS dissertations they content-analysed focused on only one of the three variable groups, while only 8 per cent considered relationships among all three of the groups. They argued that more studies should focus on process variables and take a contingency perspective (two research contexts noted above). Dennis *et al.* (1988) provided a similar research model for GDSS, identifying three essential categories of variables and influences: *environment* (such as characteristics of the group, task, system and context), *group process* (such as structure, leadership, conflict) and *outcome* (such as satisfaction, outcome quality, consensus). They organized the extant GDSS research results according to these categories, noting that most of the research was experimental, with a few field and case studies.

Kraemer and Dutton (1991) critiqued the nature of extant survey research on information systems, noting (1) research areas which had some replications or cumulative evidence and those that did not; (2) much of the research used widely scattered theoretical foundations (when there *was* a theoretical foundation), (3) survey results often debunk 'conventional' wisdom by failing to find support for certain propositions or models; (4) few authors publish more than one survey-based information systems study; (5) many studies suffer from poor correspondence between concepts and their empirical indicators; and (6) the lack of a taxonomy of organizational information/communication systems hampers comparison or cumulation of results across studies. Attewell and Rule's (1984) review of research of effects of computing in general on numbers and quality of jobs, management decision-making, organizational dealings with clients and customers, and adoption of computing, provides similar analytical critiques. They point out that rather than simply concluding that results are essentially contradictory, the research to date may reflect that both positive and negative (as well as neutral) outcomes may be (simultaneously) associated with computing in general. However, it is difficult to make even this assertion because so little of the research (1) uses cross-organizational data; (2) compares public-sector to private-sector results; (3) identifies the level of computing usage that is presumed to have the influence; (4) uses consistent or valid indicators (even when they are industry-level or governmental data); or (5) specifies what the primary contextual variables are (such as size, industry, labour specialization, etc.). Dennis *et al.* (1988) concluded that most groupware studies ignore the informal aspects of groups, level of group development and the structure imposed on the group by the system, and more studies should be done in actual field settings. Swanson (1987) noted an overemphasis in information systems research on determinants rather than effects, and on individual decision-making rather than behaviour in organizational and historical contexts.

Another new methodological and evaluation context for organizational research is use of the computer-monitored data. Rice (1990a), Rice and Borgman (1983), and Williams *et al.* (1988) discussed possibilities, characteristics, advantages and disadvantages of usage measures collected by the CMC computer itself. Rice (1990a) organized a review of such data according to whether the data were simply *monitored* or obtrusively *initiated* by the system (such as by polling or online experiments) on one dimension, and the extent to which the data involved *samples*, *types of usage*, *content* or different *network levels* on the other dimension.

Empirical reviews

Finally, there are many straightforward empirical reviews that attempt to summarize 'what is known' with respect to various sets of computing, information system or CMC issues. There are, of course, many reviews of related research not specifically considered here that focus on broad sociological changes, specific work-related impacts, legal and management issues, etc.[2]

Some that do, focus specifically on CMC systems. For example, Steinfield

(1986) organized his review of CMC systems research into design issues, acceptance and appropriate users, implementation, application case studies, evaluation methods and impacts (information load, group process and decision-making, productivity and media substitution, organizational structure). Hiltz and Turoff's original book on computer conferencing (1978: ch. 5) is still one of the few sources for consideration of uses and implications of CMC for the disadvantaged; indeed, their book presaged most of the primary issues and results of CMC research to date.

There are several comprehensive reviews of research on group media, GDSS and CSCW (see note 1). Rice's (1984) early review based on computer conferencing research focused primarily on how social presence theory could be used to understand the accumulated, and rather consistent, results of mediated group communication, such as greater equality of participation, reduced leadership emergence, reduced consensus and greater accuracy, quality and diversity of group solutions. DeSanctis and Gallupe (1987) used their three-level GDSS typology to identify the most important environmental contingencies critical to conceptualizing GDSS differences and designing GDSS: group size, member proximity and group task (generating, choosing and negotiating). Dennis *et al.*'s (1988) typology for conceptualizing system/context differences was slightly different, involving group size, group proximity and time dispersion. Kraemer and Pinsonneault's (1990) extensive review is organized according to their framework of (1) *contextual variables* (personal factors, situational factors, group structure, technological support and task characteristics); (2) *group processes* (decisional characteristics, communication characteristics, interpersonal characteristics and structure imposed by the system); (3) *task-related outcomes* (characteristics of the system, implementation of the decision, attitude of group members towards the decision); and (4) *group-related outcomes* (various attitudes towards the group). However, by distinguishing the nature of the system (GCSS or GDSS, as noted above), they were able to identify results common to both types of systems (increased depth of analysis, participation, and decision quality, and decreased domination), and results unique to each type (such as increased consensus, confidence in the decision, satisfaction with the process and with the decision for GDSS).

A seldom-used, but rich, approach to reviewing issues and impacts of organizational information/communication technologies is a sort of combined technology assessment/verbal meta-analysis. Kerr and Hiltz (1982:89–160) surveyed a small set of designers/implementors/researchers who were very familiar with a particular CMC system and the research involving that system, and asked them to summarize the extent to which results concerning their system provided positive, neutral or negative support for a literature-based propositional inventory (similar to Kraemer and Dutton's 1991 summary of MIS survey results) in nine categories: the product of three levels of analysis and three types of impacts discussed earlier. For example, the individual/affective cell included support of self-presentation; the group/affective cell considered inhibition of trust; and the societal/behavioural cell included questions about

copyright and privacy. These numerous (over 125) and explicit assessments of potential relationships at different levels and types provide a useful context for designing or evaluating the consistency of future studies. Straub and Wetherbe (1989) used key academic, vendor and consultant informants for their qualitative technology assessment, finding consistency in the ranking of classes of technologies according to perceived organizational impacts in the 1990s. Foremost were human interface technologies, then communication technologies to enhance data and interpersonal communications, then system support technologies with largely indirect impacts, and then minor or not yet mature technologies.

An example: diffusion and adoption of CMC systems

A major influential perspective in CMC research is diffusion and adoption of innovations theory (Rogers, 1983, 1986: ch. 4; Williams *et al.*, 1988: ch. 5). Because so many studies have been conducted in this tradition – some of which are included in the propositional and empirical reviews noted above – it is a suitable example of how some of these contexts have been or might be applied to improve our understanding of the adoption process.

The main elements in diffusion of an innovation include the innovation, and information and interpretations about it which spread through communication channels over time among members (e.g. organizations and individuals) of a social system (e.g. an industry or an organization). An innovation may be an idea, practice or material object perceived as new by the potential adopter. General perceived attributes of the innovation, such as system features, functions, applications and cost/benefits, are often subsumed into five categories: relative advantage, compatibility, complexity, trialability and observability. For example, freedom from temporal and geographic constraints may be perceived as relative advantages, but the decreased media richness may be perceived as incompatible with an organization's culture that values informal discussions and symbolic values. However, the technical, social, conceptual, perceptual and linguistic characteristics of such systems are rarely well-understood or made explicit, and often change over time. (Indeed, implementors and users could possibly use some of the typologies of system characteristics to establish a common context for deciding on which aspects of systems to evaluate and focus debates.)

Thus, because the referent is so ambiguous and often dynamic, individuals' perceptions of such innovation attributes should be especially susceptible to social information processing, which occurs through proximity to salient others within one's personal, group and organizational networks (Rice, 1992a; Rice and Aydin, 1991). Note that an emphasis on social influences also explicitly allows for non-adoption as a viable outcome, avoiding the optimist's bias toward adoption (e.g. see Rice *et al.*, 1990).

'Adopters' in this situation involve at least two levels of actors – the organization and the individual users – though other levels such as department, work unit, supervisor and co-workers may play a role. The adoption decision obviously involves different levels of analysis, multiple phases and on-going processes. The decision process for individuals involves awareness of knowledge of the innovation, then forming an opinion about it (which may involve positive or negative persuasion), leading to a decision to adopt or reject (either of which may be altered later, depending on the innovation), followed (if positive) by implementation (which may involve a 'fair trial' phase) and, finally, confirmation of the decision (adoption or rejection). At the organizational level, five phases may be identified: agenda-setting and matching (or the initiation phase), and redefining, interconnecting, and routinizing (or the implementation phase). The agenda-setting stage is typically grounded in rationalist or technicist paradigms, because the organizational initiators tend to be upper-level managers or systems personnel, interested in improving organizational productivity, technological systems, symbolic status or controlling workers through rationalization with computer-based systems. However, because of the inherently ambiguous and value-laden issues associated with new organizational information systems, potential individual designers and adopters may have different agendas and thus perceptions of the innovation, generating conflict and bursting the implicit assumption of consensus and common organizational goals. Implementation and change processes stimulate the need to develop familiar meanings for these new systems, generating linguistic characteristics discussed above which may or may not be favourable. For instance, Markus (1984) shows that labelling problems associated with a system as 'user resistance' or 'system hassles' inherently constrains discussion and implementation options, and obscures the underlying problem of failure to appreciate the interaction between organizational and system features. An institution-historical approach (suggested by Iacono and Kling, 1988) might emphasize that past commitments to certain technologies and vendors influence future adoption choices, that adoption and implementation are constrained by on-going politics and interests (such as between workers in central locations or remote buildings – see Manross and Rice, 1986), and that relevant actors involve interdependent groups and interactions between units. Mowshowitz's (1981) analysis might be used to identify the underlying assumptions of the parties; as both pluralists and devolutionists believe that active participation by conflicting groups is required to reduce inequity in computing use and outcomes, but devolutionists believe that constructive intervention to reduce social domination (such as differential access to a CMC system which would increase organizational knowledge gaps) is also required.

At various adoption phases, the adopter may *reinvent* the innovation – that is, adapting it after adopting it, by altering components or applications of the innovation. Thus, users themselves contribute to the changing and ambiguous nature of a system. This is a fairly recent extension to the diffusion model, rejects the notion that adoption is an all-or-nothing affair measured by the

faithful implementation of the diffuser's conceptualization of the innovation, and provides the basis for some rich implementation theory and research. The concept of reinvention allows us to combine diffusion theory with aspects of theories about information economics, leading to an information/innovation theory of implementing information systems (Johnson and Rice, 1984, 1987; Rice, 1987). The essential argument is that as information work becomes the predominant organizational activity, managing information work as industrial work, such as through measures of efficiency and productivity, suppresses innovative and effective uses of information systems. Yet, as organizational environments become more complex, turbulent and competitive, innovation and reinvention of new systems – both as channel and as content – become more necessary and important internal resources. For example, on-going adaptations may lead to an interactive multi-media CMC system, offering some of the compound forms identified by Heeter (1989) and Ciampa (1989), or applications supporting innovation at different phases, as suggested by Rice (1987).

This theoretical context generates research questions such as: What aspects of CMC, management policies and interactions organizational policies, work-group structures and organizational communication foster greater reinvention? For example, Rice (1991), taking an explicitly multi-level analytical approach, showed how word processing work structures (such as centralized or decentralized groups) may reduce or emphasize the influence of organizational policies on workunit reinvention. Note that traditional diffusion theory tends to stop at the point when the new system has been adopted – at either the organizational or individual level – and does not explicate the information-economic concepts necessary to raise such implementation questions. But contexts not typically associated with the diffusion of innovations literature would be informative as well. For instance, evaluations of a new CMC system might consider Zmud's (1990) concerns about whether this new medium might allow strategic manipulation of information, especially by those with greater prior computing experience or semantic skills. Alternatively, models such as proposed by Olson and Lucas (1982), Huber (1990) or Hauser and Byrd (1990) could be used to identify communication-oriented areas to evaluate, such as changes in interdepartmental relationships.

While innovation theory often emphasizes the importance of considering the stage of adoption, little empirical research actually controls for this important contingency or processual context. Comparative studies of different innovations across time, or of similar innovations at different stages, are required for more rigorous analyses of the role of adoption stage. However, one aspect of diffusion stage that has received recent attention is the role of *critical mass*. Markus (1990), Rice (1982) and others have theorized that the value of any particular CMC system rises, and thus the relative cost of adoption decreases, as a 'critical mass' of individuals begins to use the system. Without this critical mass, it is unlikely that widespread adoption of the system by the social community, and thus widespread access to the community's members by others through the

CMC system, will occur. Gurbaxani (1990) and Rice *et al.* (1990) have provided empirical support for the influence of critical mass on CMC system adoption. The structurational perspective may provide a rich context in which to embed the concept of critical mass in studies of CMC diffusion, because network structures both influence the adoption and use of a CMC system (such as through critical mass) as well as change to reflect new communication and power relations provided through the system (such as communicating across hierarchical levels) (as described by Contractor and Eisenberg, 1990).

Thus, both organizational and individual adoption may well be more complex for CMC systems than for other kinds of innovations, requiring understanding of different forms of system characteristics, contingency and interaction processes, longitudinal analyses and data (such as retrospective, multiple time-periods, archival), qualitative and quantitative approaches, conceptualizations of the nature of both communication channels and communication processes, and understanding of the social structure in which this communication and decision-making occurs.

Conclusion

While not explored in much detail here, it should be obvious that a wide variety of research contexts can be applied to traditional approaches to studying organizational CMC, such as diffusion of innovations theory; underlying meta-theoretical assumptions about the rationality, symbolism or political nature of the adoption process; attributes associated with specifically situated but generically described CMC systems that may influence the adoption and evaluation process; multiple levels of analysis, such as individual, group and organizational adopters; different evaluation criteria, such as adoption, types of usage, extent of acceptance and satisfaction, and reinvention; multiple sources of data, such as surveys, case studies, reported and computer-monitored usage and network data; adoption phases and reinvention processes; contingent influences on adopting and evaluating a CMC system such as information processing requirements and situational constraints; models of organizational implementation and individual media choice with specific propositions about new media; and wide-ranging, often inconsistent results and critiques from substantial prior research about the influences on and process of adopting CMC systems.

Returning to a point made earlier, it is difficult to be aware of and choose among the many alternatives within each of the subcontexts discussed in this chapter, precisely because of the multi-disciplinary nature of the topic. Designers and researchers, journals and books, technological and social concerns, all represent different perspectives, and are accessible only through different outlets. However, the integration and diffusion of CMC systems themselves may help us reduce this difficulty, in two ways.

One is the increasing interdisciplinarity of training as well as research in these areas. Some computer science departments hire anthropologists and social scientists, and conduct organizational and social research in computing. Some communication and organizational departments now provide better preparation in technological aspects of information and communication systems. Some textbooks, journals and conferences make special efforts to present discussions of organizational CMC from several perspectives. The other possible improvement is the use of CMC systems themselves to foster interdisciplinary discussion by online invisible colleges through a wide variety of communication networks, bulletin boards, list-servers, online conferences, and online databases of syllabi and bibliographies (McClure *et al.*, 1991; Rice, 1987, 1992c). For example, Newsted *et al.* (1991) developed a computer database of thousands of references to publications using or developing survey items for MIS research, now available in diskette format.

These two sets of changes may foster increasing awareness of different research contexts, and should enrich each particular context with new sources of experience, theories and models, methodologies and comparative reviews. Even a general awareness of the diversity of these contexts, much less the numerous studies associated with the various contexts, should obviate the easy and ill-informed introduction found in many CMC studies, that 'there is little theoretical or empirical research in this area'.

Notes

1. See, for example, Bostrom *et al.* (1992); Dennis *et al.* (1988); DeSanctis and Gallupe (1987); Ellis *et al.* (1991); Galegher *et al.* (1990); Greenberg (1991); Grief (1988); Hesse and Grantham, 1991; Hiltz (1984); Hiltz and Turoff (1978); Johansen (1988); Kraemer and Pinsonneault (1990); Kydd and Ferry (1991); Olson (1989); Rice (1980a); Rice and Shook (1990b); and Schrage (1990).
2. See, for example, Attewell and Rule (1984); Danzinger and Kraemer (1986); Dunlop and Kling (1991); Forester (1981, 1985, 1989); Gergen (1991); Gregory and Nussbaum (1982); Heim (1987); Hiltz and Turoff (1978); Kiesler (1986); King and Kraemer (1981); Kraut (1989); McClure *et al.* (1991); McCreary (1989); Mowshowitz (1981, 1986); Mulgan (1991); Otway and Peltu (1983); Quarterman (1990); Rapaport (1991); Rice (1980b, 1987); Rice and associates (1984); Rice and Shook (1988); Rogers (1983); Rule and Attewell (1989); Sproull and Kiesler (1991); Uhlig *et al.* (1979); Williams *et al.* (1985); and Zuboff (1988).

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