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Negotiations and Interactions in Electronic Markets

**Proceedings of the Sixth Research Symposium
on Emerging Electronic Markets
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Contents

Preface

The Department of Information Systems, University of Muenster, organized the research symposium to bring together researchers from various European countries to discuss current issues in the development of electronic markets as well as future perspectives and areas of research and collaboration. In particular the workshop focused on negotiations and interactions in electronic markets. Among the topics covered were:

- transformation or innovation in the design of market mechanisms
- automated negotiations
- electronic auctions
- social, personal, psychological aspects of interactions in electronic transactions
- the impact of different products/ services or industries on interactions.

The paper by *Mareike Schoop*, Technical University Aachen, "A Theoretical Framework for Speech-Act Based Negotiation in Electronic Commerce" conceptualizes negotiations in a computer-mediated environment as written communication and looks for ways to avoid breakdowns in communication. Mareike used Searle's speech act theory and Habermas' theory of communicative action in order to distinguish and develop different categories of negotiations and as basis for decisions about the design of negotiation modules in Electronic Commerce systems.

Katarina Stanoewska, St. Gallen University, presented "Requirements Analysis for Secure Electronic Contract Objects from the Implementation Point of View". Her work is positioned in the media reference model (see Lechner's papers for details) and looks into the implementation of negotiations. (Not included in the proceedings)

In her paper "Media – Towards a Model of Communication, Coordination and Organization in Electronic Commerce" *Ulrike Lechner*, St. Gallen University, introduces the notion of a medium as sphere for the communities of human and artificial agents and the Media Reference Model, which has been developed at the Media and Communication Management Institute, St. Gallen. The media model is used as a blueprint to design and develop electronic market platforms. The focus of her joint paper with Beat Schmid and Martina Klose is the presentation of a general logic as a framework for selecting languages to model components of a medium. This formal representation of the medium is a precondition for artificial agents to be able to act on market platforms and to contribute to the development of a community.

Eric van Heck, Erasmus University, presented results related to the laboratory experiments with web-based auctions that he has conducted in the Digital Erasmus Auction Lab (DEAL). The research focuses on the winner's and the loser's curse in electronic auctions. (Not included in the proceedings).

Margherita Pagani, Bocconi Business School Milano, discussed the impact of the convergence between the Internet and TVs, called interactive TV or Web TV. On the one side TV's are used as devices to access the Internet, which will have an impact on the types of offers, modalities of consumption, technological and productive structures and business models. On the other side, the Internet will be used as a broadcasting channel for TV content. Technological, organizational and service innovations are the key for understanding the behavior of firms and institutions in the development of interactive television.

The title of *Thomas Adelaar*'s presentation, who is affiliated with the Telematica Instituut in Enschede, was "Electronic Commerce and New Media: Implications for the Art and Antiques Trade; An Inter-Organisational Perspective on the Auctioneering Industry". Thomas took an (services) industry level perspective, focusing on the art and antiques trade, in order to study the impacts of recent innovations in ICT. (Not included in the proceedings.)

Stefan Klein, University of Muenster, presented joint work with *Claudia Löbbecke* on "Signaling and Segmentation on Electronic Markets: Innovative Pricing Strategies for Improved Resource Allocation". The paper provides some conceptual background for developing net-based pricing strategies and reflects first empirical evidences against it. It suggests a number of extensions to existing methods of pricing and trade negotiations.

Rita Walczuch, Maastricht University, presented joint work with *Katja Hofmeier* on measures of customer satisfaction on the Internet. As the Internet and specifically the World Wide Web is increasingly used as a marketing and distribution channel for products and services, using it as a medium for market research, in particular measuring customer satisfaction becomes more and more salient. The research focused on a decision making framework for choosing a data collection method for online customer satisfaction research. Rita's presentation was very much designed as a learning experiment based on the problem-based learning method and raised discussions about means to distinguish the influence of the channel from the influence of product and service quality on customers' satisfaction.

Victor Tsygankov, Turku School of Economics and Business Administration, discussed work in progress about "Questions of privacy in information technology based relations". He developed a conceptual framework to capture privacy issues within computer-mediated business transactions. (Not included in the proceedings.)

This working paper makes available selected papers which have been revised after the symposium and submitted for publication.

Stefan Klein and *Bernd Schneider*, Münster, August 2000.

Interactive television:
a model of analysis of business economic dynamics

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Abstract

The purpose of the paper is to understand from a business point of view, how the move towards interactive television is not limited exclusively to technology valence, but also has a profound impact on the whole system. From the types of offer to modalities of consumption, from technological and productive structures to business models. In order to analyse the relationships and links this study is organised around two significant dimensions of analysis.

The first analytic dimension can be divided into three areas:
- observation of the current state;
- determining economic factors;
- development guidelines

The second analytic dimension is, conversely, aimed at understanding the interactions among the following categories of the survey;
- technological development;
- sector development;
- economic implications for the business.

Reference to the economic implications for the business in this paper will focus on only some strategic and management problems that broadcast management have to cope with, such as the modality of consumption, offer types, and profit types.

The proposed model comes from the need for an integrated scheme of analysis that can express the business economic position as the result of interactions among interactive digital technology, the industrial structure and forms of competition.

This study first considers the details of the interactive digital technologies as the factor responsible for producing significant transformations in the structure of the sector, such as the change in the economic rationale of services and the value chain of the system in order to establish new models of communication.

Analysis of the competitive development generated by interactivity makes clear the opening up of new business areas. On the one hand this makes television an interesting area for new entrants as well, while it also allows for new positioning along the value chain for existing operators.

After describing the background both in technological and competitive terms the determining economic factors of the new interactive digital technologies are made clear, through analysis of the main competitive technological trajectories and new offer types.

It is worthwhile emphasising that the interactivity considered here can have several levels. It involves both transmission systems (which have to be able to have a two-way function), and the processes of product realisation and consumption. For this reason the phenomenon also involves business which transmit the signals, generally telecommunications businesses, as well as businesses which design the messages (communication product concept, production and sale), together with the business that make the terminals which are tied to electronics and computer sectors.

All these different business with their distinct characteristics could be influenced by the process of development process that is going on in the television sector, and many of them are actively seeking to influence this change.

With regard to television broadcasters, some business economic implications have been investigated, such as demand analysis, offer type, and the model of remuneration adopted.

A transversal analysis of the three dimensions comprised of technology, competitive and business system was then carried out, and alongside the variable state and the economic factors the developing direction of the phenomenon was also illustrated. The results of the present work allow for an understanding of the impact of interactive television on the whole economic system, together with the significant changes in the market, operator types and distributive systems. There are many problems that management has to deal with as a result of the changing behaviour of the audience, the status of the viewer, and the nature of the medium and its function. Technological, organisational and service innovation is undoubtedly the key for understanding the behaviour of firms and institutions in the development of interactive television.

1   Introduction

Interactive television can be defined as the result of the process of convergence between television and the new interactive technologies. Interactive television is basically domestic television boosted by the interactive functions generally supplied through a 'back channel' and/or a modern terminal. The distinguishing feature of interactive television is the possibility that new digital technologies give the user to interact with the content offer. There are, however, many transmission systems, technical standards, possible uses and contents. The range includes the world wide web and home shopping, digital video broadcasting and the internet, and film on demand and the video telephone. The success of these competing delivery systems in the consumer market will depend on the range of features, ease of use, cost of equipment, cost of use and content (quality and quantity).

The purpose of the present work is to understand from a business point of view, how the move towards interactive television is not limited exclusively to technology valence, but also has a profound impact on the whole system. From the types of offer to modalities of consumption, from technological and productive structures to business models. In order to analyse the relationships and links this study is organised around two significant dimensions of analysis[#] (Figure 1).

The first analytic dimension can be divided into three areas:
• observation of the current state;
• determining economic factors;
• development guidelines

The second analytic dimension is, conversely, aimed at understanding the interactions among the following categories of the survey;
• technological development;
• sector development;
• economic implications for the business.

Reference to the economic implications for the business in this paper will focus on only some strategic and management problems that broadcast management have to cope with, such as the modality of consumption, offer types, and profit types.

[#]   The analytic scheme used makes reference to the circular model in '*Tecnologia e concorrenza nei mercati industriali*', A. Farinet.

The proposed model comes from the need for an integrated scheme of analysis that can express the business economic position as the result of interactions among interactive digital technology, the industrial structure and forms of competition.

	DIGITAL TECHNOLOGY	SECTOR DEVELOPMENT CHARACTERISTICS	BUSINESS OF REFERENCE
CURRENT STATE	Characteristics of interactive digital technology ①	• New value chain • Positioning of the main players ②	Strategic and management problems ④
DETERMINING ECONOMIC FACTORS	• Competitive technological trajectories • New offer types ③		
DEVELOPMENT GUIDELINES	Market trends ⑤		

Fig. 1:   Analytic dimensions (Source: own elaboration)

This study first considers the details of the interactive digital technologies (quadrant 1) as the factor responsible for producing significant transformations in the structure of the sector, such as the change in the economic rationale of services and the value chain of the system in order to establish new models of communication (quadrant 2).

Analysis of the competitive development generated by interactivity makes clear the opening up of new business areas. On the one hand this makes television an interesting area for new entrants as well, while it also allows for new positioning along the value chain for existing operators.

After describing the background both in technological and competitive terms the determining economic factors of the new interactive digital technologies are made clear, through analysis of the main competitive technological trajectories and new offer types (quadrant 3).

It is worthwhile emphasising that the interactivity considered here can have several levels. It involves both transmission systems (which have to be able to have a two-way function), and the processes of product realisation and consumption. For this reason the phenomenon also involves business which transmit the signals, generally telecommunications businesses, as well as businesses which design the messages (communication product concept, production and sale), together with the business that make the terminals which are tied to electronics and computer sectors.

All these different business with their distinct characteristics could be influenced by the process of development process that is going on in the television sector, and many of them are actively seeking to influence this change.

With regard to television broadcasters, some business economic implications have been investigated, such as demand analysis, offer type, and the model of remuneration adopted (quadrant 4).

A transversal analysis of the three dimensions comprised of technology, competitive and business system was then carried out, and alongside the variable state and the economic factors the developing direction of the phenomenon (quadrant 5) was also illustrated. The results of the present work allow for an understanding of the impact of interactive television on the whole economic system, together with the significant changes in the market, operator types and distributive systems. There are many problems that management has to deal with as a result of the changing behaviour of the audience, the status of the viewer, and the nature of the medium and its function. Technological, organisational and service innovation is undoubtedly the key for understanding the behaviour of firms and institutions in the development of interactive television.

2   The new digital interactive technologies

The impact of digital technology is the first determinant in evaluating the technological asset as the origin of the structural and competitive transformation of the television market. The

technological change brought about by the advent of the new digital technologies will be surveyed here, showing the significant economic components from a relativistic approach.#

Digital technology is based on the transmission of a numerical or digitised signal that is transformed through algorithms into a signal that removes all redundancies of space and time.

This change in the signal's nature has important effects on service power, including.

- reduction in the use of the electromagnetic spectrum due to the compression of the digital signal, and a consequent increase in the number of channels that can be transmitted and an increase in choices. Nowadays it is possible to have 4-6 digital channels with the same quantity of frequencies that were once necessary for one analogue television channel. The space occupied by one terrestrial analogue channel can nowadays be used to transmit roughly 18-24 megabits a second, while the transmission of a digital channel at standard definition requires a capacity of roughly 4 Megabits a second;

- better transmission of image and sound quality;

- the possibility to use larger format television screens (from 16:9 to large-size flat screens);

- greater flexibility for broadcasters in the use of transmission resources. In a specific area of coverage, for example, the number of channels transmitted can be reduced in exchange for greater image quality (that can also be transmitted at high definition).

The second order of factors concerns the series of additional interactive services that can be added to television, and that allow the user to interact with the offered content (Figure 2).

For this reason it is worthwhile distinguishing between the digital and the interactive concepts, as the latter is made possible by the existence of new digital technologies.

\#   Vaccà demonstrates the methodological need to investigate the features of the economic and competitive implications of the new technologies. S. Vaccà, *Imprese e sistema industriale in una fase di rapida trasformazione tecnologica ...*, op. cit. pp. 78-79

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What is needed in order to have 'interactivity'?

1. **Activate the connection**

2. **Select the service of interest**

3. **Activate the downstream connection**

4. **Download the 'application'**

5. **Execute the application**

- **DSM-CC and MHEG provide all the tools for steps 2-5**

- **DAVIC is the body that provided the standards**

</div>

Fig. 2:   The phases of the interactive service (1998) [Source: CSELT (1998)]

On the basis of the terminology used in this paper interactive television is defined as domestic television boosted by interactive functions, and this coupling is made possible by the significant effects of the digital technology on television broadcast systems.

Reception of the digital signal by the user is possible by means of a digital adapter (hereafter called a *set top box*) which is linked to a normal television or integrated in a digital television in the most developed versions. The set top box decodes digital signals so that they are readable for older analogue televisions (Figure 3), and has a capacity for interpretation and memory that allows for the handling and visualisation of information. The consumer can thus acquire a simple form of interactivity by connecting the device to the domestic telephone line.

This means that even where there is no personal computer connection is still possible to the services associated with the Internet. Interactive services via television can be used separately or they can be combined with television transmissions, for example to enrich programmes with information on request. In this way the user can interact with the contents of television programmes, using the telephone line to send messages in reply to the service provide or to advertisers.

This service facilitates services such as home shopping and electronic banking. The Web will be transformed by "e-commerce" which will allow secure on-line transactions.

At present, handling charges (e.g. on credit cards) outweigh the cost of many services but future developments will permit low cost "micro-transactions" and content providers will be able to charge users.
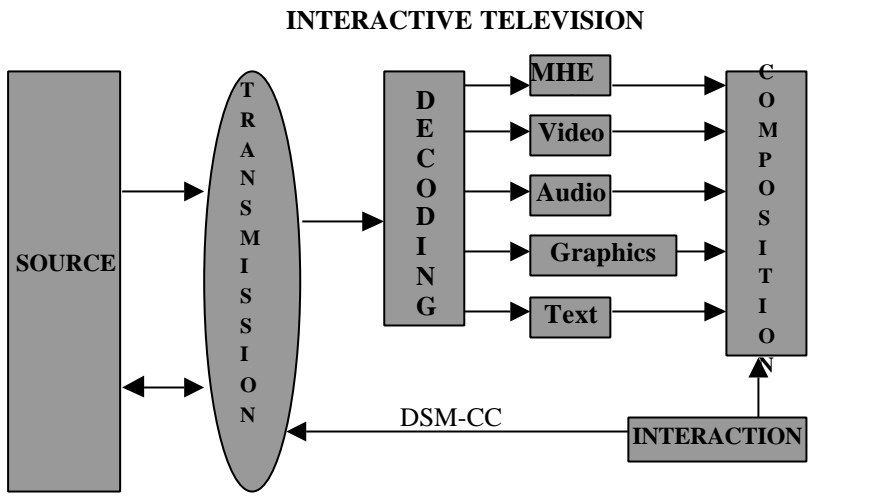
INTERACTIVE TELEVISION

Fig. 3: The functioning of interactive television (1998) [Source: CSELT (1998)]

3 Developing features of the sector: the new technological and functional configuration

In order to understand the main developing features of the television sector as part of the content industry it is first necessary to understand the impact which the new digital technologies are having on the whole communications industry (Figure 4).
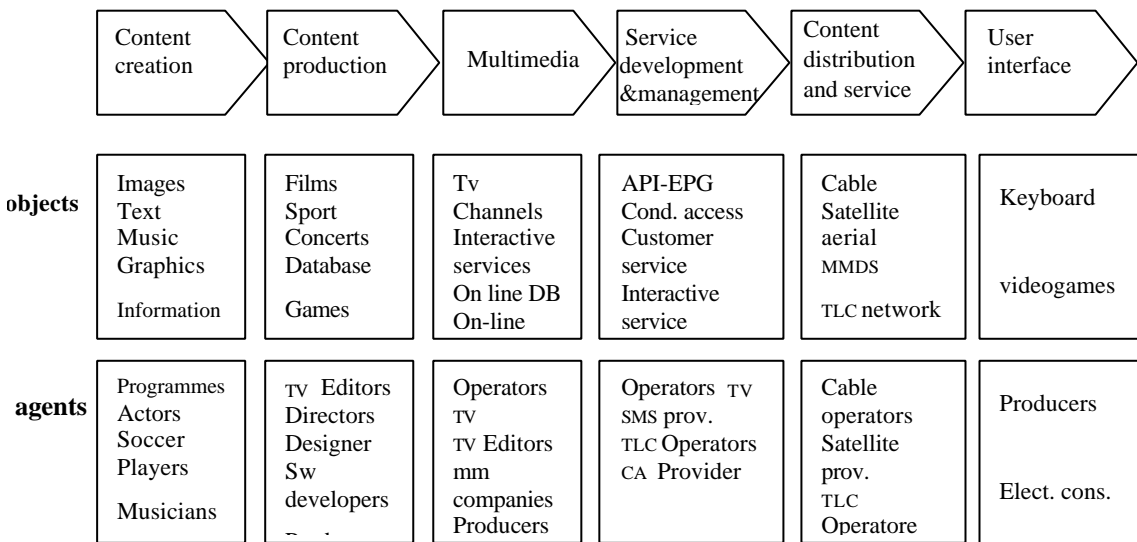
	Content creation	Content production	Multimedia	Service development &management	Content distribution and service	User interface
objects	Images Text Music Graphics Information	Films Sport Concerts Database Games	Tv Channels Interactive services On line DB On-line	API-EPG Cond. access Customer service Interactive service	Cable Satellite aerial MMDS TLC network	Keyboard videogames
agents	Programmes Actors Soccer Players Musicians	TV Editors Directors Designer Sw developers	Operators TV TV Editors mm companies Producers	Operators TV SMS prov. TLC Operators CA Provider	Cable operators Satellite prov. TLC Operatore	Producers Elect. cons.

Fig. 4: The value chain in the emerging multimedia market (1998) [Source: The communications industry in Italy – Instituto Economia dei Media (1998)]

Emphasis on the interactivity of content use only partially shows the strong innovative features of the new digital cycle of the content industry. Innovation is wide and profound, and is

not limited to just increasing consumption if the emerging role of all the software agents within the value chain is taken into account.

Innovations can be seen in both production and service, as well as in operating activities and management styles.

There have been significant transformations in the supply of hardware deriving from the multiplication of network access platforms that have pushed many operators (from consumer electronics or computers) to consider many new opportunities.

In order to take part in this new market and to offer new services the players are seeking to develop new capacities and to establish new relationships with partners in the market. Figure 5 illustrates the strategies, by type of operator in the market and element of the value chain, and the types of trade relationships which are coming into existence among the different agents. This is simply a diagram that sometimes makes it difficult to distinguish between content creation, presentation, and service supply.
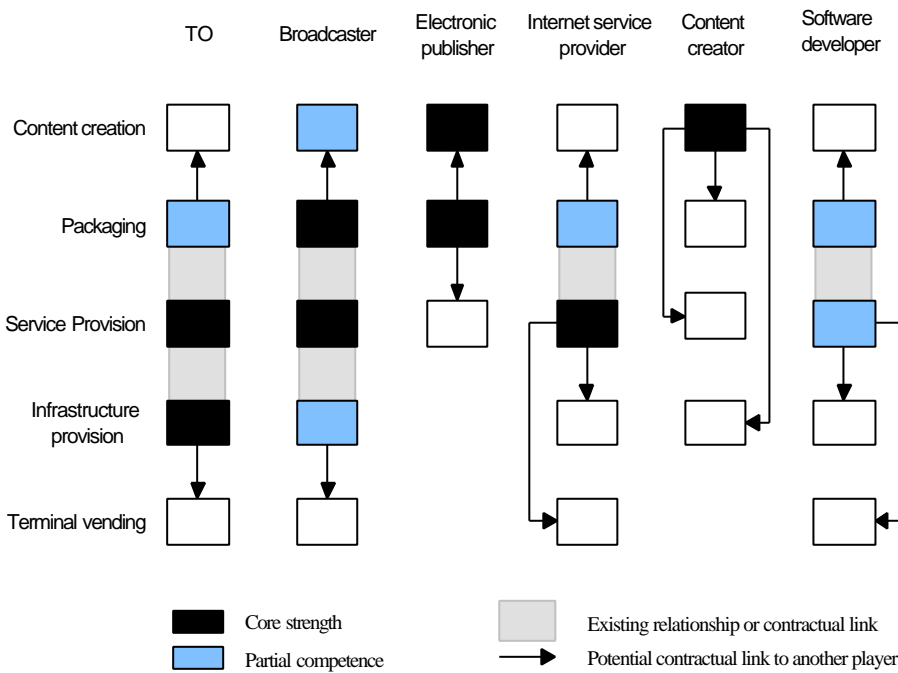

Fig. 5:   Positioning within the value chain of the most important operators and their reciprocal relationships [Source: Our adaptation from Squires data, Senders Dempsey LLP and Analysis Ltd. '98]

Infrastructure suppliers, and to a lesser extent service suppliers, are the segments in the value chain with the greatest degree of concentration. The margins are low in these areas for high infrastructure investment. Content and packaging suppliers (for example Bertelsmann and

BskyB) have larger margins and many businesses are seeking to enter these areas. The entry barriers in the areas of content creation and packaging are initially low (for example Amazon.com), and many small competitors can exist alongside larger ones. This new value chain should see the emergence of two distinct types of players: service and connection suppliers, and packagers and integrators.

New functions are also emerging within each new segment, such as the organisation of information and navigation companies like Firefly (a personal information agent) and yahoo in the content packaging and information segment.

The most radical consequence of the development of the multimedia market is the marginalisation of monopoly network operators like the telecommunications operators and television broadcasters that had a monopoly over the control of user access before liberalisation. The success of open networks and distribution channels like the Internet makes it possible for content suppliers, packagers and service suppliers to have direct access to users without making use of intermediaries. This means that the flows of money in the future multimedia market will be fundamentally different to those of the present. Further, contents will be increasingly important in the emerging market structure.

Digital technologies have large effects at every stage of the value chain for television broadcasters (from production of programmes to their distribution). These technologies allow for the reduction of production and distribution costs of the television signal, the quality increases but the investment required to purchase content rights are higher.

With the advent of the portal the real strong point is the ability of strong brands to supply both content and access. The television broadcaster can in this way become both the producer and packager of content at the same time.

4   PC- and TV-based technological trajectories

Having described the concept of interactive digital technology and the new technological and functional configuration that has been brought about in the market, it is now possible to analyse the economic determinants of the phenomenon.

As consumption develops, television and computer industries are seeking to capture the attention of viewers by offering increasingly integrated products, while television manufacturers and broadcasters are increasing the interactivity of the services and equipment offered. The offer of interactive multimedia can be seen as having two main trajectories. The first, which

can be identified as TV-based, is the closer to television. The diffusion, and thus the use, of interactive multimedia contents takes place in this case through the television terminal whose functions and components are progressively enriched so as to allow for the simultaneous viewing of Internet-type textual information, and increasing interaction with information sources and other users. The peripheral terminals (the set top box or decoder) of digital televisions is already able to unite the television and communication functions, and television sets can also be used as monitors when they are connected to equipment allowing for Internet access (PC terminals) at a low price.

The second trajectory which can be defined as PC-based, uses the personal computer as the user terminal by means of which interactive multimedia contents can be diffused and used. The continuous PC enrichment with 'television functionality' makes it able to download from the net and to manage multimedia contents such as video and sound. This trajectory is usually led by computer businesses, although many audio-visual agents have also taken part in experiments in this area.

The TV-based technological trajectory

In analysing the competitive technological features of this trajectory, it is necessary in the first place to distinguish between those initiatives that provide for the direct participation of television agents and those that involve television but where the agents are not television ones.

The introduction of the cable or satellite digital television system is perhaps the most significant innovation brought about by television agents. The digital channels of the present, and those that are about to be launched are not interactive, but the adoption of the digital system is an indispensable step through which it will become possible to personalise programming and contents, and to introduce service tariff systems and enrich television with interaction systems and Internet contents. It is here that the experiments in integrating television transmissions and Internet contents are important. The American television network NBC has established MSNBC, an online information service, as a joint venture with Microsoft network. It has launched a cable TV channel, also called MSNBC. Its programmes have frequent 'interspersions' with contents from the web site (web references and further details, contents developed for simultaneous use, and so on).

The PC-based technological trajectory

Among the numerous initiatives that have taken place within the PC-based trajectory, a significant percentage has had television operators as the main agents. They have rapidly consolidated their Internet presence by opening many sites, and as well as presenting institutional ty-

pe contents, some have also begun experiments designed to offer television contents through the Internet. The American network NBC offers multimedia contents that are linked to well-known television programmes but are specifically designed for the Web, through its Cybershow site. These contents integrate television images with the opportunities for interaction that are offered by the internet. Many initiatives benefit from Webcasting. Through applications like VDOLive, netShow and Vxtreme it is possible to download through a normal telephone line and to view pre-recorded video on a domestic PC, and to follow the camera work, the filming is in real time. Some of the larger television channels that are present on the Internet, such as CNN, ABC and Canal+, increasingly offer this possibility.

All the agents in the computer world are very active in developing the functionality of the personal computer so that the terminal can be used for multimedia interactivity.

4.1   The types of offer

There are many technological opportunities[#] offered by the development of new technologies. Figure 6 shows the main products that have come about as a result of the convergence between the Internet and television, and the respective market of reference. Two further technological opportunities are explored, the Intercast and Web TV (Figure 7), with their technological, economic and competitive features.

[#]   See C. Mauri, *Concorrenza dinamica*, op.cit., on the the development role of product differentiation in the sector and in competition.

Operator	Product	Market	Price $
Access	sw for Internet access	Japan	
Acer	Internet-TV STB	Singapore	
Akai	Network Computer STB	Asia	349
Bandai Digital Ent.	Internet-TV STB	Japan, USA	695
Batra Group	TV Internet-Terminal	USA, Europe	299
Cabot Software	Browser per STB	Phillipines, Indonesia, Sri Lanka	
Com One	TV Internet-Terminal	France	500
Continental Edison	Internet-TV STB	Europe	
Coollogic	TV Internet-Terminal	USA, Australia	399
Daewo	TV Internet-Terminal	South Korea	
EnReach Technology	sw for Internet access	USA	
Exhibit	TV Internet-Terminal	Italy	
FoxLink	TV Internet-Terminal	Taiwan	
Funai	Network Computer STB	Japan	500
ISP TV Inc	TV Internet-Terminal	USA	
Loewe Opta	INTEGRATED TV	Germany	2.000
MiTAC	TV Internet-Terminal	USA, Asia	
NetGem	TV Internet-Terminal	Finland, France, Spain, Germany	
NetProducts	Internet-TV STB	UK, Scandinavia, Australia	
Network Computer	sw for Internet access	USA, Singapore	
NewCOm	TV Internet-Terminal	USA	349
Nokia	Internet-TV STB	Europe	
PCtv Net	TV Internet-Terminal	Scandinavia	
Philips	Internet-TV STB	Malaysia, Singapore	
Proton Industrial	Network Computer STB		499
Sampo Group	Internet-TV STB	Taiwan, China	300
Sanyo	Integrated TV	Japan	
Sharper Logics	Internet-TV STB		500
Spyglass	sw for Internet access	USA, Europe	
Steria Solinsa	TV Internet-Terminal	Spain	
Sun MicroSystem	TV Internet-Terminal	USA	
Teco	Internet-TV STB	Taiwan, China, Japan	
Teknema	TV Internet-Terminal	USA, Asia, Europe	
Telia	TV Internet-Terminal	Sweden	
Thomson Multimedia	Network Computer STB	USA, Japan	300
UniView Tech.	Internet-TV STB	USA, Europe	399
Vestel	Internet-TV STB	UK, France, Germany	
Video Surfer	Internet-TV STB		nd
Web TV Networks	Internet-TV STB	USA, Japan	
Zilog	TV Internet-Terminal	USA	

Fig. 6:   Principal products for the convergence of Internet-TV [1998]

[Source: Istituto Economia dei Media elaboration of "Screen Digest" data]

Technology	Features of technological trajectory	Type of product	Competitive economic factors
INTERCAST (Intel technology)	*PC-based trajectory:* Addition of television programmes to the applications of a personal computer	Simultaneous access to web applications and television transmissions; the latter on part of the PC screen (a window that can be enlarged to fill the screen). The web content is transmitted terrestrially or by satellite, in the part of the TV signal called VBI (*Vertical Blank Interval*) or through cable TV.	Intercast services are usable: If the signal is transmitted by TV stations in the area. A personal computer equipped with Intercast is needed, or an Intercast card. The cost of the service has to be needed to the cost of this equipment. Intel has developed a partnership for Intercast with contents producers such as NBC, CNN, MTV, and the state television channel PBS for the development of services that can be accessed by users.
WEB TV (technology developed by a Palo Alto company bought by Microsoft)	*TV-based trajectory* Addition of web applications to television.	This requires a *set-top-box* produced by Sony and Mitsubishi under licence. The set top box is added to the television and has a remote control device which allows access to Internet t services without the need to buy a personal computer. Subscription to a service (Web TV Network) takes the place of connection to a traditional Internet provider. It is now possible to access the Web through a 56 kbps telephone link or through the cable link of *cable TV*, thereby increasing the speed of transmission, and to provide the television with a local memory of 1,1 GB.	The technology can be accessed through: The purchase of the set top box with a remote control Accessible cable infrastructure (this is a significant limit/bottleneck) Subscription service Internet is offered to anyone who has television without the creation of new editorials for the development of typical televisual or journalistic content (new services are being tried such as the chance to buy cinema or sports events tickets online, local weather forecasts, and access to news groups …) This permits the enlargement of the market base that is accessible to the Internet, overcoming the bottleneck spread of computers.

Fig. 7:   The principal economic determinants of Intercast and Web TV offer
[Source: Author elaboration]

Push technologies are in brief the application of relationship methods between the user and the television. These render the television more intelligent or increase the PC band-width, so that it is possible to have a continuous flow of information as the medium is programmed beforehand on the basis of user personal tastes and interests.

Interactive television products	Technologies	Economic competitive factors	Different content type partners
Microsoft Web TV	• Set top box with modem • 350.000 users	Combination of web contents with TV through a "link"	♦ "Baywatch" ♦ Disney ✲ MTV/M2 ✲ CNBC
Intel Intercast; Microsoft Web TV for Windows	• PC with TV • From 100.000 to 300.000 users	Distributes web contents through TV signal	■ QVC ■ CNN ■ M2 ■ CNBC ■ The Weather Channel
WorldGate	• Modern televisions via analogue cable • Being launched	Transmits associated Web pages to TV programmes	♦ The Weather Channel ♦ HGTV ✲ CNN ✲ A&E
Wink	• Modern televisions via analogue cable • Being launched	Extraction of graphics from the top of TV programmes	■ CNN ■ The Weather Channel ■ ESPN ♦ NBC ♦ TNN
ICTV	• Modern televisions via analogue cable • Being launched	PC applications on video TV	✲ Catch TV ✲ Broderbund ✲ Bravo ✲ Independent Film Channel
Source Media Interactive Channel	• Modern televisions via analogue cable • Being launched	Offer of Internet access and contents on demand	✲ E! ✲ CourtTV
AOL TV (includes NetChannel)	• Set top box • Not yet significant	Not available	None as yet

■ Functions 24 hours

✲ Only agreed

♦ Some programme

Fig. 8:   Interactive television platforms [1998]

[Source: author's adaptation of Forrester Research. Inc. data '98]

"Which platforms will you support?"
Percent of 28 TV programmers interviewed

Current
Planned

WebTV 29% 82%
WorldGate 18% 64%
Intercast 32% 54%
Wink 21% 50%
WebTV for Windows 14% 46%
AOL/ NetChannel 7% 29%

"How much programming will have an interactive component in 2001?"
Number out of 28 TV programmers interviewed

80% o more — 7
50% to 79% — 2
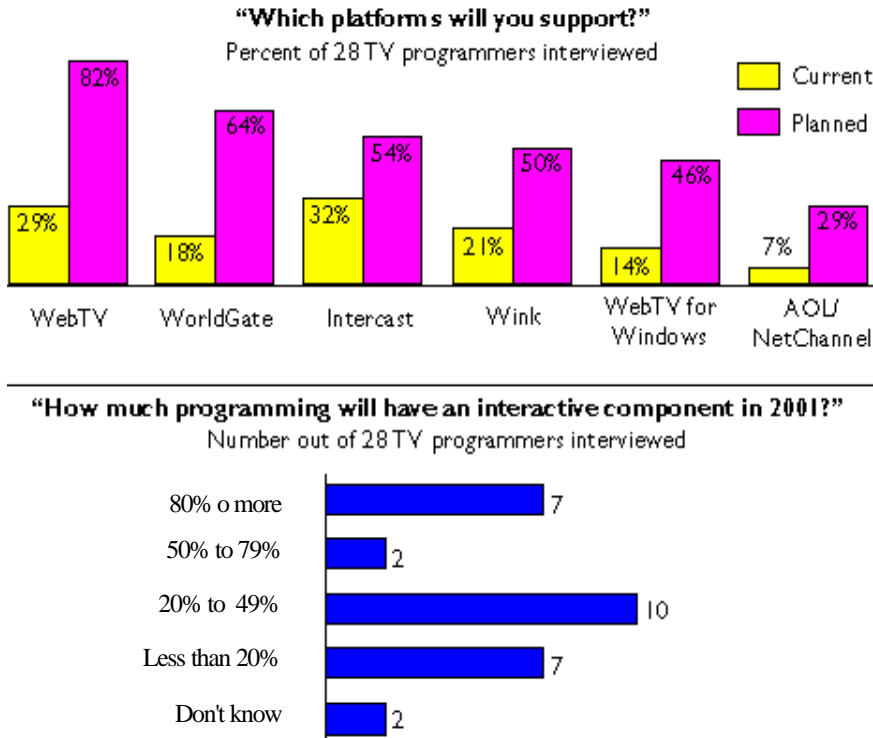20% to 49% — 10
Less than 20% — 7
Don't know — 2

Fig. 9: TV Programmers Plans for ITV Platforms in USA
[Source: author's adaptation of Forrester Research. Inc. data 1998]

5 Strategic and managerial problems

Having described the features of the interactive digital technologies and the developing featu-
res of the sector in terms of the present state and the determining economic factors it is now
possible to analyse the strategic and managerial problems which television management has
to deal with.

The work analyses the following main functions:
- the economic criticality of the offer model;
- the determinants of demand for interactive service;
- the remuneration model.

From this point of view what is important is the technological opportunity of Web TV which
offers the possibility of sending Internet type information as well as television type informati-
on, thus creating a system that can supply a series of domestic multimedia services.

A new language is being tried out, and new tools and transmitting methods, as well as new
professionalism.

5.1   The economic criticality of the offer model

The offer model generated by the process of convergence between the Internet and television, which has been analysed from the technological and competitive points of view earlier, presents some areas of criticality.

In the first place the main elements that differentiate the diffusion of television on digital Internet networks from other media can be summarised thus:

- Internet is decentralised in nature (this is a critical success factor);
- Internet video is transmitted through commutation;
- Internet video is available both on demand and through well-targeted transmissions
- Viewing conditions are very different
    - TVs are viewed from a considerable distance
    - computer users are much closer to the screen
- TVs are often viewed by several people, whereas computer usage is a solitary activity
- TVs are unsuited to interactivity, but PCs will be used to display TV programmes

The competitive success of the business model of the new market deriving from the convergence of the Internet and television naturally depends on its content richness, but also on the possibility to exploit the synergies between the two media.

Briefly, interactive programming requires an increasing ability to manage databases, interactive information, navigation and brand and programming strategies.[#]

Broadcasting is a "public good" because the marginal cost of extra listeners or viewers is zero. On the Internet broadcasters have to pay additional costs per hour for each extra listener and each listener may have to pay additional costs (telephone call charges and/or ISP charges). The crucial questions that remain unanswered include:

- whether the consumer is prepared to pay a higher rate of subscription, or to pay for additional channels. This in itself, will seriously effect the rate at which change takes place;

- how advertisers will adapt to the new media.

It remains to be seen how the standard thirty-second slot of broadcast advertising and Internet advertising from banner to interstitial to real media, evolve and merge. The content will evol-

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[#]   V. Reevell, *The long, slow birth of iTV*, op. cit.

ve to include interactive functions. Advertisers will have access to a more targeted audience then ever before, focused on the content they seek out, whether visually or interactively. As is happening on the Net, advertisers will be guaranteed access to an audience with a high level of interest in their product.

Many broadcasters already use the Web to offer:
- programme-related information
- audio services (quality now OK)
- video services (quality unacceptable)

Some of Europe's most popular web sites are operated by broadcasters which are attracted by the global reach of the Internet as it offers real benefits for international broadcasters and even little stations can be "global" players.

As regard for the Web there is no clear "business model". Almost all web sites lose lots of money, they generate little or no income and large web sites are expensive to develop and to keep up-to-date.
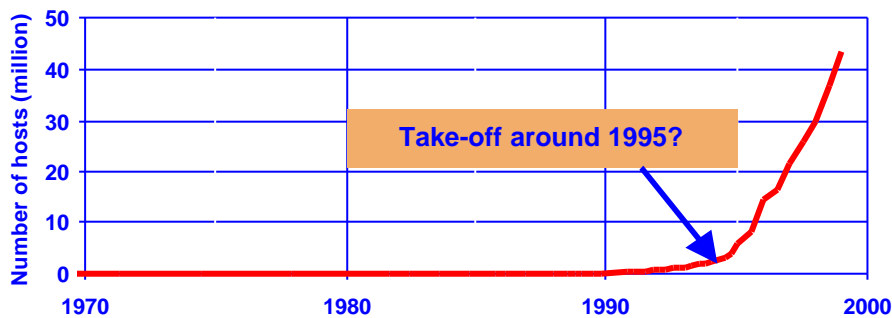

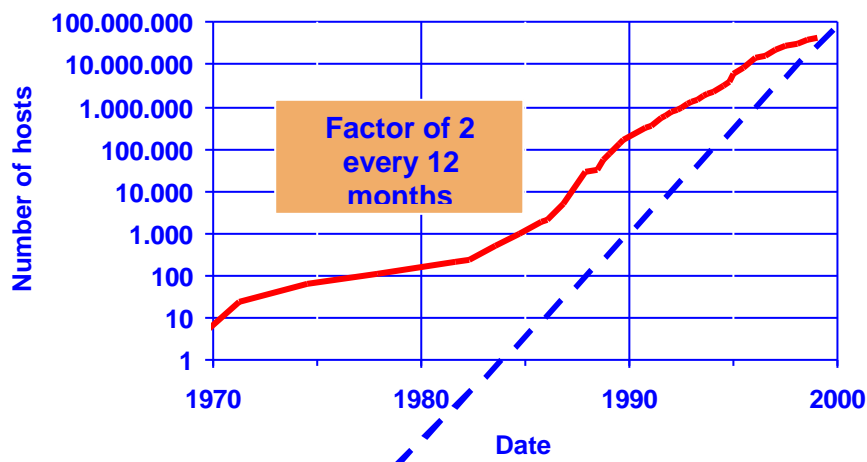
Fig. 10: Growth of the Internet [Source: Network Wizards (http://www.nw.com)]

Fig. 11: Growth of the Internet [Source: Network Wizards (http://www.nw.com)]

5.2 Principal characteristics of the demand for interactive services

What will be most interesting to see is how and whether the consumer of what has been a passive medium makes the change to the new interactive age. Will the usage patterns of the digital TV consumer be proactive or remain inactive?

There is a very high degree of uncertainty about new products and services where demand is concerned. The newness of the offer, the variety of technical options, the high degree of substitutability between products and services, the difficulty of forming a sufficiently wide demand, all make it difficult to estimate the times and methods of development. The number of failures recorded up to the present in the launch of interactive multimedia services provides an example of the risk rate that characterises new communication markets. The newness of services, above all in the area of interactive services and the various forms of pay per view, require an intense (and costly) work of persuasion and training aimed at consumers.

The present monetary costs of domestic equipment and the (psychological) costs of habitualisation seem to make for a premium on the perceived advantages in countries where there is an abundant free offer of television (Italy, Germany), and the domestic use of the computer is modest (Italy, Spain).

The user no longer invests in the quantitative expansion of consumption so much as in qualitative expansion. This means that the user is prepared to spend in order to have access to an ever increasing variety of alternatives, and in order to make a 'personalised' selection within this variety. Figure 12 shows an estimation of the speed of penetration of subscription to interactive television in the American market, distinguishing according to platform type adopted.

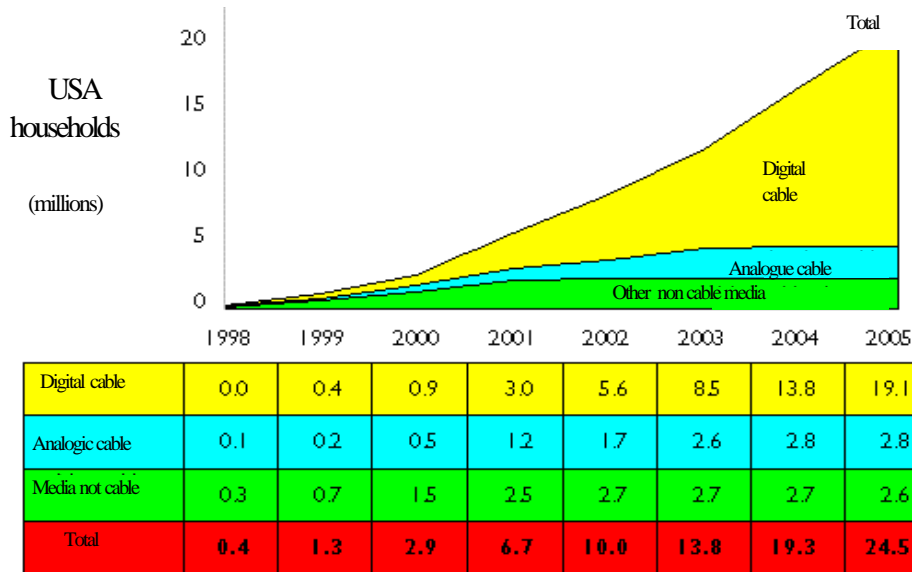|	1998	1999	2000	2001	2002	2003	2004	2005
Digital cable	0.0	0.4	0.9	3.0	5.6	8.5	13.8	19.1
Analogic cable	0.1	0.2	0.5	1.2	1.7	2.6	2.8	2.8
Media not cable	0.3	0.7	1.5	2.5	2.7	2.7	2.7	2.6
Total	0.4	1.3	2.9	6.7	10.0	13.8	19.3	24.5

Fig. 12: Subscriptions to interactive television by platform type
[Source: Forrester Research. Inc. '98]

The degree of PC penetration (specifically multimedia and Internet PC's) in nuclear families is a decisive factor for the take-off of new services, and in this regard Italy has a low Internet penetration.
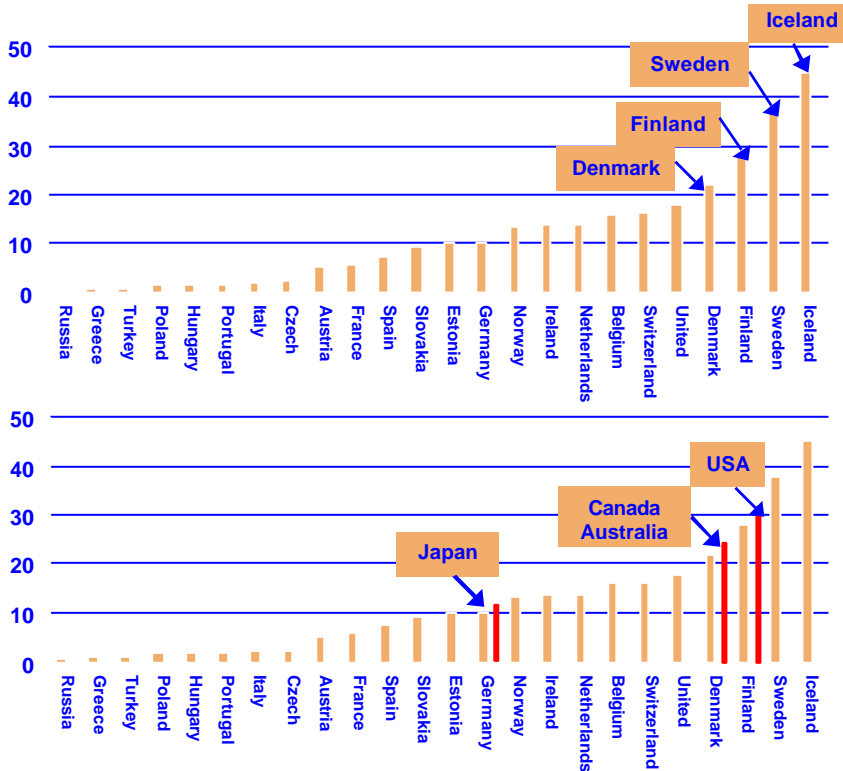

Fig. 13: Internet penetration - Europe and world and the European Internet Population (98-01) [Source: author adaptation of Forrester research. Inc data 1998]

The growth results presented were obtained by means of interviews conducted with managers from a sample of 95 companies representing the weight of industrial sectors and European countries. The results also refer to data supplied by the European Information Technology Observatory (EITO), Eurostat, Organisation for Economic Co-operation and Development (OECD), and analysis and data from official statistics.

5.3 The remuneration model

There are various remuneration models for the service provided, and these can be grouped into two categories:
- remuneration through subscriptions or pay by view;
- advertising.

a) Service payment

All the innovations that have used television as the user terminal follow the remuneration model based on subscriptions or pay per view. They are therefore a long way away from the model of free commercial television that is paid for through advertising.

The sale of contents has not worked on the network except in the case of specialised contents.

The Internet is a medium of communication that can provide highly personalised contents. Remuneration through subscription or pay by view has been problematic, and there is a continuous increase in advertising. These include push services such as Pointcast; this sends a lot of advertising messages to user computers, the proceeds from which are partly used to pay for the supply of contents.

In the latter case, contents suppliers like CNN Interactive, or publishers like the Wall Street Journal Interactive are remunerated through advertising licensing agreements that are made with the managers of the push service.

b) Advertising

Recent developments in television and computer technologies that are leading towards the convergence of the Internet and television also have radical consequences for the advertising market. As was shown when dealing with the Web TV technology the domestic PC of the near future will be transformed into an interactive television that will allow the viewer to be connected by telephone with a company's Internet site and to order a product directly, by clicking on the appropriate icon during an advertisement.

What will make this medium particularly attractive for advertising investors? One of the main benefits of interactive TV advertising is the possibility for the advertiser and advertising agent to use simple software in order to monitor the user's interaction with the brand and services offered.

A producer of a wide range of gardening items, for example, can discover how much time the user dedicates to the analysis of individual products, and this reinforces the decisions linked to marketing strategies.

The user is connected to the web site in real time. Each click of the mouse activates a user request to the advertiser's server. This process is possible by means of interactive cable TV platforms, thanks to the client/server structure. The problem occurs, however, in the case of interactive satellite television.

For the response click to be recorded the user has to click on to an icon during an advertisement to request a product sample or brochure. It is only in this way that the connection between the modem of the set top box and the broadcaster's server is effected.

Naturally the strength of satellite is the huge market that can be monitored.

In this case the Internet becomes a new tool that can be used by television channels for acquiring clients and users of advertising. It remains to be seen what the return of operations like these will be, both in terms of new client acquisitions and in terms of the internal management of marketing strategies by advertisers (see Figure 15).
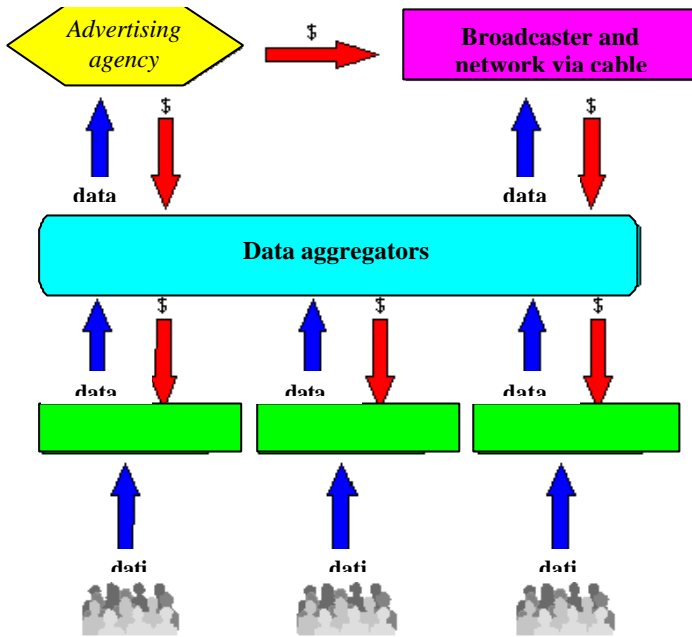
Fig. 15: The marketing strategies of advertising agencies in interactive television
[Source: Author adaptation of Forrester Research. Inc. data (1998)]

6 The developing guidelines: market trends

In developing the principal conclusions that have been obtained, it seems interesting to carry out a transversal analysis of the three categories that have been analysed, technology, competitive system and business, presenting alongside the variable state and economic factors, some development of the phenomenon.

Market operators are continuously increasing their exploitation of the possibility offered by the new platforms (in particular the Internet), in order to extend their own activities beyond the boundaries (geographical and productive) of the markets in which they have traditionally been active. An example is the Web transmissions cited above and the entry of telecommunications operators into the Internet as suppliers of network telephone services.

The flexibility of digital information makes it possible to offer more and enriched traditional services (digital radio and television, for example, and better quality mobile communications) as well as a wide range of new services and applications, including electronic newspapers, online markets and catalogues, domestic banking and the use of multimedia web sites as a means of internal communication or work tools.

Briefly, the market has the following convergence phenomena:

- radio and television broadcasters are expanding into new areas (data transmission, web broadcasts via the Internet and telecommunications services)

- telecommunications operators are offering audio-visual services (video on demand and cable television)

- Internet service providers are starting to diffuse audio-visual material, and supplier of Internet access are making programmes available for vocal telephone

Despite the current limits, as shown in this study, a series of applications are eliminating the gap between intelligent television and video via the Internet. The area in which the two sectors are converging is the most fertile ground for innovation and entrepreneurial activity, such as the creation of radically new content types like advanced graphic 'Internet channels' which make use of creativity from previously distinct fields (video production, computerised graphics, and information management). New hybrid multimedia applications are beginning to appear (for example television which works on the basis of 'commercial information advertising' through the use of Internet mechanisms that allow for the interactive ordering of catalogues on CD-ROMs, and Internet connection for price and contents updating, commercial Web sites with local extensions on CD-ROM for multimedia demonstrations that use high memory).

At the other end of the value chain, that of diffusion, operators are repositioning themselves in what are for them new areas of activity. New possibilities are being added to existing services on all the networks, and services themselves are evolving and uniting services that were previously separate.

To sum up: the evolution of the market generated by technological innovations increasingly requires individual companies to know their own positioning and the state of the dynamic competitiveness. This study is an aid to understanding how no business economic analysis can leave out of account the relationships that are coming into existence between technological innovation, dynamic competitiveness and a firm's market policy in the process of convergence between television and the Internet.

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Measuring Customer Satisfaction on the Internet

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Abstract

Based on the Expectancy Disconfirmation Model as the underlying construct, methods to measure customer satisfaction with products and the steps to be undertaken in the research process are investigated. The measurement of Derived Satisfaction using (dis)confirmation was identified to be the appropriate approach to CS measurement. Prior research has also shown that during the research process, several points specific to CS measurements need to be accounted for.

The Internet services currently used by marketing and social researchers include E-mail, mailinglists, newsgroups, Internet Chat, the World Wide Web (WWW) and Virtual Worlds. Virtual Worlds, being most advantageous for observational studies, are not useful for customer satisfaction research. Virtual Communities, in turn, have some promising characteristics for future use. Internet research methods based on these services include E-mail surveys and WWW-surveys. Common advantages of E-mail- and WWW-surveys include administrative and response speed, cost savings and global reach of respondents. Their greatest common disadvantage is the non-representativeness of the respondents for the larger population as well as their self-selection. Unless access is restricted to a known population, probability sampling is impossible when using the World Wide Web.

Based on these insights, the Internet was found to be an advantageous medium for customer satisfaction studies only if specific conditions are met. Companies need to investigate on a case-by-case basis if the online measurement of customer satisfaction is possible in their specific situation. The recommendations were summarized in a decision-making framework.

The results of a survey among market research agencies show that practitioners are to a large extent aware of the limitations within which the Internet can be used for customer satisfaction surveys. However, especially WWW-surveys sometimes are conducted in a way that does not lead to representative results.

1   Introduction

The importance of customer satisfaction has gained considerable attention in the marketing literature. "As the cornerstone of the marketing concept, customer satisfaction has been embraced by practitioners and academics alike as the highest-order goal of the company" (Peterson & Wilson, 1992, p 61). With increasing global competition, accelerating customer choice opportunities and demands, customer satisfaction has become a vital goal for the survival of the company. Individual countries as well as the European Union have recognized this importance and started to develop their own customer satisfaction indices in order to provide their companies with a standard benchmark within their industry or country (Bruhn, 1998).

Since its opening to private and commercial use in 1995, the Internet has been growing tremendously (Agrawal, 1998). Because of this tremendous growth, the new medium has also gained the interest of (marketing) researchers. Coomber summarizes that "the existence of the Internet and the World Wide Web (WWW) clearly provides new horizons for the researcher. A potentially vast population of all kinds of individuals and groups may be more easily reached than ever before, across geographical borders and even continents" (Coomber, 1997).

Although Internet marketing research is gaining popularity and studies concerning this subject are finally emerging on a larger scale, no specific investigations of customer satisfaction measurements on the Internet could be found. This paper will therefore investigate how customer satisfaction can be realized on the Internet.

A few studies concerning WWW-Surveys and E-mail surveys have been investigating market research on the Internet from various viewpoints and have produced some scattered knowledge. Schillewaert et al. ask that "future studies should be aimed at developing a comprehensive framework for describing when to use and when not to use the various sampling methods for WWW surveys" (Schillewaert, Langerak, & Duhamle, 1998, p 320). The aim of this paper is to firstly accumulate the findings of previous related research. Based on the insights from these studies some recommendations are developed, which are then combined in a decision-making framework. The recommendations given can furthermore be used as reference points for refining future studies. The paper also reports the results of a survey among marketing re-

search companies, which investigates how customer satisfaction research on the Internet is performed in practice and identifies gaps between theory and practice. Because of the difference in the satisfaction formation between products and services, customer satisfaction with products is the focus of this paper.

2   The Expectancy Disconfirmation Model

The construct of customer satisfaction (CS) has been researched extensively during the past decades. However, as of today, no generally accepted model has emerged (Berger & Mens van, 1997; Johnson, Anderson, & Fornell, 1995; Kaapke & Hudet, 1998). In this paper, the dominant model underlying customer satisfaction research, the Expectancy Disconfirmation Model has been chosen.

Richard Oliver led customer satisfaction research with the Expectancy Disconfirmation Model. This model has consistently been validated in empirical research (Engel, Blackwell, & Miniard, 1995; Peter & Olson, 1996) as well as build upon by various scholars (e.g. (Gupta & Stewart, 1996; Halstead, Hartmann, & Schmidt, 1994; Oliver & De Sarbo, 1988; Patterson, Johnson, & Spreng, 1997; Spreng, McKenzie, & Olshavsky, 1996; Tse & Wilton, 1988)).

According to the Expectancy Disconfirmation Model, a customer's satisfaction has three antecedents: Pre-purchase expectations, perceived product performance and confirmation or disconfirmation of these expectations. While the role of affect has not yet been resolved clearly, there is consensus over the existence of an emotional reaction to the intensity of satisfaction experienced (Müller, 1998). As of today, this model has been dominant in theoretical CS research (Berger & Mens van, 1997; Boulding, Kalra, Staelin, & Zeithaml, 1993; Engel et al., 1995; Gupta & Stewart, 1996; Müller, 1998).

Expectations have been defined differently by various researchers. Wilton et al. (Tse & Wilton, 1988), treat expectations as the likelihood of an event as well as an evaluation of its goodness or badness. Müller (Müller, 1998) summarizes the following expectation concepts, which can be found in the CS-literature: Expectations as ideal product performance expectations, minimal expectations, and product-specific norms. According to the current literature (Berger & Mens van, 1997; Klingebiel, 1998; Müller, 1998), expected product performance defined as a product's most likely performance ('predictive expectations') is the most common presumption used in customer satisfaction research. Engel et al. support this statement with the motivation that "this is the logical outcome of the pre-purchase alternative evaluation process" (Engel et al., 1995, p. 275). In correspondence with these authors, expectations will be treated here as 'predictive expectations'.

Perceived performance expresses the performance of the various product attributes as recognized by the customer. There is general consensus that expectations as well as perceived performance are not formed on an aggregate product level but for each product attribute separately (Oliver, 1993a; Oliver, 1993b). Halstead et al. (Halstead et al., 1994) state that this separate recognition allows for the assessment of the contribution each attribute makes to the overall satisfaction judgement.

According to Engel et al. (Engel et al., 1995), *(dis)confirmation* is the result of a comparison of expectations against perceived performance. Consumers make these comparisons using better-than, worse-than heuristics (Oliver, Rust, & Varki, 1997). *Positive disconfirmation* occurs whenever a consumer's perceived performance exceeds his[#] expectations, resulting in some degree of satisfaction. *Negative Disconfirmation* occurs when expectations exceed product performance, resulting in dissatisfaction. The intensity of the (dis)satisfaction experienced by the consumer is related to the intensity of the experienced (dis)confirmation (Patterson et al., 1997). Finally, under *confirmation* performance equals expectations, also resulting in satisfaction (Peter & Olson, 1996). However, this can be regarded as a more neutral stance, not being very extreme (Engel et al., 1995).

The degree of satisfaction/dissatisfaction experienced by the customer in turn triggers an emotional reaction on his part as a result of the unexpected discrepancy between expectation and perceptions (Müller, 1998). This affective reaction then influences the customers' repurchase intentions, complaint behavior and word-of-mouth communications (Gupta & Stewart, 1996; Patterson et al., 1997; Peter & Olson, 1996).

According to De Ruyter et al. (De Ruyter, Bloemer, & Peeters, 1997), a growing number of studies have also shown a direct influence of product performance on customer satisfaction. However, Halstead et al. (Halstead et al., 1994) provide an overview of studies showing a wide disparity of findings. In agreement with more current findings (Berger & Mens van, 1997; De Ruyter et al., 1997; Oliver, 1993a; Oliver, 1993b), perceived performance will be treated here as exerting both, a direct and an indirect influence on satisfaction via (dis)confirmation. Figure 1 provides an overview of the Expectancy Disconfirmation Model.

[#] For the ease of writing, only the male form will be used while all propositions are equally valid for males and females.
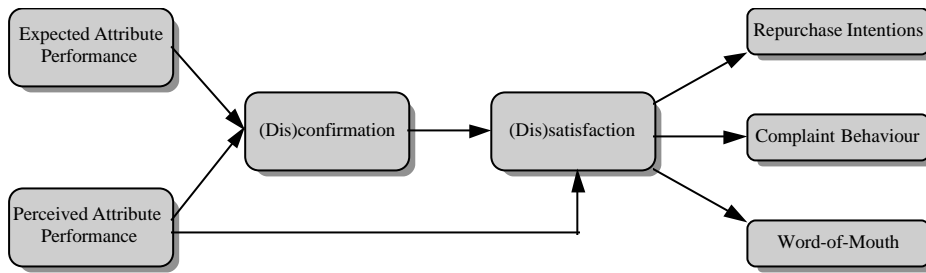
Fig. 1:   The Expectancy Disconfirmation Model
          [Source: Adapted from (Berger & Mens van, 1997; Müller, 1998).]

The scope of this paper has been restricted to customer satisfaction with products since satis-
faction with services is not yet well understood in the marketing literature. The evaluation
process for services is perceived as being more difficult (compared to products), based on dif-
ferent types and sources of expectations as well as based on the evaluation of the process as
well as an outcome (Halstead et al., 1994). Specifically, prevailing in the service satisfaction
literature is the dominant role of performance in service evaluation (Boulding et al., 1993; De
Ruyter et al., 1997).

3   Customer Satisfaction Measurement

3.1   The CS Research Process: Sampling Design & Data Collection (Method)

The measurement of customer satisfaction follows the steps described in general marketing
research but each of them requires actions specific to CS research. A discussion of these spe-
cific actions would go beyond the scope of this paper. Figure 2 gives an overview of the seven
steps of the research process. This paper is focused on performing steps 3 and 4 - Data Col-
lection - using the Internet. Possibly, Step 2 - Explorative Investigation (i.e. assessing impor-
tant product attributes) - could also be supported by online methods but this discussion is not
within the scope of this paper.

According to Dutka, "telephone interviews and mail questionnaires are the chief methods of
collecting data for customer satisfaction research" (Dutka, 1994, p. 61). Unless the sample
size is very small, personal interviews are very cost- and time-intensive. Another drawback of
this method is the interviewer bias, which is less intense during telephone surveys. Telephone
surveys permit superior quality control, elicit large response rates and fast turnaround times
(time between data collection and return). Mail surveys, in turn, are superior when customers
are difficult to reach; they allow the customer to choose his own responding time and are less
expensive. Their greatest drawback is the low response rate, which questions the representa-

tiveness of the returned questionnaires (Dutka, 1994; Fowler, 1997; Werner, 1997b). During the last ten years, computer-assisted telephone interviewing (CATI), computer-assisted personal interviewing (CAPI) and self-administered questionnaires have also been used in market research (Ronig, 1998).

The following section will introduce data collection methods for customer satisfaction research.
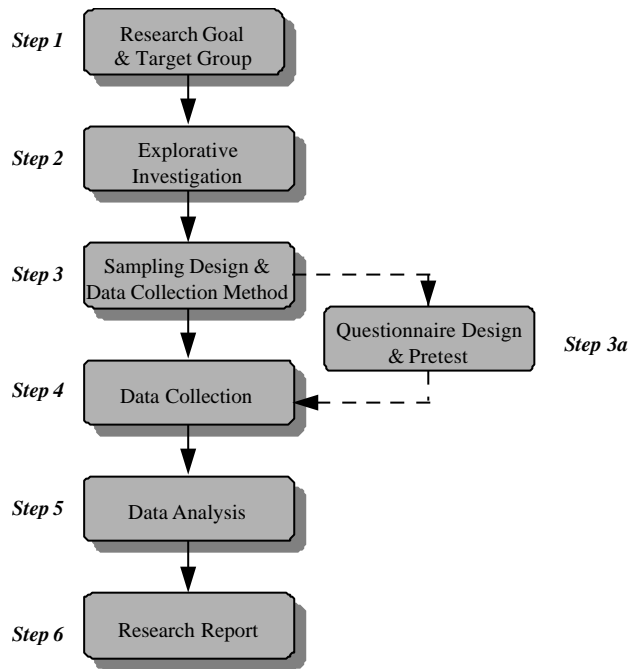

Fig. 2:   The CS Research Process
[Source: Adapted from (Churchill, 1995; Homburg & Rudolph, 1995)]

3.2. Measuring Customer Satisfaction

A common problem with customer satisfaction measurement is the fact that in practice, a large amount of different approaches exist (Klingebiel, 1998; Ramos, 1996) of which a considerable number is not based on any theoretical foundation at all (Peterson & Wilson, 1992). This can partly be attributed to the complexity of the (potential) concepts related to the construct of customer satisfaction. However, the success of any research for a large part depends on its theoretical foundations because "theory .. summarizes what is known about an object of study and states the uniformities that lie beyond the immediate observation .." (Cooper & Emory, 1995, p. 43). Although the Expectancy Disconfirmation Model might not capture all the antecedents of customer satisfaction, it is based on extensive research and empirical validation and therefore superior to a purely intuitive approach.

Because its aim is to investigate a precisely specified problem and the statement of the degree to which customer satisfaction is present, a CS investigation can be classified as descriptive research (Churchill, 1995). The CS-measurement methods can be classified into two major categories: Objective methods and subjective methods.

Objective methods measure observable quantities that are independent of the investigator's interpretation. Approaches include the analysis of sales turnover, market share, the degree of customer migration and the repurchase rate. However, these methods have two serious draw-backs: Firstly, their relation to customer satisfaction is not clarified theoretically; they are not included in the Expectancy Disconfirmation Model. Secondly, and related to the first point, it is also accepted throughout the literature that these methods are lacking validity (Lingenfelder & Schneider, 1992; Töpfer, 1996). Based on these arguments, subjective methods are often preferred to objective methods.

Subjective methods make use of a pre-defined construct of customer satisfaction and attempt to measure it via indicators (Lingenfelder & Schneider, 1992). These methods can further be classified into attribute-specific methods and event-specific methods.

Figure 3 provides an overview of the most common approaches. Please note that within the subjective methods, only approaches relating to product satisfaction are taken into consideration.
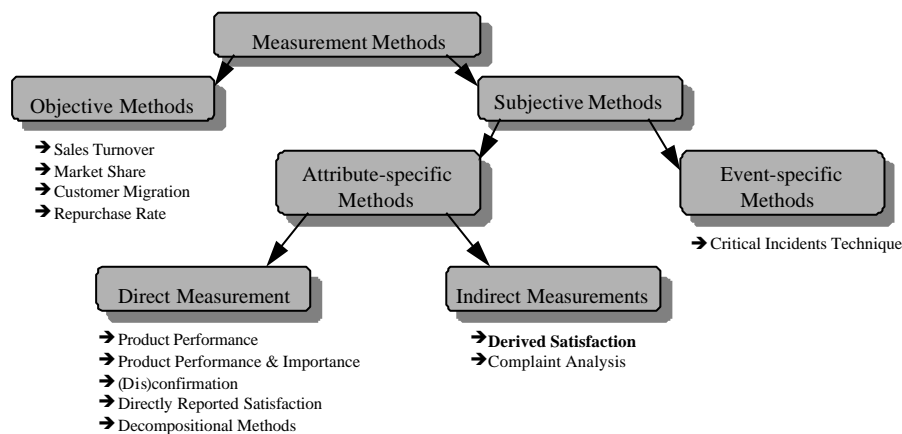

Fig. 3:   Methods of CS Measurement [Source: Adapted from (Klingebiel, 1998)]

Attribute-specific Methods

Attribute-specific methods are based on the assumption that the customer forms his product evaluation via individual product attributes (Eversheim, 1997). This view is in conformance with the Expectancy Disconfirmation Model. Attribute-specific methods are especially suit-able for standardized, timely and cost-effective measurements of features which are usually

expected by the customer (routine attributes) (Eversheim, 1997). These methods can further be sub-classified into direct or indirect measurements.

Direct measurements approach satisfaction or its components in a straightforward way. Methods include the measurement of product performance, product performance and its importance, (dis)confirmation, directly reported satisfaction and the decompositional method (Bruhn, 1997; Kotler, 1994; Lingenfelder & Schneider, 1992).

As its name implies, the analysis of product performance only takes the influence of performance but not that of (dis)confirmation into account and is therefore incomplete from a theoretical viewpoint.

The measurement of (dis)confirmation in turn does not account for a separate influence of performance as modeled in the Expectancy Disconfirmation Model and is therefore inferior in situations where performance has a greater influence than expectations.

In the case of directly reported satisfaction, overall or multi-attribute satisfaction is measured via satisfaction scales. This approach shortens the measurement process because expectations and performance do not need to be measured separately. On the other hand, the disentanglement of the separate influences of (dis)confirmation and performance is inhibited which reduces its information content (Bruhn, 1997). Consequently, the separate influence of performance again cannot be accounted for.

Making use of the decompositional method, customers have to rate their satisfaction with different sets of pre-specified combinations of product attributes. Attribute combinations are constructed in a way that they differ at the individual attribute level between groupings. Via a decompositional statistical analysis (e.g. Conjoint Analysis) the relative importance of the different attributes is assessed after the questioning has been conducted. This method does not allow for the separate assessment of (dis)confirmation and performance. Furthermore, by setting the individual product attributes at different levels, customers are expected to express their satisfaction with a product performance that they did not experience. According to the Expectancy Disconfirmation Model, this is not possible.

Indirect measurements do not measure satisfaction directly but only its antecedents (derived satisfaction) or infer from its consequences (complaint-analysis).

Derived Satisfaction measures the degree to which a certain attribute was expected as well as experienced (Bruhn, 1997; Kotler, 1994). This method acknowledges both influences on customer satisfaction and therefore also allows for the measurement of the separate influence of

performance. However, according to the Expectancy Disconfirmation Model, expectations as an indirect influence on customer satisfaction are completely mediated through (dis)confirmation. Another option therefore is to measure the degree of (dis)confirmation as well as performance (Eversheim, 1997; Klingebiel, 1998; Lingenfelder & Schneider, 1992). It follows that this approach best presents the Expectancy Disconfirmation Model because it accounts for the direct influence of (dis)confirmation and the possible separate influence of performance on satisfaction. Furthermore, if supplemented with an evaluation of overall satisfaction, this method allows for the assessment of the importance of individual attributes after the data have been collected (Zacharias, 1998).

With regard to complaint analysis it should be noted that in general only about 5% of unsatisfied customers ever complain (Aaker, Kumar, & Day, 1998; Eversheim, 1997; Kotler, 1994), which severely limits the method in is predictive ability.

Summarizing, the measurement of Derived Satisfaction was chosen as a good fit with the underlying theory of this paper.

Event-specific Methods

Event-specific methods rest on the assumption that a customer's satisfaction is largely dependent on the incidents he experienced with the company. These methods are based on so-called 'story telling' whereby customers are asked to report their experiences with the company/product in question in an unstructured way (Bruhn, 1997). The timing of the investigation is critical because customers must have been able to form an evaluation over the product as well as being able to remember that incident in detail (Eversheim, 1997; Töpfer, 1996). It should be noted that event-specific methods are very unlikely to generate a complete picture of the customers' satisfaction (Homburg & Werner, 1996; Töpfer, 1996).

The Critical Incidents Technique focuses only on occasions where customers made exceptional, non-routine experiences (Stauss, 1995). Because the experiences under investigation are non-routine, they are believed to be stored in memory for a long time (Eversheim, 1997). Hayes (Hayes, 1992) adds to that point by stating that a critical incident is always specific to one single behavior or product characteristic. Customers are questioned via open-ended, standardized questions which facilitate the recall of these special incidents (Bruhn, 1997). Since the influence of critical incidents (exceptional, non-routine customer experiences) is not modeled within the Expectancy Disconfirmation Model this technique will not be further discussed in this paper.

To conclude, the measurement of Derived Satisfaction using (dis)confirmation is the appropriate approach to CS measurement within the context of the Expectancy Disconfirmation Model. All other methods only cover either (dis)confirmation or performance or measure satisfaction in a direct or incomplete way.

4 Internet Research Methods

Research on the Internet is being conduced by marketing and social researchers while "collection of primary information over the Internet is still in its incubation stage" (Aaker et al., 1998, p. 168). Methods can primarily be classified as reactive and non-reactive (Batinic & Bosnjak, 1997a). While non-reactive methods are based on observation, they are not relevant for customer satisfaction measurements[#]. Reactive methods make use of survey questionnaires and online interviews. This section introduces the methods' main characteristics and advantages and disadvantages compared to traditional methods. In the next chapter, their suitability for the measurement of customer satisfaction will be discussed.

Table 1 summarizes the advantages and disadvantages of the Internet research methods that are discussed within this section.

4.1 E-mail Surveys

E-mail surveys use E-mail for the entire process of sending/receiving, completing and returning the questionnaire. E-mail surveys are the most comparable to traditional mail surveys because both are sent to a specific person and are completed by that person independently (Ronig, 1998; Selwyn & Robson, 1998). When designing the questionnaire, ASCII formats should be used to ensure the proper representation of all characters while lines of maximal 65 characters prevent unwanted line breaks (Hambridge, 1995). Usually, enclosing of attachments containing multimedia is not advised because it increases downloading times. Moreover, the recipients might not have the necessary programs to view and open the attachments (Batinic & Bosnjak, 1997a). Because many mailers strip header information, contact information should always be included on the bottom of the message.

[#] Non-reactive methods include server-log analysis and observations in Internet Relay Chats and Virtual Worlds (Batinic & Bosnjak, 1997a).

To prevent publication of the recipients' addresses, the mailing list must be entered into the blind-carbon-copy field of the program (Ronig, 1998). A computer program can be used to prepare the questionnaire and distribution list and to extract the data from the replies. However, manual data entry can still be required due to varying layouts of the returned questionnaires (Gräf, 1998). The last point to mention is that unless an encryption device is used, E-mail on the Internet is not secure. In addition to their use in survey research, E-mails are also commonly used for the questioning of experts on a specific topic (Hauptmanns, 1997; Naether, 1995; Naether, 1996).

The biggest advantages of E-mail surveys are their ease of administration, low cost compared to traditional survey methods and global reach. Furthermore, the majority of responses usually occur within the first three days after the mailing (Comley, 1996; Mehta & Sivadas, 1995; Oppermann, 1995). Drawbacks are the often manually required data entry, messy return data and the fact that not everybody has E-mail, (Tuten, 1997). Another drawback is the minimum of layout options that can be used (Smith, 1997; Whatt, 1997), while some E-mail software limits the length of a message ((CustomerSat.com, 1999a; CustomerSat.com, 1999b, Tuten, 1997 #364). Moreover, respondents can rewrite and delete questions, extend scales or simply delete unwanted mail (Krasilovsky, 1996). Most importantly, 'Netiquette' prescribes to keep unsolicited E-mail ('spam') at a minimum. Spam includes unsolicited advertisements and mass E-mailings, an out-of-context posting in a mailinglist/newsgroup, unusually large or frequent postings in a mailinglist/newsgroup and putting someone on a mailing list without consent and requiring him to 'opt-out'[#]. (Kurzman, 1998). A last point to mention is the response rate. Compared to traditional mail, some authors indicate that response rates are usually higher (Anderson & Gansneder, 1995; Booker, 1996; Comley, 1996; Oppermann, 1995; Parker, 1992) while others report lower response rates (Agrawal, 1998; Kittleson, 1995; Schuldt & Totten, 1994; Tse, 1998; Tse et al., 1995). Other authors (Bachmann, Elfrink, & Vazzana, 1996; Mehta & Sivadas, 1995; Rosenfeld, Booth-Kewley, & Edwards, 1993) have not found any difference in response rates. Some authors have suggested that response rates of E-mail and mail surveys are narrowing because people are getting increasingly comfortable in deleting unwanted mail (Bachmann et al., 1996; Tuten, 1997).

When used for the questioning of experts, the interviewer bias of a traditional face-to-face interview is eliminated and no additional interview transcript is needed. However, "a great deal of tacit information that would be conveyed in a conventional interview is lost" (Selwyn & Robson, 1998). Although 'Netiquette' (Net Etiquette) proposes the use of Emoticons (e.g. ;-))

[#] The EU Directive of May 20 concerning Distance Contracts (97/7/EC) prescribes grant respondents the possibility to 'opt-out' from a mailinglist. Member states are furthermore free to introduce more stringent provisions (e.g., the requirement to 'opt-in') (EuroCauce, 1999).

to express nonverbal reactions, it is questionable whether they can substitute the non-linguistic cues of a face-to face conversation (Selwyn & Robson, 1998). Lastly, immediate probing into experts' answers is not possible due to the asynchronous character of the medium.

4.4   WWW-Surveys

The programming of a WWW survey lets the researcher choose from a large amount of options. Question answering modes that can be used include checkboxes, radio buttons, drop-down lists for single or multiple-choice and conventional text fields (one to multiple lines). Furthermore, adaptive questioning (subsequent questions asked depend on the respondent's answers to previous questions), forced answering modes and real-time data verification and re-entry can be achieved. Adaptive questioning can be realized after every batch of questions or following immediately after each question (Kehoe & Pitkow, 1997). Questionnaires can then consist of various pages which are linked so that the adapted questioning can be realized as effectively as possible (Gadeib, 1999). Moreover, questionnaires can be made 'lively' by inserting pictures, video clips, audio and 3D animations while questions can be put into a randomized order to prevent question order effects. To restrict access to a pre-selected group, passwords can be used (Batinic & Bosnjak, 1997a). If respondents take part in a longitudinal survey and keep their original passwords, their previously submitted demographic information can be filled in to make the survey more convenient for them (Kehoe & Pitkow, 1997). Agrawal (Agrawal, 1998) states that an increasing tendency is to use online incentives (e.g. a prize redemption code sent via E-mail that allows the respondent to order a product for free). However, this in turn might increase the tendency of multiple submissions by one person. Related to this point, Carl (Carl, 1998) advises to use only immaterial incentives.

After having been programmed, a WWW survey is placed on a Web server on the client's or the research company's location. Since it is unlikely that respondents find the survey by chance, it needs to be promoted (Bandilla & Hauptmanns, 1998; Coomber, 1997; Werner, 1997b). Promotions can include links to other pages (also banners), entries in search engines or ads in traditional print media (Werner, 1997b). Moreover, questionnaires can be posted in newsgroups and mailing lists (Ronig, 1998). For reasons of data protection, a researcher should ensure to use secure-server technologies within the WWW (Batinic & Bosnjak, 1997a). Returned data can automatically be transferred to a data analysis program (Batinic, 1997). Furthermore, "data base queries can be programmed to give periodic reports of the data to-date, including statistical analyses" (Carver, Kingston, & Turton, 1998; Whatt, 1997). Summary statistics of the respondents' input can be provided instantaneously and be used as an incentive for their participation.

Research	Advantages	Disadvantages
E-mail Survey	Administrative ease, low cost, global reach, fast response times	limited penetration, undesirability of unsolicited E-mail, minimal layout options, length restrictions, respondents can alter the questionnaire which requires manual data transfer
Expert Questioning via E-mail	all advantages of E-mail surveys, no interviewer bias, instant interview transcript	loss of tacit information, no immediate probing into answers
WWW-Survey	all advantages of E-mail surveys, overall effectiveness, visual appeal, automatic data transfer, possible report of online results after each survey-submission, summary statistics can be used as an incentive to participate	limited penetration, respondent pays for being online, self-section bias, non-representativeness, without controlled access: multiple submissions possible and no accurate response rate, depending on the browser used: differing layouts, increased down-loading times, Java incompatibility
Online Focus Group	Global reach, no travel (costs) for participants, easy control of dominant participants, no environmental influence of a studio, Instant interview transcript	no control over the respondents & situation, nonverbal cues cannot be observed, unclear influence of anonymity on the honesty of answers people with poor typing abilities might be intimidated, answers can be less spontaneously
Targeting Internet-specific Groups	**Advantages**	**Disadvantages**
Posting in Newsgroups/ on Mailing-slists	Increased awareness of the survey	low response rate, cross-postings violate Netiquette, no commercial use allowed on some lists, biased results through public discussion, no response rate calculation possible
Research in Virtual Communities	To the authors' knowledge, no marketing research in Virtual Communities has been conducted yet. The success of communities depends on the number of providers, a critical mass of members and access to their user profiles. Potential advantages: access to a homogeneous group, communication in community chat rooms; potential disadvantage: restricted access to personal information.	

Table 1: Advantages and Disadvantages of Internet Research Methods

The major advantages of this method are its relatively low cost compared to other traditional methods, global reach, overall effectiveness (e.g. automatic question skips and plausibility checks) and visual appeal (Carver et al., 1998; Tuten, 1997). Furthermore, manual data entry is completely eliminated, so data are accurate. Also, the majority of responses occur within 2-3 days, while after the first week, responses decrease significantly (Batinic & Bosnjak, 1997b). Cost savings compared to traditional methods are achieved mainly through the ease of distribution and data collection (Agrawal, 1998). Lastly, respondents can complete and return the questionnaire at any time they find convenient.

The largest problem when using WWW questionnaires is that of self-selection, meaning that not every person in the population has the same chance of finding the survey (Werner, 1997a). Another drawback is the sample bias because the Internet population is still relatively small and non-representative for the general population (Aaker et al., 1998; Tuten, 1997). It follows that the construction of a random sample is possible only with controlled access and personal

invitations. Furthermore, without access restriction to the questionnaire, there is no quality control over the sample of respondents participating and multiple submissions by one person are possible. A related problem is the determination of response rates in surveys without restriction. Usually, the quotient of questionnaires sent and received is taken as the response rate. However, three problems center on this method: Firstly, only people who actually requested the questionnaire (as opposed to those who saw its promotion) are counted. Secondly, multiple submissions by the same person are possible. Thirdly, when the questionnaire is saved on a local proxy server, the exact amount of requested questionnaires cannot be controlled (Batinic & Bosnjak, 1997a). Moreover, the response rate can be influenced by the questionnaires' graphical designs because those might differ depending on the respondents' browser. In addition, the usage of multimedia or adaptive questioning can increase downloading times substantially. Lastly, different browsers handle Java applets, which are used for adaptive questions, differently (Kehoe & Pitkow, 1997).

A general issue regarding online surveys is that the respondent himself incurs the costs for the completition of the survey (Bandilla & Hauptmanns, 1998). Urgent research is therefore necessary to investigate this potential influence on the response rate.

4.5   Online Focus Groups

According to Agrawal (Agrawal, 1998, p. 196), "online Focus Groups ... are yet to attain popularity". However, some marketers (NFO; CustomerSat.com, 1999 #419) have already started using them. In online Focus Groups information is exchanged in the form of text. After having received the URL and a password, participants log onto the webserver of the moderator and interact via the sending and receiving of messages (Hagenhoff & Pfleiderer, 1998). Recruitment of participants can be made via telephone, E-mail or the automatic invitation of every n-th visitor of the company Web-site (Hagenhoff & Pfleiderer, 1998; Levy, 1998). Each respondent anonymously answers the moderator's question simultaneously by typing his answer into a field provided for this purpose (Hagenhoff & Pfleiderer, 1998).

The moderator can 'broadcast' messages visible to all participants or 'whisper', meaning that only a targeted recipient can read his message. This enables the moderator to probe into points of interest (NFO,). Readily typed questions can be 'cut and pasted' in order to save time. Using the 'pause' mode, answers can be suppressed until everybody in the round has responded (Hagenhoff & Pfleiderer, 1998). Live-links to other Web-sites or broadcasting of multimedia (pictures, audio, video) can be made available in split-screen mode (Levy, 1998).

An advantage of this method is that respondents can participate without leaving their home (in remote geographical locations), which is especially advantageous in cross-national studies. The lack of environmental influences of a studio is sometimes believed to elicit more honest and spontaneous answers (Hagenhoff & Pfleiderer, 1998; Solomon, 1998). Moreover, dominant participants can be controlled more easily and the interviewer influence is reduced (Götte & Kümmerlein, 1996). All answers can be saved without the potential information loss of a traditional group since no additional transcript needs to be produced (Levy, 1998). Furthermore, communication is conducted in parallel "which may allow people to share information ... more quickly" (Dennis, Valacich, Connolly, & Wynne, 1996). Lastly, costs are usually lower due to reduced traveling expenses (CyberDialogue, 1998; NFO).

However, the 'advantage' that respondents do not need to leave their home is at the same time the largest problem one has to deal with. Because the laboratory condition of a traditional Focus Group cannot be replicated, the moderator has no control over the situation in which the participants are at the moment, whether their attention is undivided and if their participation is independent of other people's immediate influence. Naether (Naether, 1996) further states that answers in online Focus Groups are always controlled and that spontaneity is therefore not possible. A related problem is the question as to how far anonymity leads to dishonest answers (Grüne, 1998; Solomon, 1998). Furthermore, because some people might not be able to type fast, important thoughts might not be expressed, while the ability of Emoticons to substitute nonverbal reactions is questionable. Sketches and drawings that might be part of a product-related discussion cannot be displayed in a text-based online group. As was the case with WWW surveys, the costs for being online are borne by the respondents. Since online Focus Groups usually last around one hour (Solomon, 1998), the company by all means should reimburse the participants' costs.

Another serious point to mention is that no systematic investigations of online Focus Groups are yet available. Moreover, researchers of general computer-mediated communication have found varying results. After having conducted a laboratory experiment concerning the effect of anonymity in Internet relay chats, Sassenberg and Kreutz (Sassenberg & Kreutz, 1997) found that with decreasing knowledge about the other participants in an online communication, the individual participant's orientation focuses more on his individual attitudes and needs. According to Briggs et al. (Briggs, Nunamaker, & Sprague, 1998), recent studies have found that convergence is much more difficult with distributed than face-to-face groups. However, according to Kiesler and Sproull (Kiesler & Sproull, 1992), experiments have shown that, compared with a face-to-face meeting, a computer-mediated discussion leads to more equal participation among group members and status equalizing effects among other things. Sassenberg (Sassenberg, 1999), in turn reports that in comparisons of computer-mediated and face-to-face communications, contradictory results have been obtained in that a

stronger mutual influence of respondents was sometimes found in computer-mediated and sometimes in face-to-face communication.

4.6 Internet-specific Target Groups

Another characteristic of the Internet is the fact that it is 'populated' by some target populations that cannot be reached offline with the same ease. These groups include subscribers to newsgroups or mailinglists and members of Virtual Communities. We will discuss the use and implications of these groups shortly in the following sections.

Newsgroups and Mailinglists

Subscribers to newsgroups or mailinglists can be recruited as survey participants (Aaker et al., 1998). Using this method, an invitation to a WWW-survey is placed in the newsgroup or on the mailinglist. When E-mail questionnaires are used, the researcher can choose between directly placing the questionnaire or only placing an invitation (Bandilla & Hauptmanns, 1998).

While recent evidence indicates that surveys in newsgroups are usually characterized by a low response rate, 'cross-postings' in various groups to heighten the response rate are recommended (Bandilla & Hauptmanns, 1998; Batinic & Bosnjak, 1997a). However, excessive 'cross-postings' and postings of unrelated topics violate 'Netiquette', while many newsgroups do not allow commercial content. Moreover, questionnaire length is a critical issue since newsreaders usually report the number of lines next to its header. Another drawback of this method is the likely emergence of a public discussion of the survey that would bias its result trough its uncontrolled influence (Batinic & Bosnjak, 1997a). In addition, the refusal rate cannot be determined because the message is not saved on a central server but on all news-servers around the world which offer the particular newsgroup (Batinic & Bosnjak, 1997a). Lastly, and most important in a CS context, the results of the survey are not representative due to the self-selection of the respondents.

Virtual Communities

Virtual Communities are a promising target for marketers. Paul and Runte (Paul & Runte, 1998) state that these communities offer superior possibilities for online marketing and predict that they will increasingly function as an intermediary between providers and consumers. While Kannan et al. (Kannan, Chang, & Whinston, 1998, p. 39) state that "the business model for supply of information products from e-communities and individual consumers is still evolving", Virtual Communities can, under certain conditions, also offer possibilities for on-

line marketing research. This can be translated into significant revenue potential for Virtual Communities (Kannan et al., 1998).

Paul and Runte (Paul & Runte, 1998) acknowledge that the success of Virtual Communities depends on how fast a critical mass of members, their preference- and transaction-profiles and providers themselves accumulate. Related to that point, Hagel and Armstrong (Hagel III & Armstrong, 1997) hypothesize that communities will eventually be a vital part of the total sales of a company.

Because of their novelty and the immaturity of these communities, it is difficult to make a statement regarding their suitability for online research in general. An advantage of these communities is that buying power is concentrated in relatively homogeneous groups, which makes a focused targeting very easy. Specific consumer-preferences can be generated through the tracking of their online behavior or through the direct questioning of their preferences when joining the community. According to Paul and Runte (Paul & Runte, 1998), many current communities choose the latter approach. The authors argue that product offerings can be tailored to each member based on his preference information, which then leads to the closer binding of the member to the community.

Moreover, while personal communication between members can be realized in chat-rooms, these rooms can also be used for context-related and moderated 'public' or restricted discussions.

More ambiguous are the product/service-specific word-of-mouth communications between the community's members. While they can be advantageous whenever the opinions are positive, negative experiences are also discussed openly which can have a detrimental effect for the supplier. Furthermore, Virtual Communities will eventually have to provide access to competing product/service providers in order to keep their members. This could make it easier for competitors to monitor the research efforts and themes of the conducting company. Lastly, Hagel and Sacconaghi (Hagel III & Sacconaghi Jr., 1996, p. 31) warn that "privacy is likely to rise as a significant policy issue". One will have to wait if members in the future will still be willing to provide a great deal of personal information and in how far the tracking of their movements will be possible.

4.7   Summary

Concluding, with its growing user profile, the Internet is an interesting new medium for customer satisfaction measurements. Internet research methods include E-mail surveys, WWW-

surveys and online Focus Groups. Common advantages of E-mail- and WWW-surveys in-clude administrative and response speed, cost savings and global reach of respondents. Their greatest common disadvantage is the non-representativeness for the larger population and the self-selection of respondents. While both methods can be used for survey research, it has been found that E-mail surveys have serious disadvantages compared to WWW-surveys. WWW-surveys in turn offer opportunities that are not available with any other method. However, unless access is restricted to a known population, probability sampling is impossible when using the World Wide Web.

The conduction of online Focus Groups in turn is not (yet) advisable because next to its many other disadvantages, the moderator cannot ensure that the participants' attention is undivided and independent of other people's influence. Accordingly, online Focus Groups will not be discussed further in this paper.

Target Groups specific to the Internet include members of Virtual Communities and subscrib-ers to newsgroups and mailinglists. While Virtual Communities might be suitable for online research in the future, postings in newsgroups/on mailinglists are not advisable due to the large number of disadvantages and the non-representativeness of the survey results. For these reasons, Internet target groups will not be discussed any further in this paper.

5   Customer Satisfaction Measurement on the Internet

CS studies on the Internet are very new phenomena: The first worldwide customer satisfaction survey was conduced on the Internet only two years ago, in 1997 (Slevin & Chisholm, 1997). In this section the usefulness of the Internet research methods for customer satisfaction meas-urements will be evaluated from a theoretical viewpoint. In the previous section we have identified E-mail and WWW surveys appear to be the most appropriate options for online CS research. We will now discuss how and when these instruments can be used. First, a general discussion of online measurement of derived satisfaction will be followed by the implications for E-mail surveys, WWW surveys and a combination of both. Throughout the section, rec-ommendations are derived from the literature and combined in a decision-making framework (Figure 3).

5.1   Online Measurement of Derived Satisfaction

As has been explained earlier, measurements of Derived Satisfaction are conducted in order to obtain a representative picture of the current satisfaction level of the customers. However, it

has been explained in the previous section that representative surveys on the Internet are only possible for a defined population with access to the Internet. Ronig (Ronig, 1998) concludes that representative Internet surveys can (so far) only be conducted within closed groups or when an offline quota of the population under investigation is available.

> Recommendation 1: *For online measurement of CS, access of all customers to the survey medium (Email or WWW) must be assured.*

In order to be conducted in a standardized and timely manner, Derived Satisfaction can be measured via E-mail or with a WWW survey.

5.1.1 E-mail Surveys

Independent of the online method chosen, the question of customer access must always be clarified first. While the population of interest in a CS research are the customers and the appropriate sampling frame is the customer database, customers' E-mail addresses should be readily available or easy to access. However, not all customers need to have access to E-mail. Often 20% of a company's customers generate about 80% of the profitable sales, which makes them prime targets in a CS survey (Hanan & Karp, 1989). Therefore, probability sampling should in general be possible when surveying via E-mail. However, when there is only quota information about the customers available (e.g. when selling a mass-product), E-mail addresses are not easy to acquire. Furthermore, the sending of mass E-mails on the basis of E-mail directories is not acceptable according to 'Netiquette' (Batinic & Bosnjak, 1997b). In the same vein, the European Society for Opinion and Marketing Research (Esomar, 1999a) also urges to keep unsolicited E-mail at a minimum.

While some authors conclude that a relationship with the group of individuals to which an E-mail survey is sent is advisable (Batinic & Bosnjak, 1997b; Schonland & Williams, 1996), Kurzmann (Kurzman, 1998) states that "spam often seems worse when it comes from someone you know and into which you've placed your trust". He even suggests that companies should adopt the policy of never purchasing from other companies who are sending out 'spam'. Moreover, while according to the EU Directive concerning Distance Contracts (97/7/EC) a person not wishing to receive unsolicited E-mail has to actively 'opt-out', the directive also states that member-states may introduce more stringent provisions[#] (EuroCauce,

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[#] As an example, in Germany, customer data may only be used for marketing research when the customer has provided his explicit consent (Werner, 1998).

1999). In Australia, Europe, and North America coalitions against 'spam', which are lobbying government legislation, have already been formed.

It follows that unsolicited E-mail surveys have large potential to negatively influence a customer's perception of the company sending the survey. The point seems especially severe in a CS context because the negative affect created by unsolicited E-mail could temporarily influence a customer's ratings negatively. Peterson & Wilson (Peterson & Wilson, 1992), in their meta-analysis of CS studies found that mood and satisfaction ratings tend to correlate, although the specific influence of mood has not yet been clarified. Summarizing these insights, the following recommendation can be given:

> Recommendation 2: *E-mail surveys should only be sent out with the explicit prior consent of the customers.*

While a customer's consent can be asked for with regular mail or via the phone, the most convenient way is to ask him via E-mail, which again raises the 'spam' issue. Within its guidelines for Internet marketing research, Esomar (Esomar, 1999a) prescribes to "reduce any inconvenience or irritation such E-mail might cause to the recipient by clearly stating its purpose in the first sentence and keeping the total messages as brief as possible". Relating to this point, Kurzmann (Kurzman, 1998) states that a short, individually e-mailed message to customers seems acceptable. Another issue is the sending of E-mails to unknown customers whose addresses have been obtained from an E-mail directory list. 'Netiquette' and Caube (CAUBE,) regard this as violent misbehavior.

> Recommendation 3: *Using E-mail to ask for customer consent should be acceptable when there is an existing business-relationship and the message is short and individually addressed.*

Another issue to deal with is the fact that E-mail questionnaires can only handle a certain amount of lines. While this in part depends on the program used (by the respondent), E-mails containing more than 100 lines are considered to be 'long' by 'Netiquette' (Hambridge, 1995). While one also has to restrict oneself to 65 characters per line, the available space is filled very fast due to three reasons: Firstly, the measurement of Derived Satisfaction as an indirect measurement involves asking two questions for each product attribute. Secondly, when the company wants to benchmark its performance against that of the competitors, another question regarding competitors performance (for each product attribute) needs to be asked. Lastly, answering scales used are usually interval scales (e.g. better then/worse than expected) which usually range from 5 points to 10 points, thereby furthermore contributing to

the length of the questionnaire. It can be concluded that given that recommendations 1 and 2 are not violated, E-mail surveys can be used for short, single-product surveys.

> Recommendation 4: *E-mail surveys should only be used for short, single-product surveys.*

5.1.2   WWW Surveys

WWW-surveys offer the researcher advantages, which are not available with traditional methods or E-mail surveys. While many of them (e.g. adaptive questioning and forced data entry) can also be realized with computer-assisted surveying (CAPI or CATI), others are unique (e.g. global reach, administrative and response speed, and low cost especially compared to CAPI and CATI). Cost advantages can be especially large in a CS context where the questionnaire is only programmed once and then used several times in a longitudinal survey. Furthermore, the programming task itself is easier compared to the programming of a CAPI or CATI questionnaire (Werner, 1997b).

However, as was the case with E-mail surveys, a prerequisite for conducting WWW-surveys is the target populations' access to the medium. While this information can be obtained whenever a customer database is available, its gathering might take a considerable amount of time, or, depending on the closeness of the relationship, customers might feel bothered and simply do not submit this information. However, if customer access can be assured, a random sample can be drawn. Furthermore, the password-protection of the questionnaire allows the calculation of exact response rates, the prevention of multiple responses by one person and the exclusion of people outside the target group. Whenever customer access is not previously controlled for, the representativeness of the results must be questioned and the response rate cannot be calculated.

> Recommendation 5: *Given that a sampling frame is available, WWW surveys must be password protected and access of the target population to the WWW must be assured (R1).*

The need to gather information about the customers' access to the WWW is completely eliminated when the product is exclusively sold online. In this case, without access to a sampling frame, a random sample of customers can be drawn by exposing the survey to every n-th visitor of the homepage (Pfleiderer, 1997). By asking every respondent about the frequency of his visits, the mean visits per n-th visitor can be calculated. The hits on the page within a given time-frame can then be divided by the number of mean visits per respondent to get an

indication of how many individuals visited the site within the time frame (Hagenhoff & Pfleiderer, 1998). This allows for an approximation of a response rate and weakens the problem of self-selection (Werner, 1997a). In order to reduce multiple responses, their previous participation within a given time frame can also be asked for. Lastly, the respondents can be offered the opportunity to be contacted via E-mail in order to fill out the survey at a later time (Pfleiderer, 1997).

It should be noted however that not every customer has the same probability to be included while multiple responses by a customer cannot always be prevented. The company conducting the survey could also consider giving up the anonymity of the respondents by requiring them to enter e.g. their customer number in order to prevent multiple submissions. Because of these problems, the method should only be chosen if a customer quota has to be met and accordingly no sampling frame is available.

However, if the company conducting the survey has neither a customer database available nor exclusively sells via the web, the situation is very different. In this case, the offline customer quota can be compared to the current user profile on the web. However, even when the quota can be met on the web, Bandilla (Bandilla, 1997) warns that customers in both groups can still be different on many characteristics (e.g. demographics, interests, and preferences). While a combination of online and offline methods seems to be a solution to the problem, we will explain later why this is not (yet) advisable.

It follows that the web is not suitable for a measurement of Derived Satisfaction when no sampling frame is available and the product is not exclusively sold online.

> Recommendation 6: *Given that no sampling frame is available, a quota sample can be taken from the homepage only if the products are exclusively sold online.*

Given the fact that the product is not sold exclusively online and the customers have access to the WWW, they need to be invited to the survey. Invitations can be generated by establishing links to other pages, entries in search engines, postings in newsgroups and on mailinglists and via ads in traditional media. While these methods, with the exception of excessive cross-postings in newsgroups/on mailinglists do not violate 'Netiquette', they do not allow for a controlled access to the questionnaire, which has been required in recommendation 4. Furthermore, because of the disadvantages stated earlier, postings in newsgroups/on mailinglists are not advisable in general.

Controlled access can be assured by sending personal invitations via telephone, mail or E-mail. The most advantageous approach is to send an E-mail, which contains the URL of the

survey in its body. By clicking on this URL, customers are directly transferred to the question-naire. Furthermore, it can be combined with a customer-specific password (PRI) so that customers do not even have to enter a password anymore (CustomerSat.com, 1999a, CustomerSat.com, 1999 #418). However, it has been concluded earlier that this type of invitation is only acceptable if individually addressed to a customer who is engaged in an existing business-relationship with the company conducting the survey.

Another advantage of the WWW-survey in combination with E-mail invitations is that it actu-ally gives the company two options to ask the customer if he may be contacted in future sur-veys. While one possibility to 'opt-in' can be placed in the E-mail invitation, the other one can be added to the WWW-survey itself. This gives the respondent the opportunity to opt-out if he wishes to do so without having to access the survey. If he however decides to participate he does not have to separately submit his consent.

> Recommendation 7: *E-mail is the most convenient method to invite customers to the WWW-survey given that the message is short and individually addressed.*

A major advantage of the World Wide Web for the measurement of Derived Satisfaction is the possibility to extract a maximum amount of information while keeping the questionnaire as short as possible. This can be achieved with the help of forced choices and adaptive ques-tioning. The advantages of adaptive questioning in a CS context are likely to be greatest with multi-product surveys. Before the questions related to one product are presented to a cus-tomer, he can be asked if he is familiar with the product under question. Should that not be the case, the batch of related questions can be skipped completely, thereby markedly decreasing questionnaire length. The usage of forced entry ensures that no question has been missed and completely eliminates the 'missing value' problem of mail surveys. While Churchill (Churchill, 1995, p. 745) states that "a significant incidence of no information on any item might in itself be insightful", this method ensures that all questions are answered and that the reason for 'missing values' is always known.

> Recommendation 8: *WWW-surveys are better suited for multi-product surveys or surveys with many product attributes than E-mail surveys.*

Lastly, a WWW-survey can be programmed in a way that online results can be inspected after each incoming questionnaire. While this is convenient for surveys that provide mean values and distributions as their only results, the measurement data of Derived Satisfaction are usu-ally subject to more sophisticated analyses. However, because of the frequent skew of re-sponse distributions of CS measurements, the normality of the data needs to be checked be-

fore any parametric tests can be conducted. Moreover, the derived importance of product attributes cannot be calculated before the data set is complete.

To summarize, data from the measurement of Derived Satisfaction are subject to analyses that can only be undertaken when all questionnaires have been submitted. Furthermore, if an external marketing research company conducts the research, it might have to assist its customer in interpreting the results (e.g. of a regression analysis).

> Recommendation 9: *Survey-results should only be submitted online after the data set is complete and all analyses have been made.*

5.1.3 Comparability/Combination of Methods

It became clear in the previous sections that both, E-mail and WWW-surveys are only suitable for the measurement of Derived Satisfaction when specific conditions are met. A natural solution would therefore be the combination of methods to achieve a broader coverage of the population whenever the customers' access to either medium is only moderate. However, very little research on the comparability of methods has yet been undertaken. Agrawal (Agrawal, 1998, p. 198) states that there currently is a "lack of validation evidence and comparative studies in which web surveys are compared with traditional telephone or mail survey technology". Unfortunately, the comparability of E-mail and Web-surveys has also not been clarified yet.

According to Batinic (Batinic, 1997), a number of studies indicate that electronic surveys (not Internet surveys) are comparable to traditional paper and pencil surveys within limits. Unfortunately, he does not state what these limits actually are. Tuten (Tuten, 1997) also states that overall, computer administered surveys generate comparable results to traditional paper and pencil surveys with the added benefit of longer and more disclosing responses to open-ended questions. Having compared the results of a disk-by-mail and a paper-and-pencil-survey, King and Miles (King Jr. & Miles, 1995) conclude that administration mode has no effect on measurement equivalence. Bosnjak and Batinic (Bosnjak & Batinic, 1997), after their comparison of a WWW- and a paper-and-pencil survey also report that both versions have the same reliability. According to Breitner and Batinic (Breitner & Batinic, 1997), the combination of various methods might lead to the best success over time.

Several authors however question the comparability of paper and pencil and computerized tests. Kiesler and Sproul (Kiesler & Sproull, 1986), in their early research found that respon-

dents showed more sincerity in E-mail surveys compared to mail-surveys. According to Buchanan and Smith (Buchanan & Smith, 1999), several studies have found increased levels of self-disclosure in computer-administered tests and differing response patterns between traditional and computerized tests. The authors (p. 129) summarize that the "equivalence of computerized and traditional versions cannot simply be assumed but must be demonstrated for each test". Lander (Lander, 1998) agrees by stating that response distributions differ between surveys conducted online and with traditional methods. She further hypothesizes that there might be specific characteristics of the Internet that can be accounted for these response rate differences in distributions.

It follows that with only limited availability of comparative studies, no consensus has been reached so far. The problem of data comparability is especially important in a CS context because differences between response patterns had been found earlier in the meta-analysis of Peterson and Wilson. "Satisfaction data collected using different (data collection] modes are not comparable; on average, oral administration of satisfaction questions … appears to increase satisfaction ratings by approximately 10-12 percent relative to self-administration" (Peterson & Wilson, 1992, p. 64).

Based on these arguments, the following recommendation can be stated:

> Recommendation 10: *Online survey methods should not (yet) be combined with traditional methods.*

Even less literature can be found on the comparison of E-mail and WWW-surveys. Schillewaert et al. (Schillewaert et al., 1998) in comparing responses to a WWW survey and an E-mail survey while measuring attitudes towards the web report that user responses do not differ between the two methods. Making the same comparison, Bosnjak and Batinic (Batinic & Bosnjak, 1997a) conclude that WWW-surveys and E-mail surveys generate data having the same reliability, while a tendency of more 'socially acceptable responding' was found in E-mail surveys. However, it should be noted that the WWW-survey used by the authors allowed anonymous responding, which is likely to at least partially contribute to this difference.

While conducting a CS study on the Web, Bogner (Bogner, 1996) hypothesized that especially critical customers would return the questionnaire. However, he found that answers to his questions were mainly positive. While no conclusions can be drawn from only a single study, this again raises the question if the skewed response distribution that had been found in traditional surveys might occur in online surveys as well.

To conclude, the limited evidence available indicates that E-mail and WWW-surveys might have the same reliability if the topic under investigation is not a sensitive one. However, especially interesting in a CS context is the question if both, none, or only one of the two methods is also subject to response skews. Until results of comparative studies on this issue amount, a combination of methods for the measurement of Derived Satisfaction is not advisable.

> Recommendation 11: *E-mail surveys should not (yet) be combined with WWW-surveys.*

Summarizing, eleven recommendations regarding the choice and use of online CS surveys methods were made. As has become clear from the above discussion, representative measurements of Derived Satisfaction on Internet are only possible when very specific conditions are met. On top of this concern for representativeness, other characteristics of the online methods also need to been taken into account.

5.2 The Decision-Making Framework

The most comprehensive decision to be made in the online research process is the choice of a data collection method. A decision-making framework to guide the selection of an online method is presented in Figure 4. The framework provides an overview of the recommendations made in the previous sections.
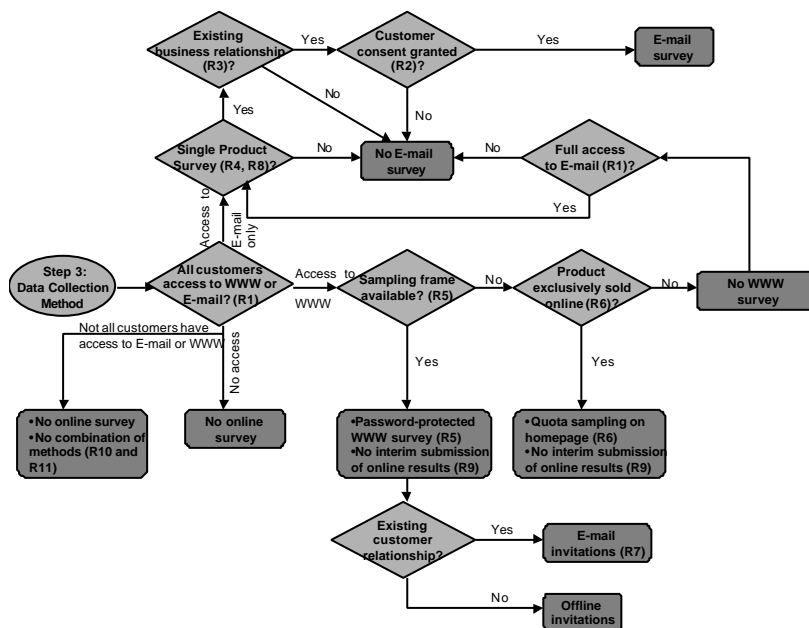

Fig. 4:   The Decision-Making Framework

First, the customers' access to the WWW and/or E-mail needs to be assured (R1). In the case of limited penetration of either medium, online and offline methods as well as E-mail and WWW-surveys cannot (yet) be combined (Recommendations 10 and 11). Secondly, the length of the survey needs to be controlled for. Because WWW-surveys offer advantages, which are not available to E-mail surveys, they are clearly superior from a theoretical standpoint, especially when many questions need to be asked (Recommendation 8).

E-mail surveys can still be considered when the survey to be conducted is short (Recommendation 4) and the company is engaged in an existing business relationship with its customers (Recommendation 3). Furthermore, the customers' consent to receive the survey must be asked for, which can be done with a short and individually addressed E-mail (Recommendation 2).

If the WWW is chosen as the administrative method, the subsequent proceedings depend on the sample to be taken. If a sampling frame is available, only a password-protected survey can be posted (Recommendation 5). Customers are invited via E-mail (with the URL of the survey in its body) only under the condition that there is an existing relationship between the company and its customers (Recommendation 7).

Should that not be the case, invitations can still be made using offline methods. However, Schillewaert et al. (Schillewaert et al., 1998, p. 313), after having compared different recruitment methods to a WWW-survey conclude that "the advantage of fast electronic data collection is lost due to the mix of a physical recruitment medium and an electronic online instrument".

When a quota sample needs to be drawn, the WWW-survey can only be conducted when the product is exclusively sold online (Recommendations 6). Lastly, survey results are submitted (online) only after the data set is complete and all analyses have been made (Recommendation 9).

5.3 Summary

In summary it can be stated that the Internet is an advantageous medium for customer satisfaction studies only if specific conditions are met. Companies therefore need to investigate on a case-by-case basis if the online measurement of customer satisfaction is possible in their specific case. A decision-making framework integrating the related recommendations has been introduced.

After the theoretical side of online customer satisfaction measurement has now been investigated, the next section will report on how these investigations are currently conducted in practice.

6 Online Customer Satisfaction Research in Practice

In practice, a large amount of approaches to CS measurement are not based on any theoretical foundation at all (Peterson & Wilson, 1992). The aim of this chapter is to find out if this is also true for the measurement of customer satisfaction on the Internet. Furthermore, possible developments in practice that have not yet been followed or preceded by academic research may be detected. In order to obtain these insights, a survey among marketing research companies offering CS investigations has been undertaken.

6.1 Methodology

6.1.1 Definition of the Population

For this investigation, the population of interest consists of all marketing research companies and other firms, which are conducting online customer satisfaction surveys. Since it is however impossible to generate a list containing all these entities, two restrictions have been taken into account. Firstly, only marketing research companies and secondly, only marketing research companies in English-speaking countries have been considered. The English-speaking countries of Australia, Canada, the United Kingdom, and the United States of America have been chosen for theoretical as well as practical reasons. These four countries account for more than two thirds of the world's online population. Furthermore, percental access of the respective populations are among the highest in the world, only to be preceded by the Scandinavian countries (NUA, 1998).

6.1.2 Data Collection Method and Questionnaire Design

The survey was conducted via E-mail. This method has been chosen for its cost-advantage and speed of administration. Furthermore, many authors have reported that the majority of answers usually are received within the first three days after the mailing (Comley, 1996; Mehta & Sivadas, 1995; Oppermann, 1995). Therefore, timely results could be expected. Lastly, the company's access to the medium could be checked easily.

The questionnaire contained questions covering some of the recommendations that have been derived from the literature in the previous section. Because questionnaire length is a critical issue in E-mail surveys, only the most important recommendations have been considered. Since the aim of the survey is to get an indication of how customer satisfaction surveys are conducted in practice and the testing of the framework, this approach should be sufficient to generate the desired results.

In conformance with Esomar's guidelines for Internet research (Esomar, 1999a), the purpose of the survey was clearly stated in the first sentence. Because Batinic and Bosnjak (Batinic & Bosnjak, 1997a) report that the offer of the survey results increases the response rate in academic research, this was used as an incentive during this survey. Formally, all criteria necessary for an e-mail survey have been met (ASCII format, lines of 65 characters, questions and return address in the body of the mail). A copy of the questionnaire and the reminder letter used can be found in the appendix.

6.1.3 Identification of a Sampling Frame

Available sampling frames included the member directories of marketing research associations. In order to qualify as a suitable sampling frame, three conditions had to be fulfilled: The directory had to contain E-mail addresses of its members as well as an indication if the member offers Internet research and/or customer satisfaction research. Furthermore, the directory had to be as current as possible (not older than 1998).

The Esomar member directory (Esomar, 1999b) was chosen as the major sampling frame because it contains all members' E-mail addresses and allowed a first segmentation on the type of research wanted (CS research in this case, an indication of online research was not made). Thus, a sampling frame of companies from Australia, Canada and the United Kingdom was obtained. Because the Esomar directory contained few Australian and Canadian companies and no firms from the US, three more sampling frames were used: The Canadian Association of Marketing Research Organizations (CAMRO, 1999), the Market Research Society of Australia (MRSA, 1999) and the Council of American Survey Organizations (CASRO, 1999). While a segmentation of companies on the type of research offered was not possible in all three member directories, homepages or enclosed company information was checked separately. While information content varied widely, companies not specifying the types of inves-

tigations they offer were left inside the sampling frame[#]. After double listings were deleted, a sampling frame of 211 members was obtained (40 Australia, 14 Canada, 66 UK, 91 US).

6.1.4 Selection of a Sampling Procedure and Sampling Elements

All companies listed in the sampling frame were sent an e-mail survey. As stated in the beginning of this section, the sampling frame chosen does not contain the totality of marketing research companies conducting online research in the countries considered. Furthermore, the selection was not made on a random basis: The sample chosen is a (non-probability) judgement sample in that "the sample elements are hand-picked because it is expected that they can serve the research purpose" (Churchill, 1995, p. 582). The investigation made is therefore an explorative one. The results that are described in the second part of this chapter are therefore by no means representative but only indicate if in general, a gap between theory and practice in Internet CS research exists.

6.1.5 Data Collection

The survey questionnaire was sent out on Wednesday the28th of April. Before, it was tested for question wording by a native speaker. All questionnaires were sent to the companies' E-mail address for general questions. In cases where only E-mail addresses specific to a contact person (for online/CS research) could be obtained, the E-mail was sent individually and contained a personal salutation. After the first week, a reminder, again containing the questionnaire was sent out to those companies who had not yet responded.

The results of the survey are presented in the following section.

6.2 Results

Of the 211 questionnaires that were mailed out, 41 turned out to be undeliverable. In total, 170 questionnaires reached their destination.

[#] The second question in the questionnaire to be sent out therefore asks about the company's offering of online CS measurements. In the case that this service is not offered, the company is asked to send the questionnaire back without answering the subsequent questions.

The majority of answers to the first mailing occurred within 24 hours. After that, the frequency of responses declined markedly. One week after the first mailing, a response rate of 29.4% (50 responses) was reached. Subsequently, a reminder, again containing the questionnaire was distributed. Responses again mostly occurred within 24 hours of the mailing. In total, 87 questionnaires were received yielding a response rate of 51.2%.

27 of the respondents (31%) answered that they do conduct some form of online CS investigations. Of all respondents, approximately 87.4% (76) indicated that they would like to receive the results of the survey that were offered as an incentive. The topic therefore appears to be of general interest even to companies that are not using online CS research (yet). The current nature of the subject has also been confirmed by various respondents expressing their thanks for the opportunity to participate or apologizing for their late response after the reminder survey.

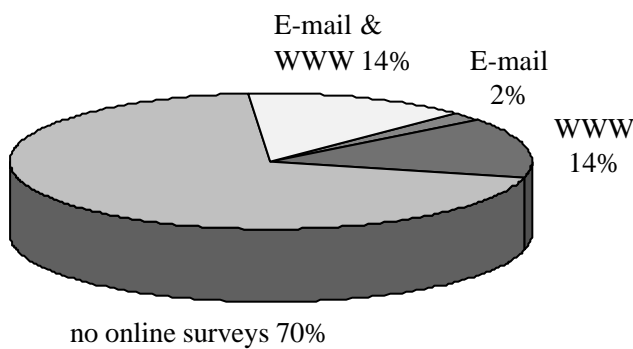Figure 5 displays the frequency of responses by the type of online survey used.

Fig. 5:   Responses by Type of Survey, (n=87)

6.2.1   Demographics

The home countries and numbers of employees of the institutes conducting online customer satisfaction surveys can bee seen in figures 6 and 7. Slightly more than half of these institutes are form the U.S., while only one Canadian company is included in this group. In order to be able to make comparisons between countries, Canada and the U.S. (55.6%, 15 respondents) as well as Australia and the UK (44.4%, 12respondents) are grouped together. These groups will subsequently be called North-American (15 firms) and Non-North American countries (12 firms), respectively. This grouping has been chosen because the Internet penetration rates of Canada and the U.S. are frequently reported in as figure in Internet statistics. These two counties oftentimes appear to be regarded as one entity concerning Internet statistics.
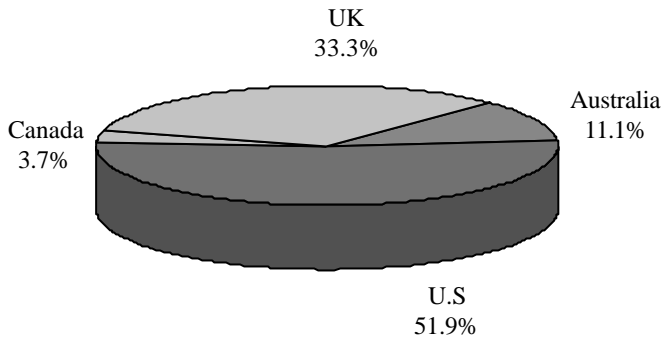
Fig. 6:   Respondents per Country (n=27)

In order to see if practices differ between larger and smaller institutes, firms have also been grouped according to the number of their employees. All companies employing less than 100 people are combined into the group of 'small firms' while all institutes with more than 99 employees constitute the group of 'large firms'.
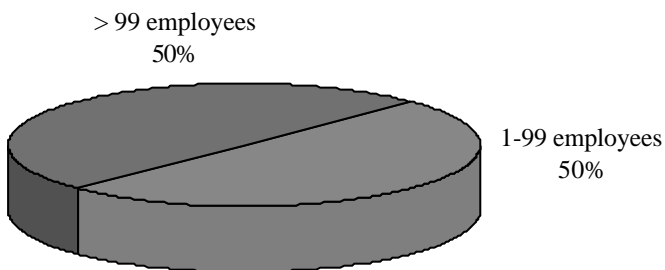

Fig. 7:   Number of Employees per Company (n=26)

In the remaining parts of this section, the results of the survey will firstly be presented for the totality of firms conducting online CS measurements. Subsequently, differences between countries and firm sizes will be presented.

6.2.2   E-mail Surveys

Of the 27 respondents conducting CS surveys online, 55.5% do use E-mail surveys. Out of these, 2 respondents use only E-mail surveys while 13 respondents (48.1%) have indicated that they engage in E-mail as well as WWW-surveys.

Table 2 shows the frequency of answers to the questions related to E-mail surveys.

Question	"Yes"	"No"	N	Recommenda- tion confirmed ?
Choice of E-mail depends on questionnaire length (R4)	80% (12)	20% (3)	100% (15)	Yes
Prior customer consent is necessary (R2)	93.3% (14)	6.7% (1)	100% (15)	Yes

Table 2: E-mail Surveys in Practice

As can be seen from the table, the recommendations that have been made in the previous chapter are followed by the majority of the respondents. Several respondents have stated that questionnaire length is not the only factor influencing the choice of E-mail questionnaires. Unfortunately, they did not specify those other factors.
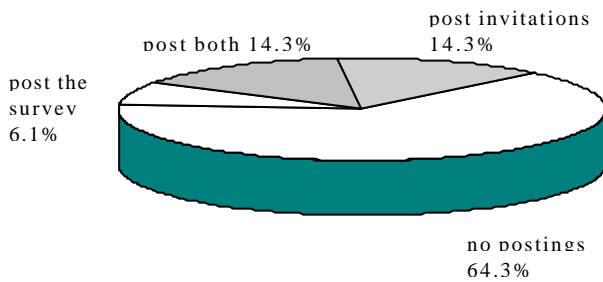

Figure 8: Postings in Newsgroups/on Mailinglists (n=14)

As can be seen in figure 8, the recommendation of not posting invitations or the survey itself in newsgroups or on mailinglists (chapter 4) is also followed by the majority of respondents. However, in total, 34.7% do use them. It can be concluded that posting E-mail surveys or invitations to be common in practice to some extent.

Differences between Countries

Usage of E-mail surveys is apparently different between countries: 66.7% of the Non-American firms but only 46.7% of the North-American companies do use E-mail surveys.

With one exception, the recommendations are also followed when looking at separate country groups. However, only slightly more than half of the American companies (57.1%) do not post the questionnaire or invitation. In contrast, 75% of the Non-American firms follow the recommendation of not doing so. It is furthermore noteworthy that 37.5% of the Non-

American firms do not believe that the choice of E-mail as the administrative method is dependent on questionnaire length (see table 3).

Question	North-American			Non-American		
	"Yes"	"No"	N	"Yes"	"No"	n
Choice of E-mail depends on questionnaire length (R4)	7 (100%)	0 (0%)	7 (100%)	5 (62.5%)	3 (37.5%)	8 (100%)
Prior customer consent is necessary (R2)	7 (100%)	0 (0%)	7 (100%)	7 (87.5%)	1 (12.5%)	8 (100%)

Table 3: E-mail Surveys by Country

Differences between Firm Sizes

When grouping the respondents according to firms sizes, a rather large overall difference in usage habits can be found: 61.5% of the large firms use E-mail surveys, but only 46.2% of the small firms do so.

Practices are also different regarding the usage of mailinglists and newsgroups (table 4). While 83.3% of the small companies follow the recommendation 37.5% of the larger firms do post (contrary to the recommendations).

Question	Small Firms			Large Firms		
	"Yes"	"No"	n	"Yes"	"No"	n
Choice of E-mail depends on questionnaire length (R4)	4 (66.7%)	2 (33.3%)	6 (100%)	7 (87.5%)	1 (12.5%)	8 (100%)
Prior customer consent is necessary (R2)	5 (83.3%)	1 (16.7%)	6 (100%)	8 (100%)	0 (0%)	8 (100%)

Table 4: E-mail Surveys by Firm Size

Again in line with the recommendations, the majority of respondents feel that customer consent is necessary and that questionnaire length needs to be considered when surveying via E-mail (table 4). The largest disparity in opinions can be found within small firms: 33.3% do *not* believe that the choice of E-mail depends on questionnaire length.

6.2.3 WWW-Surveys

An almost equal number of respondents indicated that they conduct surveys *only* on the World Wide Web (12 respondents) or on the WWW *as well as* via E-mail (13 respondents). These groups together include 92.6% of all respondents conducting online CS surveys.

In order to obtain representative results when using a sampling frame, it was recommended in the previous chapter that (a) the customers' access to the WWW should be ensured and (b) that the questionnaire should be protected with a password. As can be seen in figure 9, only 50% of the participating institutes do assure customer access and at the same time protect the questionnaire with a password.
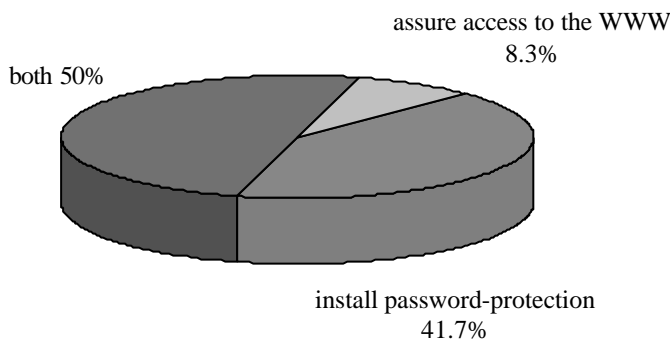

Fig. 9:   WWW-Surveys: Usage of a Sampling Frame (R5), (n=24)

Practices used to ensure participation when a customer quota has to be met vary more widely (Figure 10). Only 50% of the 22 respondents indicated that they attach the survey to the client's homepage and expose it to the customers randomly, thereby following the recommendations made. Moreover, 68.2% of the companies use some form of pre-recruitment. Recruitment practices that were mentioned include e-mail (4 respondents), mail (2 respondents) or telephone invitations (5 respondents) and recruitment form a panel (4 respondents). It is also noteworthy that approximately one third of all firms advertise the survey although this leads to the respondents' self-selection and biased results, among other things.
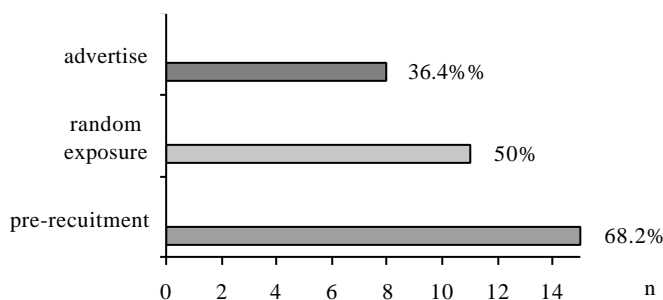

Figure 10: WWW-Surveys: Quota Sampling (R6), (n=22)

In table 5, the answers to the remaining questions concerning WWW-surveys are presented.

Question	"Yes"	"No"	N	R confirmed ?
Submission of results after each re-turned questionnaire (R9)	24% (6)	76% (19)	100% (25)	Yes
Combination of WWW- and E-mail Surveys (R11)	40% (10)	60% (15)	100% (25)	Unclear
Postings of invitations in news-groups / on mailinglists	20.8% (5)	79.2% (19)	100% (24)	Yes

Table 5: WWW-Surveys in Practice

The recommendations relating to the first and last questions of this table are again followed by the majority of the companies. Concerning the combination of WWW- and E-mail surveys, practices are more divided. More than half of the institutes do not use combinations while 40% combine surveys. However, the results of this question might not be accurate. While several respondents have stated that they use E-mail to invite customers to the survey, this in fact does not constitute a combination of methods for data collection[#]. It can therefore be suspected that more of the firms having stated that they do use combinations do not do so for the actual data collection.

Differences between Countries

All of the respondents from North-America and 83.4% of the Non-American institutes do conduct WWW-surveys.

When using a sampling frame, less than half of the American firms (40%) but 66.7% of the Non-American firms protect the questionnaire with a password and assure their customers' access to the WWW at the same time (as recommended). Companies should be aware that although Internet penetration rates are among the highest in North America, even there a mass penetration is still far from realized.

When meeting a customer quota, North-American firms prefer some form of pre-recruitment (73.3%), followed by the random exposure of the questionnaire (40%). In contrast, Non-American firms mainly expose the questionnaire randomly (71.4%) and pre-recruit their re-

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[#]   Those respondents' answers have been classified as a "no" to this question.

spondents less frequently (57.1%). However, contrary to the recommendations, 57.1% of the Non-American but only 26.7% of the American firms advertise their survey.

Question	North-American			Non-American		
	"Yes"	"No"	n	"Yes"	"No"	n
Submission of results after each returned questionnaire (R9)	3 (20%)	12 (80%)	15 (100%)	3 (30%)	7 (70%)	10 (100%)
Combination of WWW- and E-mail Surveys (R11)	8 (53.3%)	7 (46.7%)	15 (100%)	2 (20%)	8 (80%)	10 (100%)
Postings of invitations in newsgroups / on mailinglists	4 (26.7%)	11 (73.3%)	15 (100%)	1 (11.1%)	8 (88.9%)	9 (100%)

Table 6: WWW-Surveys by Size of Institute

Concerning the questions in table 6, the majority of respondents follows the recommendations. One exception, however, is again the combination of WWW- and E-mail surveys. Practices of North-American companies are almost divided equally: 53.3% do combine them and 46.7% do not. However, the same caution that applied before should be kept when interpreting the results of this question.

Differences between Firm Sizes

In total, all of the large firms and 84.6% of the small companies use WWW-surveys.

When using a sampling frame, only 38.5% of the large firms do assure customer access and protect the questionnaire with a password at the same time. In contrast, 60% of the small firms follow the recommendations and do both.

When meeting a customer quota on the WWW, some form of pre-recruitment is used most often within both groups (small firms: 77.8%; large firms: 61.5%), again followed by the random exposure of the questionnaire (small firms: 44.4%; large firms: 53.8%). Advertising is still popular with 33.3% of the small firms and 38.5% of the large companies.

Question	Small Firms			Large Firms		
	"Yes"	"No"	n	"Yes"	"No"	n
Submission of results after each returned questionnaire (R9)	2 (18.2%)	9 (81.8%)	11 (100%)	4 (30.8%)	9 (69.2%)	13 (100%)
Combination of WWW- and E-mail Surveys (R 11)	3 (27.3%)	8 (72.7%)	11 (100%)	7 (53.8%)	6 (46.1%)	13 (100%)
Postings of invitations in newsgroups / on mailinglists	1 (9%)	10 (90.9%)	11 (100%)	4 (30.8)	9 (69.2%)	13 (100%)

Table 7: WWW-Surveys by Firm Size

As can be seen in table 7, all other recommendations concerning WWW-surveys are followed by the majority of small and large firms. However, no consistent practice concerning the combination of WWW- and E-mail surveys in the same investigation exists within the group of large firms. Again, caution should be used when interpreting the results of this question.

6.3 Summary

Within this chapter, an investigation of how online customer satisfaction surveys are conducted in practice was presented. Overall, in agreement with the recommendations of this paper, WWW surveys appear to be more popular than E-mail survey.

Furthermore, the majority of respondents conduct E-mail surveys according to the recommendations put forward earlier.

However, the situation is different when looking at the companies' practices of surveying on the World Wide Web. Contrary to the recommendations, only half of the respondents assure the customers' access to the WWW and at the same time protect the questionnaire with a password when a sampling frame is used. Also contrary to the recommendations 40% combine Email and WWW-surveys. However, some respondents stated that they use E-mail only to invite customers to the survey.

In the case that a customer quota has to be met, the majority of respondents uses some form of pre-recruitment. Practices mentioned include E-mail and telephone invitation and panel recruitment. Again in line with the recommendations, most institutes do not submit the results after each incoming questionnaire and do not post invitations in newsgroups or on mailinglists.

While some differences in practices were found between large and small firms and American and Non-American companies, the most striking finding is that more than half of large firms and American companies do combine E-mail and WWW-surveys. However, the results again need to be treated cautiously. Furthermore, the majority of American firms and large firms do not assure that their customers have access to the WWW and password-protect the questionnaire at the same time.

7   Conclusion

This paper investigated the problem of how customer satisfaction measurements can be conducted on the Internet. Because of the difference in the satisfaction formation between products and services, customer satisfaction with products has been the focus of the discussion.

Concluding, customer satisfaction measurements on the Internet was identified as an interesting new opportunity. Especially World Wide Web surveys offer the researcher opportunities that are not available with any other administrative method. Pervasive advantages of WWW- and E-mail surveys include administrative and response speed, cost savings, and global reach of respondents. However, while the Internet is still far from being a mass medium, self-selection of the respondents and the target populations' access to the medium are the most immediate problems to deal with. It was shown that representative and reliable results can only be obtained when very specific conditions are met. Researchers need to investigate step-by-step if the online measurement of customer satisfaction is possible in their specific situation. A decision making framework is proposed to aid CS researchers in choosing the correct data collection method.

A survey among practitioners showed that a large number of them is aware of the factors that need to be considered when measuring customer satisfaction on the Internet. However, some practices that cannot be recommended from a theoretical viewpoint are being used to some extent. These results are a first indication of how customer satisfaction surveys are conducted in practice. Since the results are based on a non-representative convenience sample, these results are not representative for the larger population of firms conducting customer satisfaction surveys online. Based on these first insights and emerging results of Internet research, further studies should be undertaken to refine the proposed framework and to evaluate future practices.

Within this paper, the current state of knowledge about Internet-based research was accumulated and applied to the measurement of customer satisfaction. However, due to the novelty of the medium, a lot of developments are still to happen and many more research results are certain to come. While a mass penetration of the medium is the most desirable state for marketing researchers, it is questionable if this will be reached within the near future.

8   Appendix

8.1   The survey

```
Dear ,

This academic survey investigates how customer satisfaction surveys on the
Internet
are conducted in practice. It is part of my masters thesis at the Univer-
sity of Maastricht
in The Netherlands. Your company address has been obtained from
The answering of these questions will not take you longer than five min-
utes.
As a token of my appreciation for your very valuable contribution I can of-
fer you the results
of this survey. Please indicate below if you wish to receive them. I assure
you that your
answers will be treated confidentially and will by no means made accessible
to third parties.
Should you have any questions, please do not hesitate to contact me via e-
mail: Katja88@gmx.net

Sincerely

Katja Hofmaier


I. Would you like to receive the results of this survey?

(  ) No           (  ) Yes, your e-mail: _____


1. Do you conduct customer satisfaction surveys via E-mail and/or on the
World Wide Web?
(multiple answers possible)

(  ) E-mail ,continue with question 2
(  ) World Wide Web     ,continue with question 5
(  ) none of the above  ,do not answer the following questions, just send
the questionnaire back via reply


E-mail Surveys

2. Do you ask for the customers' consent before sending out E-mail ques-
tionnaires?

(  ) Yes          (  ) No

3. Do you believe that the choice of E-mail as the administrative method is
dependent on the length of the questionnaire?

(  ) Yes          (  ) No

4. Do you make postings on newsgroups or in mailinglists to increase the
awareness to the survey? (multiple answers possible)

(  ) you post invitations
(  ) you post the survey itself
```

( ) none of the above

WWW-Surveys

5. If you have a sampling frame available, you (multiple answers possible)

( ) assure customers' access to the WWW before posting the questionnaire
( ) protect the questionnaire with a password

6. If you have to meet a customer quota, you (multiple answers possible)

( ) place the survey on the WWW and advertise it
( ) attach the survey to your client's homepage and expose it to the visitors randomly
( ) other: _____

7. Do you submit the results of the survey online to your client after each returned
questionnaire?

( ) Yes   ( ) No
please motivate:_____

8. Do you combine E-mail and WWW-surveys in the same survey?

( ) Yes   ( ) No
please motivate:_____

9. Do you post invitations on newsgroups or in mailinglists to increase the awareness
to the survey?

( ) Yes   ( ) No

Exploratory Phase

10. Do you conduct online focus groups in the exploratory phase?

( ) Yes   ( ) No

11. Do you combine online focus groups with in-person focus groups in the same survey?

( ) Yes   ( ) No
please motivate:_____

12. How do you interview client personnel during the exploratory phase?
     (multiple answers possible)

( ) in-person
( ) online, via_____

13. Do you believe that Virtual Communities will be useful for customer satisfaction surveys
in the future?

( ) Yes   ( ) No   ( ) Undecided
please motivate:_____

```
Your company

14. How many people work in your company?

_____ people

15. In which country is your company located?

_____


Thank you very much for your valuable time and cooperation!
```

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A Theoretical Framework for Speech Act Based
Negotiation in Electronic Commerce

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Abstract

Negotiations in electronic commerce involve the exchange of messages. Thus, such negotiation processes can be seen as a specific type of written communication. In face-to-face interactions communication problems can usually be solved by asking for clarification. If communication takes place via a written medium these strategies cannot be employed. Even the most basic problems can then lead to total breakdowns in communication and interaction. Therefore, communication problems need to be solved for effective negotiations. This paper introduces a theoretical framework for negotiations in electronic commerce that is based on theories of communication. A set of conceptual categories is introduced that can serve as a foundation for the design of computer-based systems that will avoid breakdowns in communication.

1   Introduction

The process of negotiation has certain characteristics that are independent of the application domain. It can be conducted in a synchronous or asynchronous manner and the persons taking part in the negotiation process can be at the same place or at different locations. The media used for negotiation can be conventional types such as telephone or telefax, or new forms of media can be adopted, e.g. videoconference, Email, virtual shared workspaces. Furthermore, it can be distinguished whether negotiators engage in face-to-face or written interactions. The categories of media and type of conversations (i.e. oral or written) are obviously not exclusive categories in that negotiating persons can use a mixture of different styles and classes. For example, professionals might start a negotiation process with a face-to-face meeting, conduct further telephone conversations before engaging in written exchanges. Interactions can

furthermore be distinguished into structured, semi-structured, and unstructured interactions. Some negotiations follow clear patterns, protocols, or standards whereas other interactions show a high level of individuality. In the latter case, they will differ significantly from negotiations with different counterparts in similar contexts. Finally, negotiations can be bilateral, i.e. they involve two negotiating parties, or they can be multilateral in which case they involve three or more parties.

Negotiations in electronic commerce are usually distributed over space and time, i.e. they are asynchronous remote. The seller and the buyer are not co-present and the buyer will take time to consider any offer made by the seller.

Electronic commerce involves at least two parties, i.e. buyer and seller, but other parties can engage in certain parts of the negotiation process, e.g. finance or legal departments.

It has been observed that different media are used for interactions in electronic commerce, i.e. electronic media but also conventional media for some parts of the negotiations. Interactions are usually well-structured with clearly defined roles of the different negotiators. There are often "umbrella contracts" which serve as a basis for negotiating about specifics.

As the process of negotiation in electronic commerce is an exchange of messages it can be seen as a specific form of written communication. It has been reported that communication problems exist in multidisciplinary exchanges which can become severe in the case of written communication because there is no direct communication partner who can be asked for clarification (Schoop and Wastell, 1998). In the present paper we will introduce a theoretical framework based on current theories of communication that will specify conceptual categories that need to be considered in the design of systems that effectively support negotiations in electronic commerce.

2 Theories of Communication

It has been reported that the main obstacle to smooth and effective cooperative interactions are fundamental communication problems and that communication is used for coordinating multidisciplinary activities (Schoop, 1998b: Schoop and Wastell, 1999). Buyers and sellers engaging in electronic commerce often come from different areas so in this sense the communication is "multidisciplinary". Therefore, the idea was to look at established theories of communication to find out whether they can provide help for the analysis and classification of communication problems in the field.

The obvious candidates of communication theories for the present purposes were Searle's Theory of Speech Acts (Searle, 1969; Searle and Vanderveken, 1985) and Habermas' Theory of Communicative Action (Habermas, 1981; McCarthy 1985). Both have been influential in the area of information systems. It was decided to use both theories together for developing a framework for negotiations.

The broader context of the present work lies in the so-called Language-Action Perspective (LAP). LAP is based on Searle's and Habermas' theories and focuses on communication aspects in information systems which is also the focus of the present work. In LAP it is argued that language is used to coordinate actions, an experience that was made during ethnographic studies in multidisciplinary settings (Schoop, 1998).

The Language-Action Perspective was first introduced in the field of information systems in 1980 by Flores and Ludlow (Flores and Ludlow, 1980) who stated that human beings are fundamentally linguistic beings and act through language. It was argued that language is not only used for exchanging information as in reports, statements etc. but also to perform actions, e.g. promises, orders etc.

The conventional perspective on information systems stresses the contents of messages rather than the way they are exchanged. Thus, the focus is on the form and structure of messages. In contrast, the Language-Action Perspective emphasises what people *do* while communicating, how language is used to create a common reality for all communication partners, and how their activities are coordinated through language. Here, the focus is on the pragmatic aspect of language, i.e. how language is used in particular contexts to achieve practical goals such as agreements or mutual understandings. This new approach argues that as social action is mediated through communication, the main role of an information system should be to support organisational communication. LAP has since developed into a new paradigm for the design of computer systems (Dignum and Weigand, 1995; Lyytinen and Klein, 1985; Schoop, 1998a; Schoop and Wastell, 1998; Winograd, 1988, Winograd and Flores, 1986).

LAP is based on Searle's and Habermas' communication theories. Next these two theories will be introduced.

2.1   The Theory of Speech Acts

In the Theory of Speech Acts, John Searle argues that the minimal unit of an utterance is a speech act (Searle, 1969; Searle and Vanderveken 1985). Each speech act such as "I promise to deliver the goods" consists of two elements. The propositional content describes what the

utterance is about (e.g. deliver goods) whereas the illocutionary force describes the way it is uttered (e.g. as a promise). Taken together, both components provide the meaning of the utterance and both have to be known to understand the speech act.

Searle provides a classification of illocutionary forces according to the illocutionary point. Each illocutionary act has got a "point" which characterises that particular type of speech act. For example, as assertion is about informing other people, a request is about getting the hearer to perform an action etc. This purpose of the act is called the illocutionary point. Searle introduces the following five categories of illocutionary forces:

- *assertives* represent facts of the real world, e.g. report

- *commissives* represent the speaker's intention to carry out an action specified in the propositional content, e.g. promise

- *directives* represent the speaker's attempt to get the hearer to carry out an action specified in the propositional content, e.g. request

- *expressives* represent the speaker's psychological states or attitudes, e.g. apology

- *declaratives* change the world through their utterance, e.g. appointing a chairman.

Furthermore, Searle introduces the concept of a commitment. Each commissive and directive speech act issues a commitment for the speaker or the hearer to perform an action that is indicated in the propositional content of the utterance. Uttering the example speech act above would thus mean committing oneself to deliver the goods.

2.2   The Theory of Communicative Action

Jürgen Habermas argues that a speaker making an utterance makes four implicit validity claims (Habermas, 1981):

- that the utterance is *comprehensible* so that the hearer can understand the speaker

- that the utterance is *true*, i.e. it represents a fact or a common experience, so that the hearer can share the speaker's knowledge

- that the utterance is *truthful*, i.e. the speaker's intentions are expressed in a sincere way, so that the hearer can trust the speaker

- that the utterance is *appropriate* in relation to a given normative context, values, or standards so that the hearer can agree with the speaker in these values

- These four validity claims can be seen as four areas where communication can break down and require reparative action

- If the utterance is incomprehensible then the speaker must rephrase, explain, or translate it

- If the truth of an utterance is challenged then the speaker must justify the utterance, e.g. by explaining it, supplying more information, pointing to common experiences etc.

- If the hearer challenges the speaker's truthfulness then the speaker's intentions are called into question. Communication can only continue if the speaker succeeds in restoring the trust, e.g. through acting consistently, assuring the hearer of the speaker's sincerity etc.

- If the appropriateness of an utterance is challenged then the hearer questions the speaker's right to perform the speech act, e.g. if a speaker's role does not entitle him or her to do so, if a speaker violates recognised values or acts contradictory to norms. These problems are usually solved by pointing to other (unproblematic) standards and norms, referring to common experiences, citing relevant literature or authorities etc.

3 A Theoretical Framework for Negotiations in Electronic Commerce

The present section will introduce the theoretical framework for supporting negotiations in electronic commerce. It is based on elements from the two theories of communication introduced in the previous section and on empirical data. The framework will be described on a conceptual level by specifying the categories that "ideal" systems supporting effective and smooth negotiations would have. It can, therefore, be seen as a design basis for technological negotiation support.

3.1 Classification of speakers and hearers

First of all the possible speakers and hearers have to be specified. If the two groups of "buyers" and "sellers" are taken as the actors on which to concentrate it is, nevertheless, ob-

vious that there are main subclasses of these groups. Therefore, a more refined classification of possible speakers and hearers is necessary in order to be able to specify the speaker and hearer of an utterance in a detailed way.

For example, an order of 100 printers for £500 each might only be allowed to be made by a senior buyer and might only be relevant for sellers in a computer subdepartment. All other buyers are not entitled to issue such a speech act and for all other sellers the act is irrelevant.

3.2   Main task, primary interest

Each professional group has got a certain main task which determines the primary interest. These two elements must be considered because they partly determine what the different professionals will take about when engaging in a negotiation.

For example, the buyer will be interested in the other company's turnover, its main classes of products, its price ranges etc. in order to fulfil his or main task. i.e. getting good deals. The buyer might state that the seller's company is an established business relation and that the buyer's company is its second largest client. On the other hand, the seller might state that (s)he knows a contact person in the partner business and has done business with them before and that people in the other company speak English and Spanish.

3.3   Responsibilities and duties

Closely related to the main task are the responsibilities and duties of each professional group. The professional role indicates which obligations arise for different groups. This is an issue relevant to the set of possible illocutionary forces for each group of negotiators.

A buyer, for example, is responsible for assessing prospective sellers, getting information about turnover and business sectors of partner companies whereas a seller is responsible for informing prospective buyers, making offers, naming contact persons, and reviewing deals. Thus, "review" is an illocutionary force used by sellers.

3.4   Classification of illocutionary forces

Searle's five categories of illocutionary forces are used for classifying forces in the present work. However, there are obviously forces that are specific to the application domain. Thus, a trade-oriented set of subcategories of illocutionary forces is necessary in order to be able to

make statements about forces specific to healthcare. The following table shows the classification of illocutionary forces we developed.

Assertive	Commissive	Directive	Expressive	Declarative
assess document evaluate inform record report state	accept evaluate offer promise review	investigate order refer request	apology query	declare completion

Table 1   Classification of illocutionary forces

Table 1 shows a general classification of forces. However, some of these forces are only used by particular speakers which is determined by their professional roles and associated pragmatics. For example, an order is only made by a buyer whereas both buyer and seller use the force of reporting certain issues.

Furthermore, it must be made explicit which forces are used in the context of particular hearers. For example, a review made by a seller will only be passed on to a seller where both buyers and sellers can be recipients of requests. Thus, the possible combinations of forces, speakers, and hearers must be specified.

3.5   Professional knowledge and propositional content

The professional role determines what knowledge each professional has about a certain aspect of the negotiation process. Such knowledge is embodied in the propositional content of utterances which in general describes what an utterance is about. Formalisation of the propositional content is required in order to allow basic queries to be made (e.g. "What was the negotiation with company X on 11/11/99 about?" or "Has company Y received an offer for printers yet?") and to enable basic comprehensibility problems to be addressed.

3.6   Terminological correspondences

Comprehensibility problems can occur on two levels: that of unknown terms, where the utterance cannot be interpreted by the hearer, or that of misinterpretations where the hearer's interpretation differs from the speaker's intended meaning. In routine interaction, comprehensibility problems are usually solved by rephrasing or translating. In written communication

there is no possibility of asking for clarification. Therefore, even the most basic comprehensibility problems can lead to total breakdowns in communication and cooperation.

In order to address these problems it is clearly vital that there are mechanisms to support the translation of the propositional content according to each group's requirements if necessary. These mechanisms will provide familiar terms of the hearer's own professional terminology. Thus, the first level of comprehensibility problems must be addressed by providing synonyms or characteristic phrases. This would include the possibility for multilinguality, an issue that is important for negotiations across countries.

3.7   Validity claims

A key idea in the present approach is to incorporate validity claims as introduced by Habermas. They are critical to the success of speech acts. Only if the hearer of a speech act says implicitly "yes" to all the claims raised can the speech act be successful. The consideration of validity claims allows fruitful discursive communication.

To allow only sensible challenges, first of all the relations between the validity claims and the components of a speech act, i.e. the illocutionary force and the propositional content, need to be considered, as shown in table 2.

Validity Claim	Speech Act Component	
	Illocutionary Force	**Propositional Content**
Comprehensibility	+	++
Truth		+
Truthfulness	+	
Appropriateness	++	+

Table 2: Relations between validity claims and speech act components

An utterance can be incomprehensible because the propositional content is not understood by the hearer. This is a common communication problem. However, it is also possible to challenge the comprehensibility of the illocutionary force used in a speech act. Illocutionary forces are not always specified in an utterance which can lead to misunderstandings about which force the speaker meant to use when uttering a sentence, e.g. what was meant as a request is understood as a mere statement.

Questioning the truth of a statement means questioning whether the statement really represents a fact, a common experience etc. Thus, the validity claim of "truth" is related to the propositional content only.

The challenge of truthfulness is only related to the illocutionary force since the hearer doubts whether the speaker is really committed to the illocutionary force used when truthfulness is questioned. Here, the ostensible nature of the speech act is questioned, e.g. what seems to be an assertive act is really an attempt to deceive.

Both the illocutionary force and the propositional content can be inappropriate. However, a challenge of appropriateness concerns more often the illocutionary force than the propositional content. The hearer challenges the appropriateness of the force used by the speaker by questioning whether the speaker is entitled to use the force in the particular context. The speaker could have violated existing power relations, recognised norms, or professional standards. A propositional content can also be inappropriate. Here, the hearer questions whether the sentence fits a given normative context, i.e. whether it is legitimate to say so.

The relations between validity claims and the five types of speech acts used in the present work have been analysed. The interested reader is referred to (Schoop 1998a) or (Schoop1998b) for a discussion of the results. To summarise, comprehensibility problems can occur in all utterances, the claim of truth is only related to assertive speech acts, truthfulness can be challenged for all types of utterance, and appropriateness is related to assertive, directive, expressive, and declarative speech acts.

3.8   Commitments

All utterances create certain commitments for the communication partners. As mentioned before, the most important forms of commitment occur in commissive and directive speech acts as these types of act are important for the coordination of actions. Commissive and directive speech acts commit the speaker or hearer to carry out the action represented by the propositional content. However, the hearer has the possibility to explicitly accept or reject such commitment. Only if the hearer accepts all claims raised can the related commitment be accepted. The rejection of a commitment is based on a challenge of an underlying validity claim. Therefore, it must be made explicit which claim is problematic and to which part of the utterance the problem is related.

3.9   Dates

The date of the issuance of the speech act must be recorded in negotiation processes. In addition to the date of utterance, commissive and directive acts have a review date (which is the date given by the speaker up to which the action should be completed) and a so-called achie-

ved date (which is the date when the act was actually carried out and thus the commitment was fulfilled).

For example, an offer will usually contain a delivery date and a final deal will involve a date up to which a payment needs to be made.

4   Conclusion

In the present paper an approach to negotiation in electronic commerce has been presented that focuses on the communication aspect of such interactions. It has been argued that negotiations can be seen as a kind of written communication. Relevant elements from two theories of communication have been combined into a powerful framework for speech act based negotiations. The framework has been introduced by means of a set of conceptual elements that can serve as a basis for the design of information systems supporting effective negotiations in multidisciplinary environments.

By following the approach presented in the paper negotiations become less ambiguous for the partners involved. Preconditions, forces, and claims are made explicit which means that the negotiators know in what kind of interaction they are engaged in. Some communication problems will remain but they will be made explicit so that the negotiation partners can discuss their problems and enter into meaningful and structured discourses.

The incorporation of validity claims and the possibility of structured discussions about them enables the whole process of the negotiation to be documented, not just the outcome as in many current interactions. This process can be useful for other professionals. For example, other members of the same company could be interested in the history behind the agreement, either for future dealings with the same company or for general information. Tracability is an important issue in electronic interactions. Furthermore, the results could be used on a meta-level for specifying general patterns in negotiation.

Finally, a system based on the approach presented in this paper would allow information access of different kind, e.g. to all commitments not fulfilled, to all open commitments, to all offers made by company X, to all acts uttered by Mr Y etc.

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Media - Towards a Model for
Coordination, Communication and Organization in ECommerce

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Abstract

With media, we explore how to design and build electronic platforms supporting communities of human and artificial agents in achieving their common goals in collaboration. We argue that those media are more than mere carriers of information. They are capable of representing, collecting, and processing information and artificial agents may act autonomously on them. Seminal to our approach are the media concept and media reference model, describing the components which constitute a medium, namely logical space, organization and channel system. Those media are inhabited by agents that communicate, negotiate and collaborate in the process of creating economic value.

While all agents of the community have to be aware of the structure of a medium, the artificial agents furthermore need a formal representation of those components, in order to act accordingly. Such a formal representation, which is based on the two models, is given in the paper. Moreover, we explore the interrelation between the community and its platform. We establish a dialog between the community and the medium, leading to the continuous iterative advancement of the medium, i.e., its adaptation to the needs of the community and also to the development of the community itself.

1   Introduction

The buzzword "New Media" denotes a variety of applications in ECommerce, EBusiness or Knowledge Management, as e.g., platforms of online shops, online auction houses, Intranets,

CSCW or CSCL systems. Those platforms provide fancy representation of information and they are implemented in information- and communication technology.

We are interested in media and the communities as they are constituted by those media. Our goal is to design media for communities of collaborating artificial and human agents.

Seminal to our approach is the notion of a medium as developed in sociology. Societies can be defined as 'system of places', where every agent has a place with rights and obligations. Those societies are called *media* and they bind the agent at a place (Lechner and Schmid, 1999). Clans, firms, nations and marketplaces as well as Intranets, groupware and online shops are examples for media. Media constitute communities by facilitating communication among the members of the community. A *community* is a set of agents together with a medium, i.e., Community = Set of agents + medium (Lechner and Schmid, 2000a). *Agents* may be humans, software agents, organizational units, any entity that may play a role in the game of exchange and communication constituting the community under consideration. Artificial agents (e.g., implemented as software agents) may represent humans or companies in those spheres in autonomously gathering information, evaluating information and performing transactions. For a discussion on agents and their potential see, e.g., (Maes and Schneiderman, 1997; Foner, 1999; Jennings et al. 1998; Brauer, 1993; Schmid, 1998).

Our approach is to take communities of human agents as a first blueprint for the communities of collaborating human and artificial agents and their media. Accordingly, we study communities, media and the relation between a community and its medium. The role and value of communities for media, in particular for media on Internet is being explored, e.g., in (Armstrong and Hagel III, 1996; Hagel III and Armstrong, 1997; Schubert, 1999a; Lechner et al. 1998; Rheingold, 1993): It is the community that constitutes economic value – not the platform. We go one step further and discuss how to capture the notion of a community and how to model and formalize communities to establish a community of both natural and artificial agents. Hereby, the community is being represented on the medium such that artificial agents may act as representatives of humans in communication, collaboration, in performing transactions and creating economic value - similar to the community of human agents. We argue that this "similarity" is then the basis for frictionless communication and collaboration as well as the basis of understanding between human and artificial agents. Thus, we employ the community of human agents and the research being done to understand the role and value of communities for media to gain the information that is necessary for artificial agents to act on media. To establish media and artificial agents, we suggest a dialog between a community and its medium. This dialog establishes a media spiral of development and mutual influence of community and medium.

Note that the focus of our design is the medium (not the agent). Note furthermore, that this paper does not provide an exhaustive or interdisciplinary discussion of the notion of community. We restrict to the issues found and discussed in ECommerce literature and focus on communication and collaboration.

We make the following observations about media, agents and communities and analyze the shortcomings of media as employed, e.g., in ECommerce today:

- Most media are designed for communities of human agents – not for artificial agents. Those media distinguish themselves in fancy representation and present the information such that only human agents have the chance of understanding it and acting accordingly. The artificial agents that roam Internet, as e.g., spiders and robots have limited hardly understand their environment and do not perform transactions.

- Media designed for artificial agents, as, e.g., the Kasbah (Maes et al. 1996), or Marketmaker (ecommerce.media.mit.edu/maker/maker.htm) or Talking Heads (talking-heads.csl.sony.fr/) govern their agents. Those agents have limited capabilities of reasoning and they are confined to a platform.

- There is a distinctive lack of information that allows agents to "understand" media, to learn about media and the way communication and collaboration takes place on those media, i.e., a lack of models, architectures and descriptions of media.

We aim to design media for collaborating human and artificial agents and our goals within this paper are:

- to present general models and architectures for media, guiding the design and implementation of media: the media concept and the media reference model (Schmid, 1997b; Schmid, 1998).

- to describe and model those media, such that the model of media facilitates agents to understand media and communities and to act accordingly. We provide a formalization of the media and media components and a general architecture for media.

- to give a concept for establishing a community of collaborating human and artificial agents. We argue, that in order to build media which support communities of agents in efficiently achieving their common goals, we have to reconstruct existing – organizational - structures – on the medium and establish a dialogue between the community that employs a medium and its representation in artificial agents.

This paper is organized as follows. First, the two models, the concept of media and the media reference model are being introduced. We continue with an outline of the formalization of those two concepts. Then, the notion of communities and the relation between communities and media are being explored. We discuss the interest and motivation of community to meet on a medium. We then show how communities can be represented in media and how media can actually be build. We conclude this section with a deeper discussion of how media can support the collaboration of human and artificial agents. The paper concludes with a brief discussion of our approach.

2   The Concept of Media

With the media concept, we capture *how* to envision and model media, i.e., the metaphor and paradigm according to which platforms are being modeled and which components have to be formalized.

As a metaphor, the media concept envisions media as spheres for communities of agents. Media are modeled as organized channel systems of multi-agent systems and they form physically (open) structures, which are distributed over space and time.
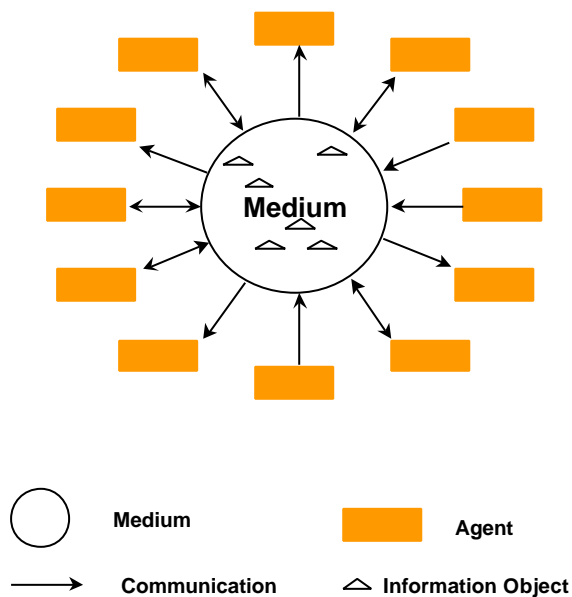

Fig. 1   Medium as Sphere for Communities of Agents

Media are described in terms of three main components (Schmid, 1997a; Schmid, 1999a; Schmid, 1999b):

1. A *logical space* with syntax and semantics of the information to be available on the platform, i.e., that may be communicated via its channels. Note, that this includes information about some domain (worlds), as well as information about the medium itself, i.e., its organization and channel system as well as the agents.

2. *A system of channels* to distribute information over space and time corresponding to a medium considered as a mere carrier of information.

3. *An organizational system* to describe with *roles* the types of its agents, i.e., the behavior expected from agents and with *protocols* the interactions of agents with the channel system of the medium.

A medium consists of a channel system for the transport of information over space and time, a logic, for capturing syntax and semantics of the information and an organizational system (roles and protocols) for structuring the behavior of its agents.

Media are employed by agents for communication. A community is constituted by (1) an ensemble of agents and (2) a medium, i.e., Community = Set of Agents + Medium (Lechner and Schmid, 2000a). *A community is an ensemble of agents sharing a common language and world, common values and pursuing common interests. The agents are connected via a medium on which they act in roles. Agents* may be humans, software agents, organizational units – any entity that may play a role in the game of exchange and communication constituting the community under consideration.

Let us motivate the definition and components of media. A common logical space, including a language or symbol system and the semantics is prerequisite for communication within a community. The logical space comprises the means to capture possible worlds. Those possible worlds might be internal worlds, i.e., media or components of media, or an aspect of the external "real world". In communication it is prerequisite that both are common to all parties and therefore we need to define them.

An organization is necessary to capture the places of agents and the rules of interaction the agents have to comply in communication. The organizational component is necessary in a system of communicating agents in which rules of interaction have to be given. Organization is the prerequisite for and typically elaborates in a collection of *collaborating* agents.

Technically speaking, a medium is a channel system for a multi-agent system. The main components of media together with components for defining the interrelation of the main components structure a medium description, they capture the characteristic properties of a medium

and provide one dimension of the structure and architecture of a medium. (Artificial) Agents are proactive, autonomous entities, capable of processing information. Agents dispose of a representation of their environment and their desire and are able to act according to desire and environment and to simulate possible worlds. See, e.g., (Müller, 1996; Wooldridge, 1999; Jennings et al. 1998; Jennings and Wooldridge, 1995; Maes, 1995).

3   The Media Reference Model

The media reference model (MRM) provides a structure for modeling media and their components and for capturing what is to be modeled (while the media model describes how to envision and what to formalize – the three main components). The MRM guides the application of media in, e.g., ECommerce or Knowledge Management. The MRM defines which communication acts have to be distinguished, captured and distinguishes the semantics of those communication acts and provides a generic structure according to which communication acts can be described. Thus, the MRM envisions and captures a platform for collaboration among agents on which economic value is being created in transactions.

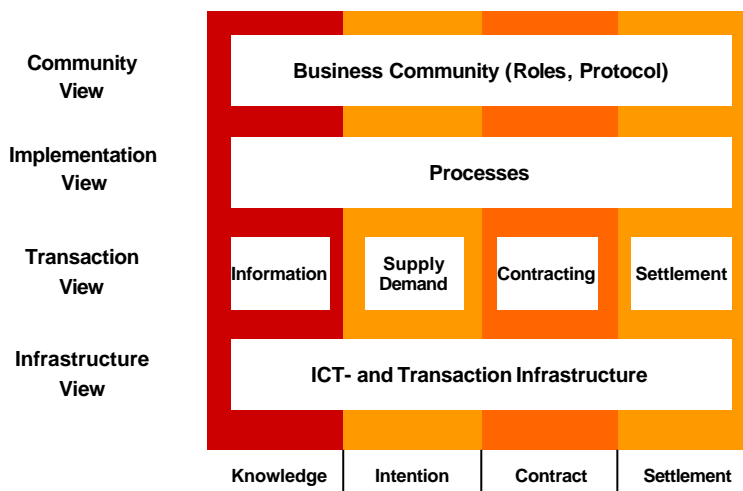|	Knowledge	Intention	Contract	Settlement
Community View	Business Community (Roles, Protocol)			
Implementation View	Processes			
Transaction View	Information	Supply Demand	Contracting	Settlement
Infrastructure View	ICT- and Transaction Infrastructure			

Fig. 2:   Media Reference Model (MRM)

The media reference model distinguishes four layers or views and, according to four action types, four phases. We give a brief description of action types phases and layers. For more detailed description of the MRM we refer to (Schmid, 1999a), for its application in the context of ECommerce (Schmid and Lindemann, 1998b)and for the application in Knowledge Management (Schmid and Lechner, 1998a; Schmid et al. 1998c). Particular to our approach is that each phase has a set of basic transactions and that those sets of transactions are distinguished by syntax and their organizational effect.

Note, that for each of the phases and layers the adequate logical space has to be provided.

3.1 Views of the MRM

The layers or views relate the platform implemented on information- and communication technology with the community's agent:

- The *community view* deals with the aspects relevant for modeling the community, i.e., its organizational structure as the shared roles, protocols, the common goals, interests and values behind it, as well as its languages. (Inter-) Action types further structure the specification of the organizational component (knowledge, intention, contracting and settlement, see below).

- The *service view* (transaction view) provides the generic interaction or communication services, as e.g., for signaling of intentions, as supply and demand, or for contracting and agreeing on contracts and the resulting bindings, as well as for the actual settlement of contracts. The services are structured according to the action types which an agent can perform (see below).

- The *process view* implements the specified community design, i.e., the community view specifications, as data structures and (business) processes on the services (channels) offered by the service layer, i.e., the roles and protocols of the community view.

- The *infrastructure view* provides the means to physically implement the services of the service layer, i.e., process information and speech acts, to transport it over space and time. Here, the respective needs for security, or safety of the infrastructure are being provided.

3.2 Phases of the MRM

The phases distinguish the various kinds of communication acts within the organization, i.e., between the agents (Schmid, 1999a):

- In the *Knowledge Phase,* assertive information about the world, the agents, or the medium is provided and communicated. Here, the common logical space with syntax and semantics, as prerequisite of the interaction in the three remaining phases is being established. This common logical space typically includes information about some domain, the channel system as well as the organization, such that agents may obtain knowledge about the

behavior expected from them, about the channels on which to exchange information, about the protocols to follow in communication. This might even include a meta-level of information about the language and its semantics employed on the medium.

- In the *Intention Phase*, agents signal their intentions. The intentions are derived from the knowledge provided in the knowledge phase, from the agent´s desires and goals and stated with the linguistic means of the common logical space (here, some type of modal logic) applying the services provided by the service layer. Supply and demand are the generic intentions agents signal within this phase.

- In the *Contracting Phase,* agents negotiate contracts. The messages in this phase are binding, in the sense that they oblige agents to act as indicated in those messages. Offer, counteroffer, accept and reject are such messages. This phase ends – in the case of success- with a contract, i.e., with an externalization of a binding protocol.

- In the *Settlement Phase*, agents act according the negotiated contract, using services offered for this purpose by the service layer. In commerce, this means, e.g., shipping of goods and transaction of money.

Note that the phases are designed to distinguish, what is called in speech act theory the illocution of a message (Finin et al. 1994; Stein and Maier, 1995; Searle and Searle, 1970). Making an offer is a binding act that obliges the agent to act according to the offer, while signaling is not binding. A message in settlement reduces the obligations of a contract and changes hereby the organization of a medium with its rights, obligations and protocols. Thus, we consider as the illocution of a message the organizational change it induces. Other illocutions are changes in the channel system or the information to be distributed. Thus, when relating media concept and media reference model, the notion of communicating agents is enriched to collaborating agents or to a contract net.

3.3   Discussion of Phases and Views

Let us briefly discuss some issues relevant for the formalization. First, this model defines phases and relations between those phases and their set of transactions. All actions or transactions are within the common syntax and semantics established in the knowledge phase. The intentions refine or implement hereby the general set of facts and rules that is established within the knowledge phase. The transactions of the contracting phase are refinements of the transactions of the intention phase – an offer or any other transaction is within the range of the

intentions of an agent. Accordingly, the transactions of the settlement phase are implementations of the transactions of the contracting phase and, in particular, the contract.

Second, the knowledge phase establishes the common logical space which is prerequisite for the remaining three phases and which is refined in the remaining three phases. Thus, we distinguish two different "levels" (1) the meta-level of the knowledge phase and (2) the object-level in the remaining three phases. Information about a medium and a knowledge phase is prerequisite for open structures.

4 Formalization and Architecture of Media

In the previous sections, general models for media have been introduced to describe media as spheres for communities of collaborating artificial and human agents. Artificial agents need a formalization of those descriptions to be able to reason about media and to act, communicate, negotiate and collaborate autonomously on those spheres. Let us state our goals of formalization:

- as the implementation of media for collaborating human and artificial agents. Our formalization aims at describing media such that agents can reason about them and act upon them. The goal in this formalization is to be comprehensive in the sense that all information relevant for an artificial agent is being provided in the formalization. This is also prerequisite for open media and open societies of agents, where agents roam media. They can employ this formalization to learn about media before entering it.

- In dealing with the variety of media. This formalization does not aim at giving a single, universal description formalism for media. Our goal is to provide a general architecture according to which domain and application specific description formalisms can be composed to form a medium.

Note that the concept of this formalization has been first suggested in (Schmid, 1997b) and has been further developed in (Lechner and Schmid, 1999; Lechner and Schmid, 2000a; Lechner and Schmid, 2000a; Lechner and Schmid, 2000b).

This section is organized as follows. First, we recall the frameworks we employ in developing the architecture and the specification languages we employ as notation (e.g., in the examples). Then, we first give a formalization of the media concept and second a formalization of the media reference model. The structures obtained in the media description are then subsumed in a media architecture.

4.1   Frameworks and Languages

General Logic (Cerioli and Meseguer, 1997) is our framework, to select the languages for modeling components of a medium from and to establish the relations between the component-specific formalisms. A general logic captures syntax, semantics of descriptions and the relations between descriptions.

Definition General Logic, Logic (Meseguer, 1998):
A general logic (or logic) is a 5-tuple L= (Sign, *Sen*, *Mod*, |-, |=) such that

- Sign is a category whose elements are called *signatures*,

- *Sen*: Sign $\to$ Set is a functor giving the set of *sentences* over a given signature Σ, called the **S**–*language*,

- *Mod*: Sign^{op} $\to$ Cat is a functor giving the category of *models* of a given signature,

- $|=_\Sigma \subseteq |Mod(\Sigma)| \times Sen(\Sigma)$ is called a *satisfaction relation*, such that for each morphism $\sigma : \Sigma \to \Sigma'$ in Sign, the satisfaction condition M' $|=_{\Sigma'} Sen(\sigma)(\phi) \Leftrightarrow Mod(\sigma)(M') |=_\Sigma \phi$ holds for all M' $\in |Mod(\Sigma')|$, $\phi \in Sen(\Sigma)$,

- $|-_\Sigma \subseteq P(Sen(\Sigma)) \times Sen(\Sigma)$, is a function associating to each Σ in Sign a binary relation called **S**-*entailment*, satisfying the following properties:
  (i) reflexivity: for any $\phi \in Sen(\Sigma)$, $\{\phi\} |-_\Sigma \phi$,
  (ii) monotonicity: if $\Gamma |-_\Sigma \phi$, $\Gamma \subseteq \Gamma'$ then $\Gamma' |-_\Sigma \phi$,
  (iii) transitivity: if $\Gamma |-_\Sigma \phi_i$ for all i $\in$ I and $\Gamma \cup \{i \in I | \phi_i \} |-_\Sigma \gamma$, then $\Gamma |-_\Sigma \gamma$,
  (iiii) |– translation: if $\Gamma |-_\Sigma \phi$, then $Sen(\sigma)(\Gamma) |-_{\Sigma'} Sen(\sigma)(\phi)$ for any $\sigma : \Sigma \to \Sigma'$ in Sign.

and the following *Soundness Condition* is satisfied: for each Σ in Sign, $\Gamma \subseteq Sen(\Sigma)$, and $\phi \in Sen(\Sigma)$, $\Gamma |-_\Sigma \phi \Rightarrow \Gamma |-_{|=\Sigma} \phi$, where $\Gamma |-_{|=\Sigma} \phi$ iff [(M $|=_\Sigma \gamma$ for all $\gamma \in \Gamma$) implies M $|=_\Sigma \phi$].

A signature Σ together with a set of sentences $\Gamma \subseteq Sen(\Sigma)$ gives a theory (Σ, Γ). A functor Th$_0$ assigns a signature Σ its category of theories. The mappings *Sen* and *Mod* can be extended to mappings on theories straightforward (Cerioli and Meseguer, 1997).

Labelled Deductive Systems (LDS) (Gabbay, 1996b) are our second framework for modeling. We employ them for combining formalisms and levels of reasoning into a single structure.

Definition Labelled Deductive System

(Gabbay, 1996b): A Labelled Deductive System is given by a 3-tuple LDS = (A, L, R) such that

- A is an algebra of labels with constructors, functions and relations,

- L is a logical language with connectors and well-formed formulas, and

- R is a labelling discipline determining, how formulas, i.e., sentences of L are labelled with sentences from A.

(t : Γ) is called a *declarative unit*, where t is an element of A, called the label, and Γ is a set of formulas from L. A database is a declarative unit or has the form (D,F,d,U), where D is a finite diagram of labels, d is a label, and U the set of all terms. A diagram of labels is a finite set of labels together with formulas $\pm R(t1,....tn)$, such that $ti \in D$ and R is a predicate symbol.

The relation between labels and formulas in deduction is subject to definition. The labels can be employed to describe, e.g., whether to use a formula in deduction, to give a preference ordering to a set of formulas, to enrich the formulas with some kind of information, to provide meta-information (Gabbay, 1996a; Basin et al. 1997). This relation is captured (1) in the labelling discipline in the construction of declarative units and (2) the deduction calculus (e.g., in a relation "flatten" reducing labeled formulas to plain formulas allowing for deduction of plain formulas according to the information encoded in the labels). Note that in our examples, we consider pairs of label and formula, while the labelling discipline may describe this relation.

In this paper, we present databases as sets of declarative units together with a predicate describing the relation between the labels. We apply the construction of LDS several times, declarative units become formulas in a next level of LDS and abbreviate, e.g., (l : (m : f)) by l : m : f. Note that we employ for representing LDS and transitions between LDS the formalism of Rewrite Logic (see below), with its declarative description of states and relations between the components.

As notation for schemata and rule format as well as for our examples we employ Rewrite Logic and Modal Logic, in particular, Deontic Logic and Temporal Logic (Meyer and Wieringa, 1993; Maibaum, 1993).

In Rewrite Logic, a system is described by some language, e.g., as set of objects and messages as in Maude or as a set of propositions about a state. Entailment is interpreted as computa-

tional progress over time, i.e., a deduction rule is a rule for describing computational progress. Those rules are marked by =>, where a rule of the format "s => s' if p" describes a state transition from s to s' provided that p holds in s. The properties of data types and states are given in equational specification. States and state transitions are considered to be equivalence classes of states and transitions between equivalence classes. The calculus is monotonic and whenever a rule or equation matches against a state at the left side of a rule, the matching part gets replaced as described in the rule. Specifications themselves consist of a signature where the operators and their functionality are defined with keyword "op" or "ops". For the concepts of structured specification we refer to (Clavel et al. 1999; Clavel et al. 1998; Clavel and Meseguer, 1996).

Modal logic features two dual modal operators. In temporal logic, they are described as $[m]\phi$ and $<m>\phi$, where $[m]\phi$ says that immediately after all transitions labelled with m the property ϕ hold and $<m>\phi$ holds if there exists a transition labelled with m such that immediately after m property ϕ holds. In deontic logic, the modalities are represented as $Obl(m)\phi$ and $Per(m)\phi$. $Obl(m)\phi$ says that m is obliged to happen and that immediately after ϕ holds and $Per(m)\phi$ represents the property that m is permitted to happen and that afterwards ϕ holds (Maibaum, 1993). We employ sentences of Rewrite Logic as the basic propositions of modal logic.

Note that we employ here labelled transition systems as models of our specifications where transitions are marked by the actions taking place.

4.2 Formalization of the Media Concept

For formalizing a medium, the languages are selected from a General Logic (Meseguer, 1992) and the architecture is given by Labelled Deductive Systems (Gabbay, 1996a). Let us give the formal definition first and explain it afterwards.

Definition Media Concept:
Let L = (Sign, *Sen*, *Mod*, $\models$, $\vdash$) be a general logic, Th_0 a functor describing its category of theories. ThCat the theory of theories and relations between theories and MCat the language of models and relations between models. Let Σ_D, Σ_C, Σ_R, $\Sigma_P \in$ |Sign|, and C_D, C_C, C_R, C_P, C_{CS}, C_{Org}, C_{Mod}, $C_{Th} \in$ N.

A media concept M(N) is given by:

$$
\begin{array}{llllllll}
M(N) = & C_R & : L & : Th_R & : M_R & : Join_R & : n_R & : Roles \\
& C_P & : L & : Th_P & : M_P & : Join_P & : n_P & : Protocols \\
& C_D & : L & : Th_D & : M_D & : Join_D & : n_D & : D \\
& C_C & : L & : Th_C & : M_C & : Join_C & : n_C & : Channels \\
& C_{CS} & : L & : Th_C & : M_C & : Join_C & : DChan \\
& C_{Org} & : L & : ThCat & : Mod & : DOrg \\
& C_{Mod} & : L & : MCat & : DMod \\
& C_{Th} & : L & : DTh
\end{array}
$$

where

$Roles \subseteq Sen(\Sigma_R),$
$Protocols \subseteq Sen(\Sigma_P),$
$D \subseteq Sen(\Sigma_D),$
$Channels \subseteq Sen(\Sigma_C),$
$n_R, n_C, n_R, n_P \subseteq Sen(\Sigma_C),$
$DChan \subseteq Sen(\Sigma_C),$
$Join_R : |Th_0(\Sigma_R)| \times |Th_0(\Sigma_R)| \rightarrow |Th_0(\Sigma_R)|,$
$Join_P : |Th_0(\Sigma_P)| \times |Th_0(\Sigma_P)| \rightarrow |Th_0(\Sigma_P)|,$
$Join_D : |Th_0(\Sigma_D)| \times |Th_0(\Sigma_D)| \rightarrow |Th_0(\Sigma_D)|,$
$Join_C : |Th_0(\Sigma_C)| \times |Th_0(\Sigma_C)| \rightarrow |Th_0(\Sigma_C)|,$
$M_R : |Th_0(\Sigma_R)| \rightarrow |Mod(Th_0(\Sigma_R))|,$
$M_P : |Th_0(\Sigma_P)| \rightarrow |Mod(Th_0(\Sigma_P))|,$
$M_D : |Th_0(\Sigma_D)| \rightarrow |Mod(Th_0(\Sigma_D))|,$
$M_C : |Th_0(\Sigma_C)| \rightarrow |Mod(Th_0(\Sigma_C))|,$
$DOrg \subseteq |Th_0(\Sigma_R)| \times |Th_0(\Sigma_P)| \times |Th_0(\Sigma_D)| \times |Th_0(\Sigma_C)|,$
$DMod \subseteq |Mod(Th_0(\Sigma_R))| \times |Mod(Th_0(\Sigma_P))| \times |Mod(Th_0(\Sigma_D))| \times |Mod(Th_0(\Sigma_C))|,$
$DTh \subseteq |Th_0(\Sigma_R)| \times |Th_0(\Sigma_P)| \times |Th_0(\Sigma_D)| \times |Th_0(\Sigma_C)|$

Note that this definition uses only single representation in each components - however a medium may have more than one component in which particular information about a component is being stored. Let us explain the structure and the components in the formalization of the media concept. We explain for each row beginning with the first row the components of the media structure. In all rows, L describes the general logic from which language, theory, interpretation are being selected and C_x the name of a component. A medium is characterized as a set of named components by

- $Roles \subseteq Sen(\Sigma_N)$ is the information about roles available on the medium, $n_R \in N$ the name of this information, Th_R the tacit information on the medium about roles, i.e., the context according to which Roles has to be interpreted, M_R the interpretation of role descriptions and $Join_R$ the relation between tacit and explicit information about roles.

- Protocols $\subseteq Sen(\Sigma_P)$ is the information about protocols available on the medium, $n_P \in N$ the name of this information, Th_P the tacit information about protocols, M_P the interpretation of information about protocols and $Join_P$ the relation between tacit and explicit information about protocols.

- $D \subseteq Sen(\Sigma_D)$ is the information about some domain available on the medium, $n_D \in N$ its name, Th_D the tacit information about the domain of the medium, M_D the interpretation of domain specific information and $Join_D$ the relation between tacit and explicit domain specific information,

- Channels $\subseteq Sen(\Sigma_C)$ is the information about channels available on the medium, $n_C \in N$ the name of this information, Th_D the tacit information about channels, M_C the interpretation of channel description and $Join_C$ the relation between tacit and explicit information about channels,

- DChan $\subseteq Sen(\Sigma_C)$ is a predicate describing the relation between names, i.e. the channel system of a medium, $Join_C$ relates the tacit information about channels Th_C with the channel system and M_C defines the interpretation (see below).

- DOrg $\subseteq |Th_0(\Sigma_R)| \times |Th_0(\Sigma_P)| \times |Th_0(\Sigma_D)| \times |Th_0(\Sigma_C)|$ is a predicate relating the theories that result from $Join_R$, $Join_P$, $Join_D$, $Join_C$ based on the knowledge of relations about theories, captured in Th_0 (see motivation and examples below).

- DMod $\subseteq |Mod(Th_0(\Sigma_R))| \times |Mod(Th_0(\Sigma_P))| \times |Mod(Th_0(\Sigma_D))| \times |Mod(Th_0(\Sigma_C))|$ is a predicate describing the relations between the interpretations M_D, M_C, M_R, M_P and the interpretation of theories in Mod (see a detailed motivation and examples below).

- DTh $\subseteq |Th_0(\Sigma_R)| \times |Th_0(\Sigma_P)| \times |Th_0(\Sigma_R)| \times |Th_0(\Sigma_D)|$ be a predicate describing the relations between the theories Th_D, Th_C, Th_R, Th_P (see below).

Note, that each of the rows corresponds to a component of a medium. Those components are (1) roles, (2) protocols, (3) domain specific information and (4) channels. Moreover, those components described in the media model have to be related. Those relations are determined in the components of the medium, i.e., (5) the actual channel system, (6) the relation between domain and channels on the one hand and roles and protocols on the other hand as well as relations between the (7) theories of the components and (8) relations between the interpretations of the components.

Note, that the domain specific information together with the channels form computerized channels which are more than mere carriers of information - i.e., those are media that are able to solve problems about some domain presented to them. Thus, channels and domain can be considered to be channels while roles and protocols together form the organizational component. Thus we claim that the media concept matches the informal definition of media given before.

Let us discuss some of the design decisions of this formalization of media more in detail. Domain and channels as well as roles and protocols are both part of the protocols. Agents are required to adhere to roles and protocols. However, the medium itself may or may not have the power to observe or enforce this on the channel system of the medium. The description of behavior expected from agents and the description of whether and how this behavior can be enforced on the medium are given in two separate components. Accordingly, both organization and relation organization domain-channels is characteristic for a medium and subject to specification.

Let us give two examples for those relations and the resulting predicates (1) a predicate describing a medium being able to enforce the organization (as, e.g., a workflow system), (2) a system in which the organization component is able to observe the behavior and notifies the users in case an action does not comply with roles and protocols (as, e.g., a knowledge management systems sending a notification, in case a deadline is not met).

Let us give the first rule pattern illustrating how deduction takes place and what the components of a medium might be instantiated. The behavior of a workflow system that enforces actions that are mandatory and that does not permit actions to happen that are not permitted could be described by (we refrain from giving general logic and name of the component here):

$$
\begin{array}{llll}
Th_R & : M_R & : Join_R & : n_R & : Roles \\
Th_P & : M_P & : Join_P & : n_P & : Protocols \\
Th_D & : M_D & : Join_D & : n_D & : D \\
Th_C & : M_C & : Join_C & : n_C & : Channels \\
Th_C & : M_C & : Join_C & : DChan \\
ThCat & : Mod & : DOrg \\
MCat : DMod \\
DTh
\end{array}
\rightarrow
\begin{array}{l}
Th_R : M_R : Join_R : n'_R : Roles' \\
Th_P : M_P : Join_P : n'_P : Protocols' \\
Th_D : M_D : Join_D : n'_D : D' \\
Th_C : M_C : Join_C : n'_C : Channels' \\
Th_C : M_C : Join_C : DChan' \\
ThCat: Mod : DOrg \\
MCat: DMod \\
DTh
\end{array}
$$

if

$$M_R(Join_R(Th_R,(\Sigma_R,Roles))) \quad \subseteq \quad M_{CD}(\ n_D : Join_D(Th_D,(\Sigma_D,D))$$
$$n_C : Join_C(Th_C,(\Sigma_C,Channels))$$
$$DChan)$$

$$\text{and } M_P(Join_P(Th_P,(\Sigma_P,Protocols))) \subseteq M_{CD}(n_D :Join_D(Th_D,(\Sigma_D,D))$$
$$n_C : Join_C(Th_C,(\Sigma_C,Channels))$$
$$Dchan$$

$$\rightarrow \quad n'_D : \text{Join}_D(\text{Th}_D,(\Sigma_D,D'))$$
$$n'_C : \text{Join}_C(\text{Th}_C,(\Sigma_C,\text{Channels'}))$$
$$\text{DChan'})$$

and $M_P(\text{Join}_P(\text{Th}_P,\text{Protocols})) \subseteq M_R(\Sigma_P, n'_R : \text{Roles} \rightarrow n'_R : \text{Roles'})$

and $M_P(\text{Join}_P(\text{Th}_P,\text{Protocols})) \subseteq M_P(\Sigma_P, n'_P : \text{Protocols} \rightarrow n'_P : \text{Protocols'})$

where DMod $=_{def} M_{CD}|\Sigma_C = M_C$ and $M_{CD}|\Sigma_D = M_D$ and $M_R|\Sigma_D = M_D$ and $M_P|\Sigma_D = M_D.$

Let us explain this rule. A state transition is permitted if (1) the actual state of channels and domain adheres to the roles. This is given in terms of a subset inclusion on the class of models. Note, that the interpretation of roles might be either an initial or a loose specification requiring that every role description has one instance in the medium, (2) the transition of domain specific information and channel system adheres to the protocol description. Note further, that protocols can be interpreted either in a lose way or by its greatest model in a final interpretation (3) the changes of the roles adheres to the protocols and (4) the changes of the protocols adheres to the protocols. Predicate DMod suggests that the interpretation of the domain specific knowledge coincides in all components and that M_{CD} interprets channels the same way as M_C and domain specific knowledge the same way as M_D.

Let us give the second example. A knowledge management system might not be able to govern the users, i.e., not be able to enforce its organizational description. The organizational component is only capable of notifying a user if, e.g., deadlines are not being met. This could be given, e.g., by a rule describing that if a transition is not permitted by the protocol, all agents are notified that the deadline has passed, the protocols components records that the deadline passed (in our model the domain specific information gets this message). Despite the fact that the deadline passed, the state transition itself may take place. A rule capturing this behavior, e.g., may have the following format:

$$\text{Th}_R : M_R : \text{Join}_R : n_R: \text{Roles} \qquad \text{Th}_R : M_R : \text{Join}_R : n_R : \text{Roles}$$
$$\text{Th}_P : M_P : \text{Join}_P : n_P : \text{Protocols} \qquad \text{Th}_P : M_P : \text{Join}_P : n_P : \text{Protocols}$$
$$\text{notify(deadline-passed)}$$
$$\text{Th}_D : M_D : \text{Join}_D : n_D : D \quad \rightarrow \quad \text{Th}_D : M_D : \text{Join}_D : n_D : D'$$
$$\text{notify(deadline-passed)}$$
$$\text{Th}_C : M_C : \text{Join}_C : n_C : \text{Channels} \qquad \text{Th}_C : M_C : \text{Join}_C : n_C : \text{Channels'}$$
$$\text{Th}_C : M_C : \text{Join}_C : \text{Dchan} \qquad \text{Th}_C : M_C : \text{Join}_C : \text{Dchan'}$$

if

$$\text{not}(M_P(\text{Join}_P(\text{Th}_P,(\Sigma_P,\text{Protocols})))) \subseteq M_{CD}(\; n_D : \text{Join}_D(\text{Th}_D,(\Sigma_D,D))$$
$$n_C : \text{Join}_C(\text{Th}_C,(\Sigma_C,\text{Channels}))$$
$$\text{Join}_C(\text{Th}_C,\text{DChan})$$
$$\rightarrow$$
$$n_D : \text{Join}_D(\text{Th}_D,(\Sigma_D,D'))$$
$$n_C : \text{Join}_C(\text{Th}_C,(\Sigma_C,\text{Channels'}))$$
$$\text{Join}_C(\text{Th}_C,\text{DChan'}) \;))$$

Let us explain this rule. It describes that, a notification message is being sent, if the state transition does not adhere to the protocol description. In contrast to the rule given above, we have specified here, that the names remain unchanged, that roles and protocols remain unchanged as well. Note, that the subset relation between the models, respectively between models and formulas is being computed from DMod and DTh along the morphisms given by L (for the interpretations and predicates see the first pattern).

Let us motivate why we distinguish implicit or tacit information within the medium and why we define an explicit Join between the two kinds of information. Let us give two reasons to have two kinds of information in each state. (1) to distinguish a general, often invariant set of rules, a general theory and the description of the state that typically changes. (2) there is information available on a medium and there are additional rules, that, e.g., are common knowledge and that have to be considered in reasoning as well. Note that programs are examples for invariant information and for knowledge that is tacit in the sense that a program is encoded knowledge while (input) data are prone to change, to be particular for a state and to explicit information. Thus, it seems sensible to distinguish those kinds of information and to provide a means to blend this information for reasoning about the information of a single component.

We decide to have formulas as explicit information and theories as tacit information. This is due to the fact that the language in which some information belongs to, i.e., a signature and the functor *Sen*, is rather implicit or common knowledge than explicit knowledge and part of a particular state description. Recall that the media reference model also distinguishes between information about the medium (the information exchanged in the knowledge phase) and information as being used or processed on the medium (in intention, negotiation and settlement phase).

The Join operation that models how implicit and explicit information is being blended - to a theory of the component is also characteristic for a medium and for a language. I.e., in a rule based language, a join might be implemented as the union or pushout of the two theories by, e.g., the union of the sets of axioms (provided the signatures coincide (Wirsing, 1990)). Some other possibility is to use some sort of preference, e.g., that the state has precedence over the general theory (see e.g., the application of LDS to defeasible logic in (Gabbay, 1996a). Note that a labelled deductive system has to define how to blend labels and formulas in deduction and that defeasible logic is one application of LDS - thus, in LDS the Join operation is subsumed in the function "flatten" (Gabbay, 1996a) .

We have an explicit description of the relations among theories and among models as part of our specification. Since in a medium the description formalisms are not disjoint. E.g., the channel system and domain specific information are typically employed in all components.

The predicate describes this relation, and it captures, e.g., the requirement that all components are based on the same axiomatizations. The predicate describing the relations among the states may e.g., capture that identical sub-theories (of the domain specific interpretation) require the same interpretation.

Typical for our medium description is that various languages are being employed to characterize a medium. Based on the framework of General Logic, the relation between the signatures, i.e., the signature morphisms, the theory mapping and mappings between models can be defined. Note, that according to LDS this relation would be given in the flatten function describing how to relate theories (labels) to interpretations (formulas) and again to theories. Between organization and domain-channel description an abstraction relation might be employed. E.g., in terms of abstract interpretation, i.e., as an (α,γ)-simulation or (α,γ)-bisimulation (Loiseaux et al. 1995; Steffen et al. 1996; Lechner, 1997). Prerequisite is the definition of the relations between the various interpretations, such that the relation between the models of the blend of tacit and explicit information can be described.

4.3   Formalization of the Media Reference Model

The media reference model structures the specification of media in four views and four phases. Phases and views have to be related. Thus, one needs at least four relations between phases and three relations between views ensuring the interoperability of the various phases. In this section, we give an outline of the formalization of the MRM. According to the media reference model, the structure of four phases and four views, relations between phases and relations between views is generic. The application domain, the transactions as well as the roles, protocols are media specific. For roles, protocols as well as for processes one can assume a general language. However, domain and transactions have to be embedded in this language.

Thus, in the formalization of the MRM, we start with a formalization of the domain and requirements towards domain specific language and a set of transactions. Those domain specific aspects are then embedded into the generic components.

The domain specific language is given by Σ_D and we require Σ_D to include (in addition to equality) a relation », where $\phi \gg \gamma$ when ϕ is more general than γ and a relation $\approx$, where $\phi \approx \gamma$ if ϕ matches γ. I.e., we require for the domain:

      sort Domain .
      ops » $\approx$: Domain Domain $\rightarrow$ Boolean .

Based on a specification of names and relations between names, the set of transactions is being defined. E.g., as set of transactions we employ:

```
sort Ta .
op assert : NameSet Domain → Ta .          -- knowledge phase
ops supply, demand : NameSet Domain → Ta .    -- intention phase
op offer : NameSet Ta → Ta .               -- negotiation phase
op counteroffer : NameSet Ta Ta → Ta .     -- negotiation phase
ops accept, reject : NameSet Ta → Ta .     -- negotiation phase
ops send : NameSet Ta → Ta .               -- settlement phase
```

The domain specific relation » and ≈ have to be extended to transactions, e.g., in a conservative extension:

```
eq m(M,φ) » m(N,γ) if M » N and φ » γ  for all transactions m
eq m(M,φ) ≈ m(N,γ) if M ≈ N and φ ≈ γ  for all transactions m
```

Messages (or transactions) are parameterized with some domain specific information as well as some set of names, indicating to whom the message is being sent.

Let us give the languages for modeling the views and components.

For the channel system, we employ a set of names to distinguish information (which might be generated in some algebra and some predicates) and a predicate isrel describing which Set of Names is related. The predicate isrel models a channel (with name isrel) . Thus, we require the signature to include at least the sorts Name and Nameset and a predicate isrel:

```
sorts Name Nameset .
isrel : NameSet → Boolean .
```

Roles and protocols are defined with deontic and temporal logic - employing some propositions on states (Maibaum, 1993; Weigand, 1999). E.g., part of the definitions of two roles client and server might follow the format:

```
Server(I) = Obl(offer(N,supply(N,p)))tt          for some N and some p
Client(I) = Per(accept(offer(N,supply(N,p))))tt   if I in N
```

A server is obliged to make some offer and a client is permitted to accept an offer, provided that there is an adequate specialization relation between names and other paramters.

For the definitions of protocols we employ some temporal logic define:

$$\text{supply}(N_I, \phi_I) \Rightarrow \exists \phi_I \gg \phi_N, N_P \gg N_N : \text{Sometimes}(\text{offer}(N_N, \text{supply}(N_N, \phi_N)))$$
$$\text{offer}(N_N, \text{supply}(N_N, \phi_N)) \Rightarrow \exists \phi_P \gg \phi_N, N_I \gg N_N : \text{Eventually}^P(\text{supply}(N_I, \phi_I))$$

Sometimes after a supply an offer has to be made, while an offer implies that sometimes in the past a supply has been stated.

After the languages of domain, transitions, roles and protocols have been defined (1) the relation between views and (2) the refinement relation between phases has to be defined.

The phases distinguish themselves in the illocution of the communication acts on the organization of a medium. E.g., a message of the intention phase has no organizational implications, while a message of the negotiation phase is legally binding in the sense that an agent has to act according to the message - once, e.g., an offer is being accepted. The relation between the language of transactions and the language of organizational models has to be given, e.g., as a signature morphism as a mapping between the signatures of the respective language and for modeling, e.g., the satisfaction relation between organization and agent-channel system. Based on this syntactic and semantic relation, the "synchronization" of transactions and organizations has to be defined. E.g.,

for describing for a given set of transactions including an offer, an accept and a contract, and where propositions on the protocols and at the agent-channel level coincide, that an offer and an accept message together form a contract, we employ the following rule format to describe the synchronization between a role, a protocol and two domain specific components with names R, P, N1 and N2:

$$
\begin{array}{lll}
R : \text{Server}(N_1) \, \text{Client}(N_2) & & R : \text{Server}(N_1) \, \text{Client}(N_2) \\
P : X & & P : \text{contract}(N_1, N_2, \phi_N) \, X \\
N_1 : \text{offer}(N_N, \phi_N) & \Rightarrow & N_1 : \text{contract}(N_1, N_2, \phi_N) \\
N_2 : \text{accept}(N_1, \text{offer}(N_N, \phi_N)) & & N_2 : \text{contract}(N_1, N_2, \phi_N) \\
N_2 \, \hat{\mathbb{I}} \, \text{customers}(N_1) & & N_2 \, \hat{\mathbb{I}} \, \text{customers}(N_1)
\end{array}
$$

An offer and an accept match provided the parameters are in an adequate relation and establish a contract. This contract is known to the components that uttered offer and accept as well as to the protocol component.

Let us give as second example for the organizational illocution of an transaction the relation between a contract and a send action:

R : $Server(N_1)$ $Client(N_2)$	R : $Server(N_1)$ $Client(N_2)$
P : $contract(N_1,N_2,Obl(supply(N,\phi_1)\phi_2))$	P : $contract(N_1,N_2,\phi_2)$
N_1 : $send(N_2,X)$ Z =>	N_1 : Z
N_2 : Y	N_2 : Y $send(N_2,X)$
N_2 $\widehat{\mathbf{I}}$ $customers(N_1)$	N_2 $\widehat{\mathbf{I}}$ $customers(N_1)$
if ϕ_1 » X	

As the second relation the relation between the phases has to be given. E.g., one has to define which transactions implement transactions of the previous phase. We follow here the notions of refinement and implementation as defined, e.g., in (Wirsing, 1990)E.g., consider an offer describing an exchange of goods for money. One agent is required to pay. There are various implementations of an obligation to pay: cash, by sending a cheque, by carging a credit card. The same holds for all transactions and between all phases. Based on this refinement relation, protocols and processes can be defined.

$$pay(N_1,N_2,S) >>_{NS} sendcheque(N_1,adress(N_2),S)$$
$$pay(N_1,N_2,S) >>_{NS} sendmoney(N_1,adress(N_2),S)$$
$$pay(N_1,N_2,S) >>_{NS} charge(creditcard(N_1),N_2,S)$$

Single transactions and composition operators have to be refined, e.g., a conjunction of offers can be refined to a sequence of actions or a single action executed in parallel. Note that we follow here refinement relations as described in (Hoare, 1985; Lengauer, 1993; Lengauer and Huang, 1986). We subscribe the operators with the phases in which they are being defined. E.g., examples for the definition of this implementation or refinement relation between negotiation and settlement phase, denoted by ">>$_{NS}$"are given by:

$$m \; and_N \; n >>_{NS} \; m' \; ;_N n' \qquad if \; m >>_{NS} m' \; and \; n >>_{NS} n'$$
$$m \; and_N \; n >>_{NS} \; m' \; ;_N n' \qquad if \; m >>_{NS} m' \; and \; n >>_{NS} n'$$
$$m \; and_N \; n >>_{NS} \; m' \; \|_N n' \qquad if \; m >>_{NS} m' \; and \; n >>_{NS} n'$$

Thus, those refinement relation have to be defined for all transactions and between all the phases. Based on this refinement relation, the adequate models for refinement of messages can be given.

Let us summarize the structure of this formalization in a definition. The formalization of the media reference model provides a structure of languages and refinements in the specification.

Definition Media Reference Model

Let L=(Sign, *Sen*, *Mod*, |=, |-) be a general logic and Σ_T be the signature of transitions. The signature of the transaction view T is characterized by

$$\Sigma_T = (\quad (\Sigma_{TK}, \Sigma_{TI}, \Sigma_{TN}, \Sigma_{TS}),$$
$$(>>_{TK-TI} : \Sigma_{TK} \rightarrow \Sigma_{TI}, >>_{TI-TN} : \Sigma_{TI} \rightarrow \Sigma_{TN}, >>_{TN-TS} : \Sigma_{TN} \rightarrow \Sigma_{TS}))$$

The signature of a Media Reference Model is defined as a structure

$$\Sigma_{MPM} = (\qquad (\Sigma_T, \Sigma_R, \Sigma_P, \Sigma_C), (i_{T-R} : \Sigma_T \rightarrow \Sigma_R, i_{T-P} : \Sigma_T \rightarrow \Sigma_P, i_{T-C} : \Sigma_T \rightarrow \Sigma_C)),$$

A media reference model is defined as a structure

$$MRM = (\Sigma_{MPM}, Sen, Th_{MPM}, Mod, |=, |-)$$

Thus, a media reference model is formalized as a structure of

- four signatures defining four languages (each for a phase) and the refinement relations between those languages of a phase for each row,

- mappings between transactions and the components roles, protocols and channels describing how the language of transactions is reflected in the models of roles, protocols and channels,

- a function Th_{MPM} that assigns languages and mappings theories and theory mappings,

- as well as the functor *Mod*, a satisfaction relation and entailment relation for those theories.

4.2   Architecture of Media

The formalization of media concept and media reference model yield a number of concepts to define an architecture for media. Additionally, we are interested in distinguishing (at least) application specific and media specific parts of a media description. Thus, the architecture has four "dimensions" along which we structure those media and which characterize the (data part) of the media architecture:

- From the formalization of the media concept we obtain the seven components of media (1) roles, (2) protocols (3) domain, (4) channels, (5) channel system, (6) relation channels and domain vs. roles and protocols, (7) relations between theories and (8) relations between models.

- From this formalization we obtain also the distinction of information available on the medium and the information it is adorned with - that facilitates to understand a piece of information. Thus we have (1) explicit information and (2) name in the channel system, (3) join to blend tacit and explicit information, (4) models (5) theories (6) general logic, and (7) name of the component.

- From the media reference model, we obtain the four phases and four views, with 16 different "logical spaces" with syntax and semantics and the relations between the views and the relations between the phases.

- In general, (1) domain specific information has to be distinguished from (2) generic media structures. The embedding has to be defined, since media allow for media specific information structures.

Note, that those dimensions are orthogonal: Each piece of information has to be adorned with all the information about it (media concept). This is independent of its place in the MRM and the structure of a media specification (following the MRM). It is again independent of the distinction of specific and generic structure and the embedding of specific into a generic structure.

5   Communities and their Media

A community# has two constituting elements: a set of agents and a medium, i.e., a community = set of agents + medium. The medium comprises the platform, a logical space and an organization and establishes a sphere in which agents interact. There are various interrelations between a set of agents and the medium in forming a medium: a medium constitutes a community by facilitating communication; the community constitutes the economic value of a medium; a community is represented on its medium.

\#   Note, that we do not aim at giving an exhaustive or inter-disciplinary discussion of communities. We restrict ourselves to literature in the field of ECommerce and discuss communities, classification, motivation and representation of communities only to learn about the reconstruction of communities on a platform and how the platform can contribute to a medium.

Our goal is to analyze this interrelation between community and the medium to facilitate artificial agents to participate in communities of collaborating human and artificial agents.

First, we discuss the interest, the motivation as well as communication and contribution of a community. We analyze, how a community, in particular the organization is represented on a medium. We suggest in the third part of this section a dialogue between medium and platform to establish communities of human and artificial agents. This dialogues includes contents and the organizational structures of communities employing a medium and community as represented on the medium. Establishing a medium is itself a process of communication, collaboration and contribution.

5.1   Interest, Motivation and Contribution

It is a common interest that motivates agents to gather on a medium and form a community and to communicate. The media provide various services to support this community in achieving the common goal and meeting the interest of the community. Thus, a community may have an interest to employ a medium - provided the medium contributes to the community with its needs for interaction. In considering the motivation to communicate, following (Hagel III and Armstrong, 1997; Schubert, 1999a), we distinguish wrt. their motivation:

- communities of interest,
- communities of fantasy,
- communities of relationship, and
- communities of transaction.

Thus, the common interest of a community to gather differs as well as the demand for services and the demand for support. This demand for support of communication has to be met by the services of a platform. However, the goal is not only to support communication on the medium, but to motivate the members of the community to interact with the platform or at least via the medium.

(Hagel III and Armstrong, 1997; Schubert, 1999a) point out, the emphasis in communities lies in the contribution of the community to the medium. It is not the platform that distinguishes a medium or the contents published on it - it is the community and the contribution of the community to the platform (Hagel III and Armstrong, 1997; Schubert, 1999a). Hence, it might be not common platform or the contents, what makes a community affiliate with a medium-it may be the community itself. We distinguish communities according to the kind of contribution:

- *Community as attraction.* The community is itself the reason to visit a platform and join a community. Examples are communities of interest, (e.g., on the medium Newsgroup) (Rheingold, 1993; Schubert, 1999a).

- *Communities of design.* For some communities, the main interest is the creation of a service or product using the platform. E.g., GNU, Linux, Mozilla all have "their" communities.

- *Community as source of knowledge.* The knowledge of the community and the means to represent this knowledge on the platform can provide valuable information to the community. The knowledge of the community can, e.g., compensate for lack of competent shopclerks on the platform. This knowledge may either be provided by the members of the community, e.g., as comments, reviews or experience reports or it can be the externalization of information gathered on the platform from the users (Schubert, 1999a). Examples for such platforms are product catalogues allowing for annotations or customer reviews, as well as recommendation services or annotation systems (Ginsburg and Kambil, 1999; Schubert and Ginsburg, 1999; Schubert and Lincke, 1999b).

- *Community as trust-generating environment*: The community and the awareness of the community creates trust that is prerequisite for performing transactions (Figallo, 1998). "Real" communities have social relations grown over time and means of signaling trustworthiness that lack in online-communities. The community and the awareness of the community may reconstruct social relations and the signaling of reliability and safety (Schubert and Ginsburg, 1999). Awareness of the community may generate "trust by commonality" (Tan and Thoen, 1999).

A community that communicates via a platform and contributes to the platform constitutes *economic value* for the medium. It establishes the basis for lock-in and switching costs for the members of the community (Shapiro and Varian, 1999).

In the communication between agents and medium and in the way a community contributes to the medium we distinguish two kinds of communication how this communication or contribution takes place:

- Agents may explicitly contribute by providing information about some application, about themselves or about the community.

- The platform may gather information from and possibly by the community, e.g., by analyzing click-streams and by collaborative filtering. The contributions or the communication is here implicit.

Let us summarize the issues in communication and collaboration on a platform. An agent contributes either explicitly and voluntarily or implicitly by the means of the platform. Communities form on a medium driven by some common interest. Their demand for communication or coordination can be supported by the services of a platform. Particular to the communities on interactive media, is that the emphasis is on the contribution of the community to the medium and the ubiquity of media allow larger communities to gather without space and time barriers. The contribution of the community creates economic value -since it is the community that distinguishes media and not the platform. In the contribution of the community to the medium, we distinguish implicit and explicit contributions. The implicit contributions are those that are particular to media provided by information and communication technology. The medium or an agent on the medium observes the user in interaction and to learn in observation (Maes and Schneiderman, 1997; Schubert, 1999a). E.g., let us consider the recommendation services of Amazon. Amazon gathers information, e.g., about users and the books the buy. Agents have knowledge about relevant books – those that get ordered at Amazon. In observing agents, Amazon learns about relevant books. Prerequisite for this reasoning is a congruence of the logical space of agents and of the platform. Here, the formalization and reconstruction is based on a common and well-elaborated and well-formalized logical space, namely the one of book description.

5.2   Representation of Communities in Media

Media as spheres for agents have to provide a representation for the community and its organization. The interactivity of those media demand for some representation of the community with its agents and its organization such that the members of the community are supported in communication and collaboration. The goal is to represent the community such that artificial agents as representatives of humans may perform transactions on those media. There are various representations of a single agent on media, avatars, verbots are fancy representations and a browser can be considered either as an agent which mediates between user and medium Internet or as a simple representation of a user, employed to navigate in this medium. We are not going to detail the representations of single users. We are interested in representations organization and single users within organizational components.

Information and communication technology provides several concepts to represent organization. Let us illustrate how organization and the single agent can be represented on media by

giving three commonly known examples: (1) computer and computer networks (2) an online-shop like amazon.com and (3) Intranets as an intra-organizational communication medium.

(1) In computers or computer networks, the organization is determined, controlled and enforced by the (network) operating system. Usually, each agent is represented by a user account, identified by a login-name and a password. This account determines the user's right to read, write or execute files resp. executables. It also restricts the individual's rights to change the organization of the user community, i.e., to set-up or modify accounts, or the organization of the data stored on the system, as e.g., the file structure. Users are clustered into different groups sharing the same set of rights. The protocols determining the interaction with the system are restricted by the rights of the user. On a technical level, they are implemented by standard protocols, guiding the transfer and representation of data. Collaboration between different users of the system can be supported, controlled (and enforced) by – distributed – applications as workflow applications relying on the basic services and organizational structures given by the operating system. They usually provide their own role structure and protocols guiding the information flow between different agents identified by a user name (and password) playing different roles. That organizational structure w.r.t. the roles and protocols are rather fix and do not adapt easily to changing needs of the community.

(2) As an example of a business media supporting online trade, let's explore the online book-shop of amazon.com. The organization of the community basically consists of the role of the customer and the role of the vendor of books, amazon.com itself.[#] A customer role is associated with the right to use the information facilities and to accept offers leading to a contract between amazon and that customer. This contract induces further rights but also duties: the right to get a book delivered and the duty to have to pay for the book and the delivery. Moreover, the user has the possibility to play an individualized customer role. In case he is willing to "register" at the site, the system (resp. amazon) collects information about his online behavior and uses this information (in combination with the information collected about other user´s) to personalize first of all the search service. The profiles and the system of profiles are an example of roles and a role system that emerges on the medium with the means of information and communication technology. The interest profiles are also used to build up a recommendation service suggesting books, which fit the current user profile and, thus, might be of interest to the individual customer. The role

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[#] Note, we are aware of amazon.com providing more than books. Moreover, there are further agents resp. roles which would have to be considered, when analyzing the business community, as e.g. the authors and the publishing houses. For the sake of simplicity, we restrict our discussion to amazon.com as a bookseller and to the community of amazon and the potential buyers.

of amazon.com can be directly derived from the customer´s role description, complementing the associated rights and duties. The protocols guiding the interaction between amazon and the customers basically follow the four phases of the reference model. They are enforced by the link-order of web-pages. Note, that there are additional protocols, restricting the use of collected data, the privacy policy. Those protocols cannot be enforced directly by the platform. Note also, that the contract between customer and amazon.com constitutes another protocol, guiding the processes of the settlement phase. They can be enforced w.r.t payment, using e.g. the SET protocol, but not w.r.t. the actual delivery, at least not by the medium itself.

(3) The medium Intranet supports employees of a business organization. Intranets are a special form of the already described computer network. The difference between a general computer network and an Intranet is (1) the common interest of the community, using the intranet as a platform first of all for the creation and dissemination of knowledge and for the creation of economic value and (2) the used web technology and access media (browsers). The Intranet relies for the representation of an organization mainly on the underlying network. Various information systems integrated in the Intranet may have their own organizational representation - e.g., their own user administration. The medium however, may let organization emerge.

Thus, information and communication technology provides various means to represent organization - as a concept to restrict users in their behavior and communication on a medium, or by enhancing communication on the medium by an emerging organization on which communication is allowed and a medium which allows to combine both concepts according to the demand.

Let us relate what information- and communication technology provides to organizational concepts. To achieve their common goal namely the creation of economic value, the community demands the support of two general organizational models, usually determining the interaction between employees within an enterprise: the task force and the bureaucracy (Nonaka and Takeuchi, 1995).

- A *task force* is an institutionalized form of a team or a group that brings together representatives from a number of different units on an intensive and flexible basis, usually to deal with a temporary issue. As such, a task force is a flexible, adaptable, dynamic, and participative organizational form.

- *Bureaucracy* distinguishes itself by formalization and by a high degree of specialization. This organizational model allows for effective routine work and repetitive tasks.

The advantage of bureaucracy lies in its efficient completion of repetitive tasks while the advantage of task force lies in its support of the combination of knowledge and the creation of new ideas (Nonaka and Takeuchi, 1995).[#]

- Bureaucracies can be implemented by a system of accounts, roles and group systems, describing the – access - rights of users and the protocols as in an operating system or application. Those structures are usually rather fix, thus cannot adapt easily to changing organizational structures. We suggest to establish contracts, as a means to specify the – temporary – organizational structure of a group of people. Those contracts can be negotiated and - given an explicit form on the medium - can be used to enforce the associated protocols.

- Task forces can be represented with a system of profiles describing the interest of users. They allow the establishment of personalization and customization protocols supporting communication and organization according to individual interests.

Looking at our three examples, we can see that while computers and computer networks can represent and enforce rather fixed bureaucratic organizational structures restricting the behavior of the individual agent, amazon establishes user profiles supporting or facilitating the interaction with the medium, reflecting the flat interest related structure underlying the establishment of a task force. In general, the two organizational forms do not exist in a pure form, but often side by side within the same community (Nonaka and Takeuchi, 1995). With the medium Intranet supporting the work within a "traditional" company, we gave an example of such a medium. It has bureaucratic structures, determining standardized routine workflows of the value creation process and the different levels of authority within a company. There are also task forces, with a flat organizational structure represented by interest profiles, which develop from the need to solve a single, non-routine problem.

5.3 Building a Medium – A Dialog

We argue that the process of building a medium for a community is a continual iterative process, alternately (1) building new organizational structures on the medium through communication and reconstructing the organizational structure of the community on the medium and (2) adapting, changing or enhancing the organizational structure.

[#] Organizational models vary in their peculiarities w.r.t. to those basic organization models and they can be considered to have some recursive structure. According to (Bleicher, 1993), the criteria applied to establish the units within an organization, one-dimensional and multi-dimensional models can be distinguished.

This establishment of a medium (and a community) follows the same pattern as the creation of knowledge according to Nonaka and Takeushi (Nonaka and Takeuchi, 1997) They distinguish *tacit* knowledge, which is basically hidden in the minds of an individual or organization and hard to communicate and *explicit* knowledge, which can be presented in some formal, and communicable form. They propose a knowledge creation process, in form of a knowledge spiral, where knowledge is created and disseminated by alternately transforming tacit knowledge in explicit knowledge resp. vice versa and combining tacit resp. explicit knowledge to create new tacit resp. explicit knowledge.

This spiral consists of four phases:

(1) In the *socialization* phase, tacit knowledge is disseminated and combined with the tacit knowledge of others through communication and interaction.

(2) Through formalization, tacit knowledge can be transformed to explicit knowledge. This process is referred to as *externalization*.

(3) In the *combination* phase, explicit knowledge is combined leading to the creation of new explicit knowledge.

(4) In the *internalization* phase, explicit knowledge is transformed to tacit knowledge by internalizing explicit knowledge (often referred to as learning).

We argue that the establishment of a medium (and a community) follows the same pattern. Corresponding to the two types of knowledge, we identify two types of organization and knowledge (1) the tacit organization, being the organization of the community resident on a medium, and (2) the explicit organization being the organization represented on the medium. Remember, that knowledge, as part of the logical space comprises the knowledge about the domain and the knowledge about the organization.

Like the knowledge spiral, the "media spiral" consists of four phases. Let us shortly describe those four phases as illustrated in Figure 3.

- During this *externalization*, the tacit organizational structure is reconstructed on the medium. This becomes necessary in order to allow artificial agents to act according to the rules of the organization and, thus, to support and act on behalf of human agents. Moreover, the explicit representation of the organizational structure enables the negotiation, the control and finally the enforcement of organizational structures. Note however, that the reconstruction needs not to be complete. Data about the users´ behavior can be collected on the medium providing further information about the organizational structures.

- The *combination* process relies on the medium's ability to process information. E.g., it can relate the access profile of individuals with their interest profile, leading to new organizational structures according to the criteria "interest".

- The *internalization* process is based on services disseminating new knowledge among the agents and thus transforming it to tacit knowledge of the organization. Those are the services of the knowledge phase.

- In *socialization*, the new tacit organizational structure and knowledge can be disseminated within the organization, through communication and interaction and new structures and knowledge can evolve merely through those communication processes.

Socialization:

Organizational Structure:

- *Dissemination and Creation of the new organizational Structure through Communication*

Domain Knowledge:

- *Dissemination and Creation of the new Domain Knowledge through Communication*

Externalization:

Organizational Structure:

- *Negotiation and Establishment of Contracts*
- *Definition of User Profiles*
- *Recording of the User´s Behavior*
- *Recording of the Settlement Process of Contracts*

Domain Knowledge:

- *Storage and Organization of Documents*
- *Collection of Access Data*

Internalization:

Organizational Structure:

- *Establishment of Rating services*
- *Establishment of personalized and automated Information Services*

Domain Knowledge:

- *Establishment of personalized and automated Information Services*

Combination:

Organizational Structure:

- *Analysis of the collected Data*
- *Derivation of new organizational Structures: User Profiles*

Domain Knowledge:

- *Adaptation of User Profils through Analysis of the collected Data*
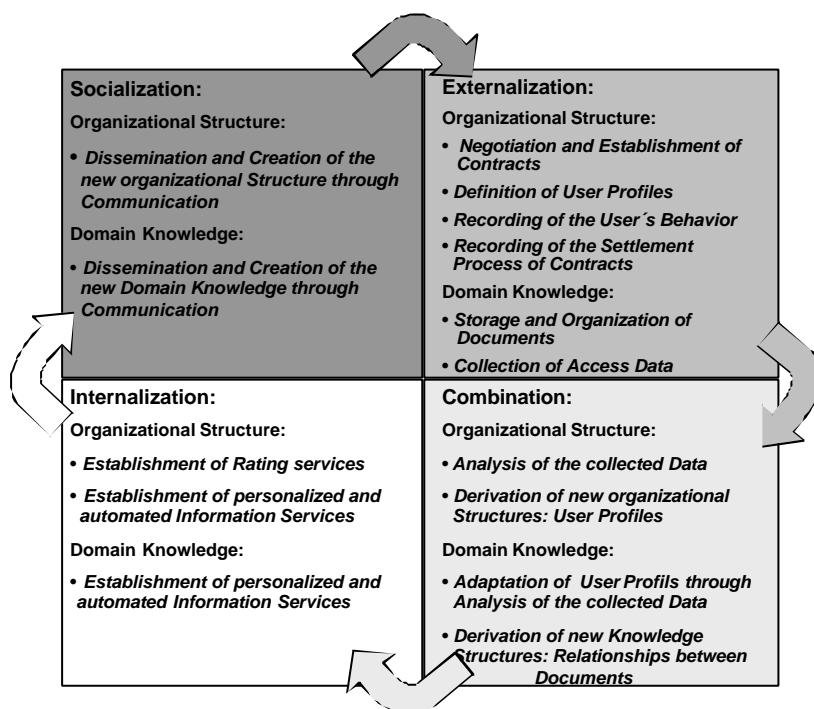- *Derivation of new Knowledge Structures: Relationships between Documents*

Fig. 3: The Media Spiral

6 Concluding Remarks

Communities of human and artificial agents on media are a general vision that demands for a reconstruction of the notion of community on media, and as part of this reconstruction, of a formalization of the relevant aspects based on general architectures and concepts. We explore the relation community and its medium and the duality of aspects implemented on it and of aspects emerging from the medium.

The general models, the media concept and the media reference model, guide the analysis of communities and the design of the platforms. Media constitute communities by facilitating communication among the members of the community. Communities are considered to be an essential concept in ECommerce. However, with the emergent technology of agents, media are the basis for collaboration and communication of the agents. Thus, we suggest to employ the communities to facilitate a dialog and a spiral towards artificial agents and the forthcoming communities and media for communities of human and artificial agents.

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Signaling and Segmentation on Electronic Markets:
Innovative Pricing Strategies for Improved Resource Allocation

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Abstract

The advent of the digital economy and the increasingly important role of various kinds of electronic market places provide unprecedented opportunity for suppliers of products and services to experiment with new pricing mechanisms and strategies. Economic appropriateness, technical feasibility, and purposes of such pricing mechanisms depend mainly on product characteristics and the role of intermediaries. In order to allow for advanced, efficient pricing strategies and fast price adjustments on the Web, technologically supported infrastructures and systems are crucial. New information technologies not only enable businesses to charge personalized prices on the Internet, but also allow for new price setting mechanisms in which the consumer specify their interests and requirements. This paper provides some conceptual background for developing net-based pricing strategies and reflects first empirical evidences against it.

1 Introduction

Microeconomic theory states that pricing depends heavily on the market structure for a certain product. In the classic case of a perfectly competitive market with many economic agents on each side, sellers are price takers and cannot influence prices (see for example Mansfield (1996) for a detailed discussion). These findings are only correct under the assumption of perfect competition. Economists speak of perfect competition as a set of market conditions, na-

mely homogeneous products, perfect market knowledge of each participant, atomism of market participants and mobility of resources (Browning & Zupan, 1999).

In the real world, however, hardly any seller acts under conditions of perfect markets. Instead of having to accept the market price, sellers have to develop their own pricing strategies and pricing finding mechanisms aiming at public relation effects, market research insights, and optimally matching various customers' 'Willingness To Pay' (WTP).

According to the OECD (1998) "More and more products will be subject to differential pricing associated with customized products, fine market segmentation and auctions as it becomes easier to change prices." Empirical data shows that differential pricing is already ubiquitous in industries that exhibit large fixed costs like airlines, telecommunications or publishing (Varian, 1996). Some market segments could not be served without differential pricing, and it can even be shown that differential pricing can be expected to contribute to economic efficiency. So far businesses have been restricted to group pricing and versioning, when differentiating their offerings. In order to allow for more advanced, efficient differential pricing and fast price adjustments on the Web, technologically supported infrastructures and systems are crucial. Information technology not only enables businesses to charge personalized prices on the Internet, but also allows for new price setting mechanisms in which consumers specify their preferences regarding additional product attributes. Reverse auctions or so-called demand collection systems are just two examples of Web-based intermediaries, which allow customers to specify their preferences for a flight and get the best offer (e.g. www.travelbids.com). Alternatively, customers specify a price and day for a flight from A to B and get information in return whether an airline has been found that offers a seat at the given price and the details of the flight (e.g. www.priceline.com).

We will present the claim that customer segmentation and innovative pricing mechanisms lead to more efficient resource allocation and show that partial approaches for customer profiling and for flexible pricing exist. We argue that the benefits of these approaches can be increased, if they are extended and combined. As these strategies are contingent on product characteristics and industry structures, we will focus on digital products and airline tickets.

2   Efficient Resource Allocation based on Multiple Attributes

In most markets, customers' Willingness-To-Pay (WTP) is heterogeneous. Thus, it is advantageous to charge different users different prices. Sometimes differential pricing is the only feasible way to produce complex services such as scheduled flights and leads to prices that reflect more closely their true market value. Two problems with differential pricing occur if we

assume that customers are generally anonymous. First, a seller has to determine the WTP of different groups of buyers. Second, the seller has to prevent customers with a high WTP to purchase the product intended for customers with a lower WTP. This means the market and the services have to be separable - by imposing boundaries or naturally through some actual or imputed characteristics. Also, trading or communication between market segments must be restricted.

One strategy is to differentiate prices based on the characteristics of the product like the quality or the time when it is shipped (versioning). Another strategy is to distinguish prices on some customer characteristics (individual or group level), e.g., if the customer is a business or a private person or if the customer is a student or some kind of club member. In this case we speak about group pricing or – in the extreme case - personalization (also Pigou 1920).

2.1 Versioning

Versioning is based on the distinction of product features or attributes. With different versions of a product offered, customers position themselves into different groups according to their WTP for certain product attributes. In cases, where observable exogenous customer characteristics have little to do with their WTP, versioning can be a good strategy. The seller in this situation provides at least two versions of a product and determines associated prices. A simple example is block pricing, where the price per unit declines with the quantity purchased by a particular customer (quantity discounts). This tends to result in greater turnover because heavy users pay prices closer to marginal cost. However, it does not convert all consumer surplus into profit like it is the case with perfect personalization, where the number of blocks would equal the number of customers.

Theoretically, the number of versions of a product offered should be equal to the number of types of consumers in the market. However, too many versions easily create confusion. Various empirical investigations recommend to offer three instead of two versions, as the average customer will most likely opt for the middle version. Other examples include airline loyalty cards with the versions standard, silver, and gold, or software packages differentiated in student, professional, and de luxe.

Another form of versioning results from aggregation or product bundling, where products are sold together as a package. Many software packages (e.g. Microsoft Office) are bundles of individual components. Academic journals or newspapers are bundles of articles sold as a package and also subscriptions of magazines can be seen as product bundles of several issues. Even flight tickets can be considered bundles of various product features such as 'on-board

service', 'right to change booking', 'total travel time', etc. The pricing advantage of bundling goods can easily be demonstrated (Bakos & Brynjolfsson, 1998).

2.2 Group Pricing

Different from versioning, group pricing focuses on customer characteristics. Group pricing occurs when prices differ among categories or groups of consumers. People who have certain purchase histories, zip codes or behavior patterns are offered different prices. This is probably the most common practice of differential pricing. For example, it is often thought that business users have higher WTP than educational users, hence many suppliers of books and journals have educational discounts. Similarly prices often depend on whether one is domestic or foreign, senior citizens, member of a club, etc..

Group pricing is already an accepted concept for selling on the Web. Like in markets for physical goods, suppliers use mechanisms like targeted promotions and loyalty programs in order to distinguish their products from those of competitors and to establish customer relationships. Unfortunately, in many cases it is rather difficult to find out about particularities of different customer groups. For example, in case of student discounts, it is cumbersome for a supplier to check student IDs without direct access to the University Information Systems. Moreover, often an individual's WTP is not correlated with any of the characteristics mentioned.

2.3 Personalization

Personalization is a familiar concept in marketing, gaining importance and followers in Electronic Markets. It aims at identifying potential customers and offering them the required products at the right time, price and conditions. Theoretically, personalization assumes that suppliers know their customers' WTP and extract from each consumer the full value of his or her consumer surplus.

Currently, perfect personalization has limited applications. It can occur only in the few cases in which a firm has a small number of buyers and is able to guess the maximum prices those buyers are willing to accept (Luedi, 1997). Various technologies are becoming available in order to gather and develop customer profiles or even to give customers the instruments to personalize suppliers' offerings, e.g. myYahoo!.

3 Technologies for Customer Profiling on the Internet

On-line newspapers provide good examples for developing customer profiles. The on-line version of the New York Times does not charge users for content, but requires them to register, providing information like name, address, gender and age. The *registration information* already gives some hints about the demographics of readers, which can be related to reading habits. More elaborate approaches are based on customer-owned personal profiles, which store information such as name, address, interests, etc. and give it away on a controlled basis to Web site providers.

Another way to learn about one's customers is *tracking on-line behavior and click streams* by using cookies or scrutinizing Web server log files. Click stream analysis allows a merchant to instantaneously gauge the interest of a Web user on different products and product categories. Each time a user requests a page from a Web server, the server keeps a record of the action in a log file. That detailed record can be difficult and time-consuming to mine, and the sheer volume can be overwhelming. Several tools for analyzing log-file data are available. Once the data is processed, analyzers can create reports based on the results.

Collaborative filtering relies on the premise that patterns of customer behavior will provide useful information for individual customers with similar tastes and preferences. Collaborative filtering is basically a statistical analysis of behavioral parameters of a large sample designed to develop recommendations. Firefly (http://www.firefly.com) is perhaps the best known example of this approach. Amazon.com is using this technology. They list buying suggestions once a customer has selected an item based on the analysis of previous purchases by other customers of the specific item. Other companies working on collaborative filtering are tracking users' movements around the site and altering what is presented based on the click trails. A profile is created based on the items a customer clicks on, whether they are text, advertising, or searches for information on the Web. Resnik and Varian (1997) give a good overview about different applications of collaborative filtering.

The examples show that customer profiling is primarily driven by suppliers or intermediaries. Even those approaches that give customers an active role, like customized newspapers, restrict this choice (and the opportunity to signal their preferences) to a given and static set of attributes. These technologies are not (yet) linked to strategies of flexible pricing.

4 "Good-bye to fixed prices": Emerging Models for Flexible Pricing

Cortese and Stepanek (1998) have used "Good bye to fixed pricing" as headline for their Business Week Special on Electronic Commerce. Their message is that consumers will increasingly be confronted with models for flexible pricing and product differentiation. The Web has been heralded as a medium which enables and requires companies to develop new or modified business models. Especially in the services industry, we have seen the emergence of new, Web-based business models. Even though these models are usually based on familiar coordination mechanisms, those mechanisms are used to a different effect in a Web environment. We will discuss 'auctions', 'reverse auctions', 'demand collection systems', and 'demand aggregation systems'. These four examples give evidence to a trend of emerging business models. These models are often driven by intermediaries in an attempt to leverage communication cost differentials offered by the Web in order to facilitate customers' preferences for lower prices. The incentives for the suppliers are the allocation of products or services with a limited shelf-life, like tickets, or to boost sales.

4.1 Demand Aggregation System

Accompany (www.accompany.com) is a unique online buying service. Accompany is trying to initiate virtual customer pools so that individual customers can benefit from volume discounts offered by suppliers. Discounts are thus not the result of negotiations but of Web-enabled pooling and aggregation of demand. Accompany contributes to shifting bargaining power to customers while at the same time providing safeguards against frictions in the service delivery. For running aggregation processes, the time limit for joining are made transparent on the Web. Email notification is offered. The business model of Accompany is not restricted to particular product features but rather to markets where suppliers are offering volume discounts and where customer preferences can be pooled. Accompany is negotiating with suppliers to identify and get volume discounts on popular products.

4.2 Ticket Auctions

Online auctions on the Web have become a popular and wide spread instrument for flexible pricing (Heck & Vervest, 1998; Klein, 1997). The strategic rationale and impact, however, vary significantly with the range of products and the design of the auctions.

Since August 1997 Lufthansa is regularly auctioning off selected flight tickets via their Web site Info Flyaway (www.lufthansa.com.) Once a month, auctions run for a full day from 10

a.m. till 10 p.m. 50 separate auctions take place during an auction day. During one auction, which lasts for approximately ten minutes, one set of tickets is auctioned off. On average, there are 120 participants in the virtual auction room, about 20 of them are active bidders. An auctioneer is trying to induce participants to continue the competitive bidding process. The Lufthansa auction is an English auction with ascending prices, the ticket list price, however, is taken as an upper limit. Successful bidders are called after the auction in order to confirm the price and verify the credit card information. Typical bidders are participants in Lufthansa's frequent flyer program Miles & More and use Lufthansa's Web site regularly. The offered tickets are for carefully selected seats on less frequented flights to attractive destinations. Auction tickets, which often are sold with a significant discount, are frequently used for an additional weekend trip or as presents. Lufthansa has included offerings from their partners, like holiday packages, in the auctions and is exporting the auction to countries outside Germany.

The auction is run by an independent agency, infoMedia (www.infomedia.de), which offers a full auction service package. infoMedia compiles the auction catalog, registers the participants, and runs the auction system with a maximum load of 2000 concurrent participants or observers. The fee for one auction day including call center operation for 48 hours is about USD 10.000. From January 1998 through March 1999, 37 auctions have been held, 24 of them outside Germany. A total of 3935 tickets have been sold during this period at an average price of DEM 508 (approximately. USD 300).

For Lufthansa, ticket auctions are in the first place marketing events and experiments in area of electronic commerce. The auction rules have been gradually adapted and modified based on the growing experience and response from participants. One goal of the auctions has been to attract (potential) customers to the Lufthansa Web site, which is also a direct sales channel. Lufthansa has moved cautiously - without major advertising activities - in an attempt not to alienate travel agencies. Lufthansa has positioned the auctions strategically as one instrument to blur the image of a high-price airline.

Despite the fact that marginal cost for additional passengers on seats that might otherwise not been sold are very low, the revenue generated from the ticket sales hardly justifies the Web auction in its current format. The benefits for Lufthansa are primarily in the area of marketing and market research. The auctions have generated plenty of publicity in traditional media, additional traffic on the Web site and in particular customer feedback, information about customers' price preferences and insights into buying patterns for discounted tickets.

4.3   Reverse Auction

TravelBids (www.travelbids.com) is a so-called reverse auction. In contrast to the Lufthansa auction, customers take an active role to specify their preferences for touristic offerings. Customers have a wide range of attributes which they can specify or intentionally leave open. On this market, all bids are visible, for everyone to see, so prospective customers can view other listings and see the results. The bidding period can be set between 1 and 72 hours. Unsuccessful bids can be repeated.

Customers' requests are posted on TravelBids, which is a specialized electronic market. TravelBids' fee of USD 10 for successful bids is split between travel agent and customer. On the supplier side, not tourism principles but travel agents bid to fulfill the demand. Travel agents use their knowledge to identify flights that fit the customers preferences and use part of their commission in order to gain additional orders.

4.4   Demand Collection System

At a first glance, Priceline (www.priceline.com) appears to be a similar solution: based on the assumption that supplier-side fixed prices do not always lead to an optimal allocation of products and services, Priceline has set-up a market platform for airline tickets, new cars and mortgages. Customers can specify their preferences including the price. Priceline then advertises these binding offers to airlines, car companies, or financial services companies who can decide whether they want to fulfill this additional demand at the listed price. Airline customers do, however, not give a detailed specification but specify only day, place of departure and place of arrival and request a flight operated by any major airline. In this way the airlines have sufficient scope to fulfill the demand, if they wish so to do, and the chances that the offers are met is increased. During the second week of January 1999, 10,000 tickets and 2,000 hotel rooms were sold via Priceline while about 50000 offers were not met. Priceline earns a commission for every sold ticket of USD10-20.

The specified offers are forwarded sequentially in a highly efficient and patented process to the potential suppliers. Customers' offers are binding and have been substantiated by a credit card authorization. The airlines can decide depending on their current load factor and price policy whether they want to take additional customers at the listed price. Feedback is given to the customers within hours.

In contrast to auctions, Priceline has set-up a private market. I.e. the demand is actively advertised to the airlines but neither the offers nor the deals are made public. The suppliers can

decide based on internal policies; they do not risk any kind of signaling effect that a flexible price strategy otherwise might sent to the market. Priceline is called a demand collection system because it functions as an intermediary which collects customers' requests for products and services at a different than the advertised price. This demand typically is not articulated and can thus not be fulfilled. Priceline has successfully applied for a US patent for their business model.

5 Analysis: Contingencies and Design Parameters for Advanced Pricing Models

The applicability and success of the sketched solutions for customer profiling and pricing are based on the existence of a global computer-mediated communication environment and specialized intermediaries which balance the interests of customers and suppliers. They are, furthermore, contingent on product and market characteristics.

5.1 Product Characteristics

We see the most drastic need for newly developed pricing schemes for those products and services, which can be delivered fully over the Internet. Loebbecke (1999) refers to *Online Delivered Content (ODC)* including on-line newspapers, magazines, music, education, searchable databases, consulting, and eventually expertise and ideas. Production costs cannot be used as a guideline for pricing ODC since there is no link between input and output. Mass consumption does not require mass production. Economies of scale are determined by consumption, not by production. Further, it is impossible to determine whether it is worthwhile to obtain a given 'piece of ODC' without knowing its content (Stiglitz, 1985). In the past, there were significant costs associated with price changes. For publishers with a large product line, for example, it could take months for price adjustments to filter down to distributors, retailers, and salespeople. Especially in the case of ODC, networks allow for instantaneous signaling of price changes, and hence significant costs reductions with regard to price adjustments. For ODC, the first copy is typically very costly to produce while subsequent copies can be produced and distributed at a very low price. Furthermore, there is basically no capacity constraint for producers. With marginal costs towards zero, cost-based pricing makes little sense and will generally not recoup sufficient revenue to cover fixed costs. This cost structure leads to substantial economies of scale – the more one produces, the lower are average costs of production (Shapiro & Varian, 1999) – and strategies focussed at increasing sales volume in order to lower average costs. As an alternative (or complementary) strategy for companies that face difficulties to extend their sales volume, differential pricing becomes more attractive.

Other information-based products such as tickets have a very different production function. Tickets per se can also be reproduced with marginal costs approaching zero. Their actual value proposition, however, is a service, e.g. the seat on a particular flight or in a specific concert hall. The production function for these services is characterized by capacity restrictions

on a short term level. A concert can not be relocated to a larger (or smaller) concert hall on short notice neither can airlines switch aircraft for scheduled flights without significant lead time and additional cost.

Any risk of 'in-house cannibalization' fades when the actual products, i.e. their detailed components - do not necessarily correspond one to one. Electronically sold products may contain additional content features, may be differently bundled. Furthermore, depending on product design and pricing strategy, the electronic channel allows customers to be more in control of how much and what kind of product to obtain. Indeed, it can be expected that when complementing traditional products and channels with electronic ones, customers will request additional value such as availability (topical information, access to data from any location), presentation (multi-media such as video clips, sound, etc.), interactivity (user-friendly downloading, search functions, etc.), and innovative product features. Table 1 summarizes the comparison of product characteristics for ODC and other information goods such as flight tickets and mortgages. The comparison highlights the differences among the products and production functions which set the scope for suppliers' pricing strategies.

Products Characteristics	ODC	Ticket for scheduled flight	Mortgage
Initial production cost	High level of fixed cost (first-copy cost).	High level of fixed cost (aircraft, crew, fuel, etc.).	Fixed cost for product design and infrastructure.
Marginal cost for additional product or copy	Marginal cost close to zero.	15-20% of overall costs are related to the number of passengers (ground service, food, etc.) within a given contingent of seats.	Marginal cost is related to opportunity cost, i.e. alternative allocations of the capital.
Individualization cost	Fixed cost for initial IT solution (individual filters etc.), Variable cost for content selection and combination (not for creating new content) close to zero.	Fixed cost for setting-up yield management and booking systems, low variable cost for price discrimination based on service level and contractual features: right to return or change ticket, advance booking, restrictions regarding timing etc.	Low cost for individualization, however, long term effects result from the decisions taken.
"Shelf-life"	Depending on content, the value of stock prices etc. depends on the delay period publication.	Flight schedule defines the shelf life, after the gate has closed the over-stocked seats are worthless.	Not allocating money to a mortgage leads to a loss in interest payments if the money is not allocated at all or a loss of a fraction of the interest, in case short term interests are lower.

Table 1: Comparison of product characteristics

5.2   Role of Cybermediaries

The Web as global computer mediated communication environment is a precondition for the emergence of business models based on flexible pricing. It facilitates low signaling cost and time on the suppliers' and the customers' side and enables last minute allocation of products and services. As the Lufthansa case illustrates, this effect can be used by suppliers as part of a direct sales and marketing strategy. It has to be noted, however, that the Lufthansa auctions have been designed for fairly small numbers of offered tickets.

The other models, in contrast, have been set-up and are operated by intermediaries which are leveraging the structural advantages of the Web (Sarkar et al., 1995; Bailey & Bakos, 1996). They have strategically positioned their applications in order to generate benefits for customers and suppliers which are not feasible in a direct sales model. They
- reduce coordination and communication cost for buyers and sellers,
- generate volume for the suppliers,
- pool homogeneous demand in order to give individual customers access to suppliers' volume discounts,
- improve the likelihood for order fulfillment for the customers,
- separate or even isolate the coordination mechanism from other sales and distribution channels and by this way limit spill-over effects of price discounts,
- operate with varying levels of transparency.

Table 2 summarizes the specifics and benefits of the four pricing models from the actors' perspectives.

Model \ Actor	Demand pooling	Auctions	Reverse auction	Demand collection
Role of intermediary	Accompany is identifying attrative products with significant volume discounts and pooling demand. It reduces the coordination cost for the participants.	Lufthansa is supplier and auctioneer. The auctioneer functions as trusted (third) party.	TravelBids operates an information platform in order to limit communication cost and expose bids to numerous travel agents.	Priceline functions as broker for the customers and has established an efficient process to forward the customer offers to multiple airlines.
Suppliers' benefit	Suppliers gain sales volume.	Auction as marketing event and part of market research. Sale of overstocked tickets.	Travel agents act as suppliers. They get additional sales at a lower price.	Suppliers have an additional option to sell their products at a customer-fixed price. They can learn about customers' preferences and benefit because Priceline operates as a private market which is isolated from the other channels.
Customers' benefit	Individual customers who pool their demand get access to significant volume discounts.	Customers get access to cheap tickets.	Customers can specify their offers and might get small discounts.	Customers can specify their offers with a fixed price and some flexibility regarding the other attributes.

Table 2: Comparison of the four business models based on the actors' perspectives

6   Extended Coordination Mechanisms Based on Signaling and Matching of Multiple Attributes

While different price discrimination strategies for suppliers have been suggested for ODC products, we have presented empirical evidence of customer-oriented coordination mechanism which aim at giving customers access to lower price services, not however ODC. Leveraging the benefits of the Web as a low-cost, information rich communication medium, in most cases intermediaries have established platforms to enable

- signaling of price preferences with varying degrees of product specification;
- extending the negotiation to complex bundles of attributes;
- shifting power to the customer by pooling demand.

The described models of price discrimination are based on intermediated coordination processes among buyers and sellers in which each side specifies an incomplete set of attributes and lets the other side decide upon the complementary attributes. Lufthansa, e.g., decides on lot size and ticket attributes sets only an interval for the ticket price (minimum offer and list price as maximum offer). The incentives for sellers to relinquish part of their control over

the attributes of the offer is to gain market share, flexible allocation of overstocks or products with limited shelf-life, and market research into customers' preference patterns.

Incentives for the customers are even more obvious: get a better price in return for a compromise on some of the product or transaction attributes, e.g. specification of airline, time and route of the flight in the case of Priceline or need to coordinate with other buyers in order to pool demand. Table 3 shows which of the product attributes are specified (flexible or fixed) by supplier or customer in the respective pricing models.

Model Actor	Demand pooling	Auction	Reverse auction	Demand collection
Supplier	Suppliers have listed discounts depending on the aggregated demand.	Lufthansa specifies ticket attributes and lot size.	Travel agents specify offer and price (in terms of reduction of their commission).	Suppliers select customer offers based on price and availability of seats that match the specification.
Customer	Customers join others to pool demand for a homogeneous product. They select product attributes except for the price.	Customers specify price in a social process of bidding.	Specify more or less complex sets of preferences and expect offer below list price.	Customers specify day, place of departure and arrival and price.

Table 3: Actors' roles in attribute specification in the respective models

7   Conclusion and Further Research

In this paper, we described several conceptually backed strategies for flexible pricing. Versioning and group pricing are ubiquitous concepts, which can be found in many industries today. Market segmentation in these approaches is often very coarse grained and leaves money on the table. In the end, models will become rather complex and will have to take into account the trajectories 'organizational mission', 'frangibility' and 'reusability' of content, the desires of the audience, etc, each with its own set of imperatives (Jensen, 1998).

The range of pricing schemes will get broader and more sophisticated, as the Internet provides a variety of possibilities of selling, sharing and giving away. With respect to ODC, consumers can be charged based on the actual 'use of ODC' or based on fixed access charges. Alternatively, pricing models may imply giving actual artifacts away for free and then charging for complementary services. Economists are developing theoretical solutions to the problem areas mentioned. However, some of the mechanisms developed (e.g. MacKesey and Varian, 1995) demand an enormous amount of data, thus questioning the trade-off between allocative efficiency and operational cost-effectiveness (Mitchell and Vogelsang, 1991).

New information technologies like customer profiling and collaborative filtering help to learn more about one's customers and to establish a much more detailed pricing model. Theoretically, these models allow coming close to nearly perfect price discrimination. Unfortunately, the data gathered from click-stream analysis and collaborative filtering is not sufficient for more complicated pricing schemes.

Based on the experience and principles of the described models, future modification and extensions can be envisioned which are in line with the identified principles.

(1) In addition to specifying fixed attribute combinations, intermediaries can assist customers to specify trade-off functions (alternative parameter settings combined with different prices) which would allow suppliers to respond even more flexible.

(2) While we have discussed different signaling solutions with more or less fixed offers, the communication platforms could be used to signal alternatives which closely match the specification and negotiate about parameter settings.

(3) A further step beyond this would be to facilitate customers to specify innovative attribute combinations they would cherish or to specify their preferences and requirements for future products (reverse marketing, Leenders & Blenkhorst, 1988).

But do these technological developments, the described pricing models, and the suggested extensions solve the problem of ODC pricing?

- The information paradox complicates customer requirements' specification.
- The pricing structure suggests that several measures even to the point of freebies may be chosen, if they promise, e.g. because of publicity and subsequent popularity of products, sales of the product at some stage or for some customer segments.
- Inquiries into customers' preferences might help to identify bundles of content and a proper price.
- Market research might suggest attributes of ODC products that customers would cherish.
- Smart combination of customer profiling and schema that allow customers to signal their preferences.

Further conceptual and empirical research will be needed to develop profitable and sustainable signaling approaches and subsequent pricing strategies for better resource allocation.

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