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**The new/given index : a measure to
explore, evaluate, and monitor eDiscourse
in educational conferencing applications.**

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THE NEW/GIVEN INDEX: A MEASURE TO EXPLORE,
EVALUATE, AND MONITOR eDISCOURSE IN EDUCATIONAL
CONFERENCING APPLICATIONS

A Dissertation Presented

by

DANA R. WELTS

Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of

DOCTOR OF EDUCATION

May 2002

Teacher Education and Curriculum Studies

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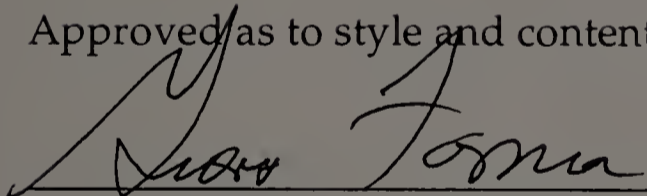
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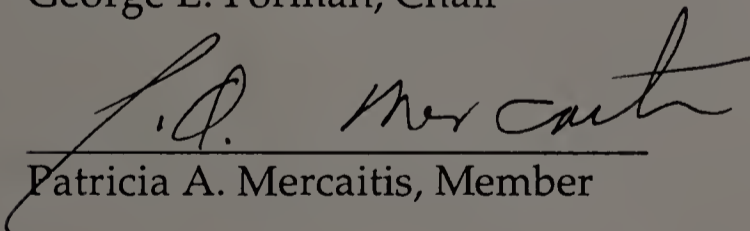
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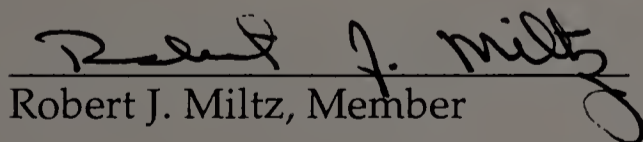
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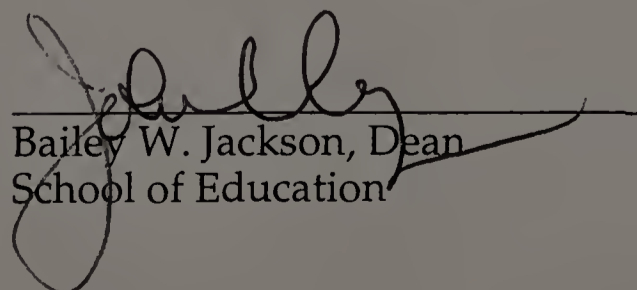
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DEDICATION

This work is dedicated to the memory of my father, Jeremy Welts.

ABSTRACT

THE NEW/GIVEN INDEX: A MEASURE TO EXPLORE,
EVALUATE, AND MONITOR eDISCOURSE IN EDUCATIONAL
CONFERENCING APPLICATIONS

MAY 2002

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This dissertation addresses the limited measures available to conduct comparative linguistic analysis across spoken, written and eDiscourse environments and proposes a new measure - the new/given index. The new/given construct of Halliday and Clark is reviewed as well as the relevant literature of eDiscourse and other persistent electronic communication. A data set of writing samples, face to face meeting transcripts, and electronic conferences is assembled and used to test and validate the new/given index. The data are reviewed and scored by raters for new and given material and the rater scores are compared with the score generated by the new/given index software parser. The data suggest that the new/given index reliably reports the presence of new and given information in processed text and provides a measure of the efficiency with which this text is resolved or grounded in discourse. The data are further processed by the software parser and aggregate new/given indices for the data types are generated. This analysis reveals that statistically significant differences between the new/give index of written text,

transcriptions of face to face discussion, and eDiscourse conferencing transcripts exist. Finally, a qualitative analysis based on interviews with the creators of the data set explore their experience in the eDiscourse conferencing environment and the relation between individual behavior in a group problem-solving situation and an individuals new/given index in an eDiscourse environment. The study concludes with suggestions for the application of the new/given index in eDiscourse and other persistent electronic communication environments.

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INTRODUCTION

This study is concerned with communication by means of speech, writing, and eDiscourse. The term "eDiscourse" describes the phenomena of two-directional texts where one person using a keyboard writes language that appears on their monitor screen and is transmitted to the monitor of a recipient, who responds by keyboard. This type of activity has been referred to in the research literature as "Computer Mediated Communication", "Computer Supported Collaborative Work", and "Computer Supported Cooperative Work".

Proponents of asynchronous electronic communication systems have presented arguments that eDiscourse, particularly in collaborative and discussion environments, provides compact communication comparable to face to face interaction. Although eDiscourse research studies have been conducted, few studies empirically support this claim. The scarcity of evaluative tools for investigating electronic discourse is one explanation for this. Additionally, structural and content analysis of computer conferences has been non-standardized and time consuming (Romiszowski and Mason, 1996). As more and more schools implement online course materials and discussion groups, the need for effective and manageable evaluative tools will expand. This study will be of interest to educators who use or plan to use eDiscourse conferencing to augment their instruction as well as to software designers and programmers who create eDiscourse conferencing software.

The Purpose of This Study

This study was undertaken to develop, validate, and test a measure to provide meaningful insight into the unique structure and content of collaborative asynchronous eDiscourse and also provide a meaningful comparative metric between asynchronous eDiscourse, text designed for reading, and synchronous (face to face) communication. Since eDiscourse exhibits the permanency characteristic of text and the immediacy characteristic of speech (Davis & Brewer, 1998), special attention has been given to unearth a linguistic construct that can accurately describe and compare features of the three types of text to be explored. Clark and Haviland's construct of a *given – new contract* (Clark & Haviland, 1977) is well suited to this purpose. It can report meaningful distinctions between the three types of text and offer a framework that suggests what those differences might mean. The given - new construct is straightforward.

Ordering of communication information, whether spoken or written, is determined by the sender's hypothesis about what the receiver does and does not know. *Given* is that which the sender believes the receiver to know and *new* is that which the sender believes the receiver does not yet know. Communication can be described as the conversion of *new* into *given* information. Given -new explains how information flows through a discourse, whether a monologue, dialogue, or multi-member discussion. In discourse, new information is continually introduced and related to the already given information. After its introduction, this new information becomes itself given

information and is further linked and replaced by other background information. By studying given - new information we can observe the form and flow of communication.

Clark & Haviland (1977) suggest a "given - new contract" that people conform to in normal discourse. This contract is an unspoken social agreement that the discourse will achieve a balance between given and new information so that as participants achieve common ground, the exchange of information may continue. If we misjudge and treat what is given as what is new, we will be boring; in the reverse case when we assume the new to be given, we will be incomprehensible.

The process by which the new information becomes given is called "grounding". For information exchange to progress, whether via face to face communication or the reading or writing of text, grounding must occur. Both speech and writing share various structural mechanisms that facilitate grounding. These include anaphora – the referencing of a previously stated noun via a pronoun, restatement, and repetition. Repeated, restated, and anaphoric words provide aural and visual anchors to given material that support working memory while new material is introduced, processed, and grounded.

In face to face discourse, grounding is confirmed through verbal ("do you understand?") and non-verbal (a "questioning" look) signal exchange. Mutual agreement in real time establishes that new information has become given. In the composition of text, feedback mechanisms found in face to face discourse are not available and the author must assume at some point that the prospective reader has transformed a new item to a given item. In English, an

indicator common to both speech and written text of the new or given status of a word is the occurrence of the discourse markers "the", "a", and "an". These particular markers, known as the indefinite ("a", "an") and definite ("the") articles, are of special interest to this study. Although these articles also serve to introduce singular and plural nouns, it is their special functions regarding given and new material that are especially important in this work.

Linguists and language instructors have long known the special functions of these articles –to introduce discourse referents not known to all participants via the indefinite and take up old discourse referents via the definite. The correspondence to what is unknown with the construct "new" and what is old with the construct "given" is obvious.

Loftus and Zanni (1975) have demonstrated the connection of the indefinite and definite articles with new and given information experimentally. Subjects were shown a brief movie of a car accident and asked a variety of questions about it. Their choice of answers was restricted to "yes", "no", and "I don't know". Half were asked, "Did you see a broken headlight?" while the other half were asked, "Did you see the broken headlight?" Even though there was no broken headlight in the film, when the question was framed as new (*a* broken headlight) 7 % answered "yes" and 38 % of subjects answered "I don't know". When the question was framed as given (*the* broken headlight), 17% answered "yes" and 12% answered "I don't know". Although the majority of subjects responded "no" regardless of the article used, the 26% difference between the groups response with certainty (yes or no) is telling. When the broken headlight was presented as new, the phrasing implied the *possibility* of a broken headlight as well as the *possibility* that the subjects missed it in their

observation. This increased degree of uncertainty was reflected in their answering the question with certainty only 62% of the time. The phrase “*the* broken headlight” presents the broken headlight as given and implied that, in fact, a broken headlight existed that they may have missed seeing. This phrasing created no uncertainty about the *existence* of the broken headlight but only whether they had seen it or not. This reduced uncertainty was reflected in their answering with certainty 88% of the time. Clearly the indefinite and definite articles provide strong cues to the new or given status of a topic.

Identification of the given and new information in discourse, reflected in the use of the definite and indefinite articles, is the basis for my analysis of eDiscourse structure and content. Using these articles to report on the given-new structure of text is similar to the use of an x-ray to report on the skeletal structure of the body—both afford a unique, although limited, look at a discrete portion of a complex system. Although neither accounts for the totality of the systems of which they are members, the information they provide helps to explain and predict the behavior of the ongoing system.

The Significance of This Study

Human communication over distributed networks has been incorporated into educational environments since the middle 1970's. Computer conferencing via networks has found important and innovative applications in online course delivery, networked classrooms, and knowledge networks linking peers and experts. Networked computers bring characteristics to the communication process that previously available communication media did not offer.

Increased transmission speed distinguishes the medium from hard copy letter and memorandum exchange. The communication in a networked conferencing

system is minimally two-way and more often than not, multi-way. One member of a group may communicate with one other member, many members of the group can offer comment to a single member, or one member may address commentary to the entire membership. Combining the permanent nature of written communication with the speed and dynamism of spoken communication, computer conferencing is a highly interactive form of communication. Individuals participating in computer conferencing connect via a local or wide area network to a central database where the conference is stored. Once connected, they are directed to source materials, written comments, questions, or text attachments from other participants such as teachers and peers. Responses to online messages are crafted and stored in the central database server and become available for others reading or response. In this fashion, whole class discussions can take place without having to coordinate a common meeting time or place. Each participant can participate from home and organize "class time" around their individual schedule. This type of electronic discourse arguably facilitates deeper thinking as participants can easily revisit old ideas and reflect longer on new ideas before composing responses and committing them to public scrutiny. Proponents of computer conferencing have advanced many such claims as to their unique properties and general efficacy although a large proportion of the research literature reports on the *potentials* of various systems and not hard research (Romiszowski and Mason, 1996). Given the scattering across time and place of most computer conferencing users, most researchers have relied on either recorded transcripts of conference sessions or electronically or conventionally distributed survey questionnaires. According to Romiszowski, "the most glaring omission in

computer mediated communication research continues to be the lack of analytical techniques applied to the content of the conference transcript. Given that the educational value of computer conferencing is much touted by enthusiasts, it is remarkable that so few evaluators are willing to tackle this research area" (Romiszowski and Mason, 1996). This study describes a measure that is the basis for a new analytical technique that can provide a reporting standard for eDiscourse conferences in and across conferencing environments.

The measure reports an index value reflecting the ratio of new to given information in a sample of conversation, written text, or eDiscourse. This value provides an indicator of the efficiency with which the new information has become given. To date few analyses, short of reading the entire conference text, have been available to the moderator of a persistent electronic conference that efficiently addresses either the quality of individual participation, or group behavior in the conference. Since few standardized discourse analysis constructs "cross over" from hard copy text and report accurately in an eDiscourse environment, this new measure will help to fill out the lean supply of conference moderation and analysis tools. This measure can expeditiously monitor and assess eDiscourse conferencing groups in a manner that has previously been unavailable as it can provide a meaningful view of ongoing as well as aggregate data in a computer conference. The automated analysis technique it employs will allow educators and other computer conference moderators to assess large amounts of data in manageable portions of time, provide a window or snapshot of individual and group conference interaction,

and quickly point the moderator towards areas requiring supportive intervention.

CHAPTER 1

THE RESEARCH LITERATURE

Why eDiscourse is a Worthwhile Pursuit

A constant stream of journal articles, conference proceedings, and edited books relating to general aspects of research and development in eDiscourse has been appearing since the mid nineteen eighties. Several comprehensive bibliographies compiled from conference proceedings, edited book sections, professional papers and journal articles contain over 400 references (Romiszowski, 1991, Burge, 1992). Many of these sources however are anecdotal in nature, written by original implementers reporting case descriptions or promoting the possibilities of the new medium for educational purposes. A 1992 survey (Cole et al, 1992) reported only 35 eDiscourse studies conducted in the quantitative/positivist paradigm that were completed or in progress. As of 1996, the majority of eDiscourse literature related to exploration or description of its' potential rather than hard research. The Romiszowski (1991) bibliography of published eDiscourse conferencing research has been sorted as follows. Of the 400 studies listed, 10% were research studies, 25% were concerned with overviews, trends, and policy; another 15% on design, development, and implementation strategies; 15% on hardware, software, systems, and logistics; another 20% on aspects of networking; and finally some 15% on topics of database access and "computer-supported-cooperative-work". The merits of eDiscourse application –access, collaboration, interactivity, self-direction, and experiential learning, although not objectified in hard research, seem intuitively obvious. Yet the continual flux of technological changes fueled by new software applications, cheaper, faster hardware, and emergent

bandwidth increases will most likely exacerbate the production of experimental studies in favor of descriptive studies for some time to come.

Research conducted prior to the popularization of the World Wide Web suggested that computer conferencing, being primarily text based, was not suitable for instruction in subjects such as science, mathematics, or the arts (Florini, 1990). Given the availability of increased bandwidth resources allowing improved conveyance of multimedia information, this issue will surely be revisited. In general, subject matter that involves discussion, brainstorming, problem solving, collaboration, and reflection is highly suited to eDiscourse computer conferencing (Wells, 1992). Proponents have long heralded the increased opportunity and improved environment for interacting within an eDiscourse environment (Moore, 1991; Harasim, 1989; Feenberg, 1989). Studies of message exchange patterns support the perspective that communication patterns are more group oriented and democratic than in classrooms or other telecommunications environments (Harasim, 1989; Levin, Kim & Reil, 1990; Siegal, Dubrovsky, Kiesler & McGuire, 1986). eDiscourse conferences have been advanced as a unique medium for collaborative learning experiences (Harasim 1989; Harasim, 1990b; Kaye, 1992). In dyadic studies comparing eDiscourse to face to face collaboration where subjects instructed each in the creation of a map route (The Map Task, (Anderson, 1991)), the initially poor performance of the eDiscourse pairs quickly matched the performance of the face to face pairs. Additionally, the eDiscourse pairs achieved greater integration ("the way in which a large amount of information is packed into relatively few words" (Biber, 1988)) using 58 % fewer words than the face to face pairs used to complete similar problems (Newlands, Anderson,

and Mullin, 1996). These studies however involved only pairs of individuals engaged in eDiscourse. It remains to be seen whether the same effect occurs with larger groups of participants. By omitting many distracting nonverbal cues, eDiscourse exchanges enhance the quality of communication by focusing the attention on the "verbal" or informational content of the communication (Beach and Lundell, 1998). This greater informational density of postings may be facilitated by the slower nature of textual message composition (Newlands, Anderson, and Mullin, 1996). Although eDiscourse groups interact less and take longer in the decision making process than face-to-face discussion, the participants tend to behave as equals in the discussion as opposed to face-to-face groups where social inequality and unequal participation are observed (Siegal et al, 1986). In spite of reduced visual and oral cues, students develop online friendships, become more casual and humorous over time, report that the medium invites more equitable participation, and tend to spend more time online than is required by the course (Boshier, 1988; Phillips, 1990; Kuehn 1988; Harasim, 1987). Students engaged in eDiscourse computer conferencing list advantages of computer conferencing as increased interaction, convenience of access, access to a group and the democratic environment it encourages, and their additional control over the instructional process. The disadvantages they reported concerned perceived information overload, delayed responses caused by the asynchronicity of the medium, loss of visual cues, increased access inconvenience, health concerns about radiation from their monitor screens, and the awkwardness they feel communicating with unknown persons (Harasim, 1987; Hiltz, 1986).

Organizational level research to explore issues of digital vs. conventional course delivery and the mechanisms by which large and diverse groups can effectively communicate and cooperate across the digital medium has been limited. An impressive attempt to facilitate this type of research is the "Project H" database. This database consists of a representative sample of international, public group, asynchronous eDiscourse messages. It was created to study messaging patterns and collaboration strategies among 100 diverse researchers spread throughout the globe and has been used to study a wide range of eDiscourse activity. An incomplete list includes the following areas:

- eDiscourse interactivity (Sudweeks and Rafaeli, 1996).
- Message threading and referencing (Berthold, Sudweeks, Newton, and Coyne, 1996).
- Gender differences in message presentation (Penkoff & Katzman, 1996).
- The "personality" of listservs (Zenhausern and Wong, 1996), and
- The relationship between grammatical structure and emotional content of list postings (the higher the emotional content the less structured the message) (Mabry, 1996).

A significant barrier to increased organizational level research has been the lack of an effective survey and feedback capturing mechanism by which data can be collected, standardized, and aggregated among multi-participatory groups (Romiszowski and Mason, 1996).

eDiscourse is a Management Problem

A computer conferencing teacher plays a very different role than a traditional classroom instructor or lecturer. Some reports state that teachers spend up to twice as long, overall, to deliver a course via computer conference

rather than by traditional means. Although the development and presentation of the course content is critical, the instructor must primarily play the role of group facilitator as opposed to content provider and lecturer. As little is documented about effective group facilitation on electronic networks (Romiszowski and Mason, 1996), this challenge to traditional role will remain. Hiltz reports that the tremendous amount of time spent planning, implementing, and monitoring a shared conference is akin to parenthood. "You are 'on duty' all the time, and there seems to be no end to the demands on your time and energy (Hiltz, 1988)." The absence of prosodic and visual cues inherent in eDiscourse exchanges make it difficult for instructors to know who is "holding back" and should be drawn into a conference. Equally daunting is the difficulty controlling off topic behavior and "conversational drift". Although easily controlled in a real-time face to face classroom, the depersonalized context and eroded authority of the instructor inherent in eDiscourse (Reinking, 1998) may allow these problems to dominate a conference. Adding further to confusion about instructor role is the finding that increased communication and participation of eDiscourse conference participants is directly related to a *reduction* in the instructor's discourse (Faigley, 1990; Feenberg, 1987). Electronic conferencing creates a discussion environment where, although there may still be domination by a "vocal" minority, this minority cannot exclude other participants from adding their input. Since restrictions of time and place are altered in asynchronous eDiscourse environments, learners requiring additional time to respond and participate are not interrupted or excluded by individuals who are more assertive (Rowe, 1974). This characteristic of eDiscourse conferencing

demonstrates an opportunity currently not available in schools.¹ Although these altered restrictions of time and place may benefit less assertive participants, these same disruptions in temporal sequencing cause their own unique set of problems. Herring (1999) has articulated the following temporally based problems. Adjacency disruptions, where the sequence of normal turn taking or question and answer type response are disrupted, occur when the messaging system transmits messages linearly, that is, in the order in which they are received. Overlapping exchanges, where users who are unaware that another user may be composing a response to their posting become impatient and send a "second" response to a message before the first one is received. These problems can contribute to overall topic decay since the focus of the discourse becomes the structure and repair of the communication as opposed to the initial topic. Generally, the larger the eDiscourse network, the richer the resources available for information exchange. However, depersonalization occurs so participants are less likely to know the experience or credentials of persons with whom they are communicating with. This can dilute the reliability and veracity of information exchanged (Romiszowski and Mason, 1996).

An additional management problem associated with eDiscourse conferencing is the measurement of their utility or success. In the case of time-limited course presentation, traditional measures such as grade distribution, program completion, or participation standards are appropriate. In persistent,

¹ "The opportunity for each member of a group to participate actively and frequently is not possible in the time-dependent, face-to-face classroom, nor is it always possible to reflect and compose a response to a discussion, or for students to work at their best learning readiness times (Harasim, 1996)."

non-traditional learning communities, these measures are generally not available. Persistent online communities currently measure participation by keeping track of the number of individual user contributions. "Successful" persistent online communities report that community members provide as much as 80% of site content vs. 20% provided by instructors, facilitators and other "experts" (Greenspun, 1999.)

Early eDiscourse applications were exclusively text-based, command line interfaces while later applications sport graphical user interfaces with improved threading functions and other aids for organizing and storing messages. The temporal methods that an eDiscourse application has available for the reading, sending, and storage of messages have a pronounced effect on the flow of discussion, control of off-topic behavior (Romiszowski and Chang, 1992), and on a user's total experience (Romiszowski and Jost, 1989). While the transparency and user friendliness of the software has been thought to impact heavily on user experience (Eastmond, 1992), social and pedagogical issues play, by far, the bigger part in the creation of a successful learning environment (Mason, 1994). Currently, much more is known about the structure of eDiscourse software applications than the content they produce.

Management and ongoing analysis of large eDiscourse conference transcriptions will remain daunting as contemporary discourse analysis tools do not reveal conversational tone, underlying social patterns, patterns of activity, or the size of a discussion group. Research in the design of graphical interfaces that visually portray individual contributors in discussion groups, user presence, and quantity of messages (Donath, Karahalios, and Viègas, 1999) show much promise for the management of online persistent eDiscourse.

Linguistics and eDiscourse

Given the recency of eDiscourse phenomena, research concerning the linguistic structure and content of the eDiscourse transcript as well as comparative research (eDiscourse vs. hard copy text vs. face to face communication) has been limited.

Linguistics provides many procedures and viewpoints for the analysis of verbal behavior, whether spoken or written, and stands perfectly poised to inform on eDiscourse. Since linguistic variation across spoken and written language is too complex to be analyzed in terms of any *single* dimension (Biber, 1988), it stands to reason that eDiscourse will also resist any type of singular variable analysis. Given its mixture of speech and text characteristics, eDiscourse may provide a rich and varied ground for the creation of new tools for linguistic analysis. The linguistic analysis of eDiscourse content has been studied at several levels and there is every reason to believe that there will be more study in the future.

eDiscourse appears to represent an emerging English language register, a special verbal style that is particularized to specific social situations (Davis and Brewer, 1998). Crystal (2001) refers to eDiscourse as "netspeak" and characterizes it as "neither spoken language nor written language nor sign language, but a new language dimension...." Linguists currently place eDiscourse somewhere between the oral and the written. The syntactical reduction that often characterizes eDiscourse transcripts with initial pronouns and articles sometimes omitted place the discourse in the same realm as "postcardese, telegraphese, and headlines" (Ferrara, Brunner, and Whittemore, 1991). Asynchronous electronic discourse bears a resemblance to

spoken discourse in that markers of personal involvement (e.g., use of second person pronouns and names) along with innovative language (plays on words and meaningful titles to postings) frequently characterize transcripts of conference sessions (Wilkins, 1991; Davis and Brewer, 1998). Indirect address in eDiscourse conferences occurs more often than direct address particularly when students are referencing an item that is the subject of disagreement and repetition of word and phrase usually function as a means to signal consent and adherence to the views of other writers (Davis and Brewer, 1998).

Although eDiscourse is undoubtedly “as complex, as varied, and as individual as the people who engage in its exchange” (Davis and Brewer, 1998), like language itself, it possesses a deep and basic structure that reveals itself in individual expression. The linguistic construct of “given – new” (Halliday, 1967; Clark & Haviland, 1977) is especially suited to inform on an important aspect of the deep structure of eDiscourse. This construct not only distinguishes eDiscourse from its’ step-siblings, speech and text, but also accounts for some of its special features.

CHAPTER 2

THE STUDY

In order to explore and explain differences between eDiscourse, speech, and singularly authored text, the creation of a new measure seemed important and potentially beneficial. I have created such a measure and call this metric the *new/given index*. I set out to investigate it as follows.

Creation of the Data

A data set composed of transcriptions of videotaped face to face problem solving meetings, transcriptions of collaborative problem solving sessions via eDiscourse computer conferencing, and hard copy writing samples was obtained. The creators of the data set were four supervisory psychotherapists employed at Hillcrest Educational Centers, Inc. who had a two-year history of professional collaboration. As they were planning to work collaboratively to solve four nontrivial administrative design problems, they graciously agreed to structure their work so that the data set used in this study could be created. They agreed to collaborate on one set of problems via eDiscourse computer conferencing using the existing Hillcrest electronic network. The second set of problems would be addressed via face to face meetings that were video taped and transcribed. Additionally, they agreed to contribute personal writing samples consisting of reports, memos, and other professional correspondence to be used for comparison with the face to face and eDiscourse transcriptions. The problem sets that were approached via eDiscourse conferencing were:

- Creation of a design specification for a discharge resource database. This is a database containing useful information (contacts, successful placement

agreements etc.) that would be used by clinicians and case managers when planning to discharge a student to a less restrictive environment.

- Creation of a design specification for an ongoing agency evaluative process.

The problem sets that were approached via face to face meetings were:

- Creation of a design specification for a training program for clinical interns.
- Creation of a design specification for student aftercare/follow up protocols.

Altogether, a corpus consisting of 35,956 words (17,501 words for face to face meetings, 11,209 words for writing samples, and 7,501 words for eDiscourse conferences) was made available for the creation and study of the new/given index.

Roughly half this data (one video transcription, one computer conference transcription, and half of the writing samples) were used to develop and test the new/given index while the remaining half was used to explore, test, and validate the new measure.

Creating the New/Given Index

A software parser to read text and parse it for instances of the definite and indefinite articles from digital files was constructed. The parser stored frequency counts of these words and computed the new/given index of the text sample. This index is arrived at by dividing the sum of articles connoting new information (the indefinite articles) by the sum of articles connoting given information (the definite article). In addition to computing a global new/given index for the entire sample, the parser tracks the index temporally by dividing the sample into four parts and computing the new/given index at the end of each quarter. The output of the parser consists of:

- the number of words in the sample

- the frequency counts of the definite and indefinite articles
- the global new/given index value ($\text{sum}(\text{"new" words}) / \text{sum}(\text{"given" words})$) and,
- The aggregate new/given index ($(\text{sum}(q1\dots4) \text{ new/given index})/4$).

Although the potential output of the parser has few limits (it can generate lists of articles and their associated nouns, associated phrases, and countless associated computations), the aforementioned output provided more than adequate information for this preliminary investigation of the index.

The meaning of the new/given index and its relationship to the data was investigated on three fronts:

- the first, a semantic and contextual analysis of the data to explore issues of construct validity,
- the second, a quantitative comparison of the differences and similarities in the computed new/given index between the three discrete groups in the data set, and
- The last, a qualitative analysis of the possible relationship between a person's role within a group and the new/given index derived from their writing. This analysis is based on interviews with the creators of the data set.

The Manual Analysis-- A Search for Construct Validity

The new/given index creates a value reflecting the ratio of new and given information in a text. It stands to reason that the manual, subjective analysis of both face to face discussion and eDiscourse texts will reflect an analogous presence of new and given material with the parser- derived index of the same texts. To test this hypothesis, sample portions (average length of 312 words) of

eDiscourse conference transcripts and face to face meetings were prepared. Raters unconnected with the study were given a brief introduction to the new/given construct and a short lesson in new/given scoring. The raters were told that they would be reading a transcript of people working together to solve a problem and were asked to code the text as new or given based on the semantic and contextual features in the text. They were instructed to look for new and given material in either singular words or entire clauses. The role of the definite and indefinite article in new/given coding was not mentioned in the training. This subjective analysis was then analyzed and a new/given index value (items coded *new*/items coded *given*) was computed and compared with the new/given index generated by the software parser for the same text sample.

In order to disguise the origin of the sample transcripts from the raters the following alterations of the original materials were made:

- All header and quoted information was removed from the eDiscourse materials as was all obvious references to the online environment (ex: "Diego hasn't logged on for a while" was transformed to "Diego hasn't been around for a while".)
- Postings from the eDiscourse conferences were presented in a script form in the exact temporal sequence in which they had been posted. This created the illusion of a moment to moment flow of dialogue when in fact hours and days separated some exchanges.
- All idiosyncratic verbal play found in the face to face transcripts was "formalized", that is, sentences such as "I wuz hopin' I'd be talkin' to ya" were transformed to "I was hoping I'd be talking to you".

The material was presented to four raters who were asked to rate at least one transcript and then complete as many more as they felt comfortable with. When finished they were informed that some transcripts were transcripts of face to face meetings and some were modified eDiscourse conference postings. When asked if they could distinguish the source of the transcripts, none of the raters were able to identify with certainty, their origin. The one rater who took a guess was incorrect.

The results of this subjective, manual analysis of the material vs. the parser-derived material are presented in Table 1.

Table 1. Illustrating the raw scores of new and given material that a rater ascribed to a text selection and the associated new/given index derived from these scores.

Face To Face 1				
Rater	NewCount	GivenCount	NG Index	
1	15	16	0.938	
2	15	16	0.938	
3	15	17	0.882	
4	16	13	1.231	Rater average:
parser	7	4	1.750	0.997
Face To Face 2				
Rater	NewCount	GivenCount	NG Index	
1	15	13	1.154	
2	14	13	1.077	
3	14	15	0.933	Rater average:
parser	6	6	1.000	1.055
Face To Face 3				
Rater	NewCount	GivenCount	NG Index	
1	14	24	0.583	
2	11	22	0.500	
3	13	24	0.542	
4	13	24	0.542	Rater average:
parser	3	9	0.333	0.542

Table 1 (continued)

Computer Conf 1				
Rater	NewCount	GivenCount	NG Index	
1	13	7	1.857	
2	10	10	1.000	
3	10	6	1.667	Rater average:
parser	10	9	1.111	1.508
Computer Conf 2				
Rater	NewCount	GivenCount	NG Index	
1	8	8	1.000	
2	6	7	0.857	
3	13	16	0.813	Rater average:
parser	9	11	0.818	0.890

The raw scores and associated new/given index generated by the software parser follow the rater scores. The first three sets describe face to face transcriptions while the last two sets describe the computer conference transcripts. Each set contains an average of the new/given index as generated by the raters. This average is located next to the new/given index generated by the software parser.

These results indicate an analogous relationship between perceived given and new material in a text and the new/given index derived from the software parser. In four out of five instances, the computed new/given index based on the raters score is comparable to that produced by the parser. Despite the raters minimal training and the small sample size, a score of .775, as computed by Kendall's co-efficient of concordance, suggests strong inter-rater reliability. Of particular interest is the difference in new/given granularity between the rater and parser scores. The linguistic literature abounds with discussion of the continuum of new/given since this construct can be used for text analyses on a word by word, clause by clause, or sentence by sentence basis. Within the new category alone there is a subjective continuum ranging from *brand new* through

inactivated new. In the majority of the ratings, the raters scored more instances of given and new material than the parser-derived analysis. However, despite these differences in the frequency of new and given clues, the *ratio* between new and given remained roughly the same in the raters' and the parser's analyses. This suggests that the parser-derived index presents a kind of minimal or "worst case" scenario of the new and given material present in the text. This is somewhat explained by the parsers' only focus being on the definite and indefinite articles. Certainly new and given information is present in sentences where these articles do not appear and the raters clearly found it ("You can't follow up in person I imagine" was coded as new and "In other words, is where we placed them where they still are" was coded as given).

These data suggest that the new/given index in fact reports on the presence of new and given cues in text and illustrates the ratio between the new and given material. With this established, the index may be used to explore and measure the presence of new and given information in the three discrete types of text found in the data set as well as investigate the meaning of differences in the relationships between these types of texts.

The Quantitative Analysis--A Search For Real Differences

Since the new-given construct describes the *flow* of information in a discourse, the relationship between given and new information in a "successful" instance of face to face communication will be one to one. As participants ground new information, it becomes given and new information is introduced effectively balancing the new-given content. The new/given index reflects the degree of efficiency that information is resolved (grounded) in face to face discourse. Face to face discourse is enhanced by non-verbal and

prosodic cues. These cues allow participants to quickly agree on mutual understanding of the discourse and maintain a one to one correspondence of given and new information. This correspondence allows the generation of the following hypothesis:

- The one-to-one correspondence of new and given information in a face to face discourse will be reflected in a new/ given index value of 1.

In the case of authored text, the new/ given index measures the degree of efficiency that the author *thinks* necessary for new information to become grounded. Where prosodic and other non-verbal aids to grounding are unavailable, authors will repeat, paraphrase, and refer to given information more often than in face to face discourse in an attempt to facilitate grounding. This "doubling" of given information insures that the reader or listener has an expanded version of the given information and allows for the introduction of new material. Pilot studies indicate that singularly authored text (text created for reading or delivery as a monologue) has a 2: 1 relationship between given and new material. This 2:1 relationship of given to new material in authored text is the foundation of the following hypothesis:

- The prevalence of given material in authored text will be reflected in a lower value (than found in face to face communication) of the new/ given index. This value will be .5 or less.

eDiscourse has the immediacy characteristic of speech and, in production, feels more like speech to the author, even though it is viewed by the recipient as written text. The immediacy characteristic of eDiscourse production accounts for an author's expectation that the recipient will ground the given material more efficiently than hard copy text and is reflected in a corresponding increase

in the introduction of new material. Pilot studies indicate that the ratio between given and new material in eDiscourse samples is 1.4: 1. Accordingly:

- eDiscourse samples will demonstrate a new/ given index value of approximately .70, a value roughly halfway between individually authored text and face to face communication.

To test these three hypotheses, the full transcript of a face to face meeting (8,810 words), an eDiscourse computer conference (3557 words), and writing samples (5937 words) were processed by the software parser. The data was unaltered with the exception of the computer conference material. Within this set, any posting where the message content was less than the header content was removed due to inaccuracies within the parser with very small samples (this limitation will be addressed in a later section of this paper). Although the deletion of 7 postings resulted in only 83% of all the postings being analyzed, the remaining 83% still accounted for 95% of the total words within the conference and was deemed a representative sample. The aggregate new/given index values for the three data groups are presented in the Table 2.

Table 2: New/Given index values which were generated by the software parser for the groups of writing samples, eDiscourse conference transcripts, and face to face meetings.

	Average of Aggregate and Quartile Mean N/G Index
Writing Sample	0.479
eDiscourse Conference	0.742
Face to Face Meeting	1.225

The average new/given index value for singularly authored text is .47. The average new/given index value for eDiscourse conferencing is .74 and the average new/given index value for face to face discourse is 1.22.

Paired sample t-tests between the three groups revealed significant differences ($p < .01$) between all groups. These results confirm the three previously stated hypotheses and may describe the differing degrees of efficiency that information is grounded, or is available for grounding, in discourse. The establishment of measurable and predictable differences in the new/given index values between eDiscourse, face to face communication and singularly authored text, provide a starting point for explanations of what these differences may mean. An understanding that these predictable differences exist may also be the foundation necessary for the development of a much-needed auditing and monitoring mechanism in eDiscourse conferencing environments.

The Qualitative Analysis- eDiscourse Feedback and A Look at Role Correlation

The third avenue of investigation of the new/given index involved interviewing the creators of the data set for two purposes. The first was to acquire feedback regarding their perceptions of the utility and productivity of the two types of meetings and determine what factors contributed to or detracted from successful problem solving in the eDiscourse medium. The second purpose was to investigate any possible correspondence between a person's role within an eDiscourse or face to face group and the new/given index computed from their postings in an eDiscourse environment. Although the software constructed for this study made it unwieldy to construct an

aggregate new/given index based on each individual utterance in the face to face meetings, generating such a personal index for the electronic conferences was straightforward.

eDiscourse Feedback

Two hypotheses with roots in the eDiscourse literature were tested in this area. They were:

- Participants will report that the computer conferences, despite initial adjustment issues, were as productive and successful as face to face meetings.
- Word counts of the computer conferences will be 40 % less than word counts of face to face meetings. This reduction of words will correspond to an increased sense of efficiency among participants.

The participants validated the first hypothesis. They all offered that they felt productive and successfully solved all attempted problems in both environments. Each conference or meeting ended in the creation of a working document or plan which became the basis for the implementation of new systems or further planning.

The hypothesis addressing word counts was validated but may be somewhat meaningless when the temporal sequence of the meetings and conferences are considered. In the final analysis, the face to face meetings consisted of 17,246 words and the Discourse conferences totaled only 7,501 words – a reduction of 43%. However, the words from the face to face group were distributed over two 1-hour meetings. The eDiscourse words were distributed over 80 independent postings that spanned a time period of roughly two weeks per problem. All the participants reported that the eDiscourse

environment seemed more efficient than the face to face environment but felt that this efficiency might only be necessary when solving very difficult problems.

Three of the four participants expressed a preference for face to face problem solving but offered that the eDiscourse environment was very convenient in that it afforded the opportunity to collaborate at a distance and at your own pace. The same three also suggested that the asynchronicity of eDiscourse would be useful when working on emotionally volatile problems. Two of the participants independently offered that they preferred face to face meetings because they got things accomplished quickly but felt that eDiscourse conferences would be excellent tools especially for people who aren't "productive" in face to face environments. One individual new to eDiscourse conferencing remarked that it seemed more of a "democratic and efficient" way to work. S/he found it a welcome break from face to face meetings where you are "on the spot all the time and have to either feign interest or come up with something intelligent at a moment's notice." S/he appreciated the asynchronous nature of eDiscourse and commented that it not only allowed for the creation of a thoughtful and reasoned response but also allowed equal participation of both "the lions and the lambs" in the discussion.

The entire group shared initial adjustment problems and mentioned problems and concerns that have appeared widely in the literature. Among these were issues concerning competency with computers, problems connecting to the network, dealing with large amounts of unread postings after several days away from the conference and the increased opportunity to procrastinate. Several participants raised one concern often echoed in the literature. They

commented that the eDiscourse environment was exceptional for brainstorming and generating new ideas but had scant mechanisms to facilitate the convergence or synthesis of new ideas into concepts or models.

A look at Role Correlation

Pilot studies and observations of the face to face meeting videotapes were the basis for the following hypotheses:

- Individuals in either face to face or eDiscourse interactions who lead the group forward (either on or off task), introduce topics before previous topics have been dealt with, or contribute a preponderance of new information will have a corresponding high new/ given index. This value will be greater than 1.
- Individuals in either face to face or eDiscourse interactions who seek assurance that they are understood or are careful to resolve old business before moving to new will have a new/ given index greater than .5 but less than 1.
- Individuals in either face to face or eDiscourse interactions who publicly “process” group activity, control off task behavior, paraphrase material, or restate/revise group goals will have a lower new/ given index. This value will be less than .5.

The participants were asked to analyze their role and the role of peers in the face to face meetings and eDiscourse conferences. As mentioned earlier, these individuals have developed an ongoing working relationship with each other and had collaborated in face to face or voice to voice environments many times. They also had ongoing availability of email contact but had used it infrequently and never collaboratively. Being trained clinicians, they were very sensitive to

and observant of group dynamics and were amenable to sharing their observations in the interview session. They willingly shared their perceptions of theirs and others' cooperative behaviors, off task behaviors, facilitating behaviors such as clarifying, restating and paraphrasing and synthesizing and contributing of new ideas. Their self - described behaviors and reports about others were remarkably consistent and homogenous. All reported their own social behaviors and styles to be consistent regardless of the type of collaborative environment they were in. They also reported role consistency of their peers whether in the online or face to face environment. Their personal descriptions can be summarized as follows:

- Bette - Bette was viewed by herself and others as a quiet listener who only spoke "when she had something to say". She frequently paraphrased the words of others and often suggested simplified solutions in a discussion. She contributed a total of 28 postings comprised of 3,145 words to both eDiscourse conferences (this represented 35% of all postings and 45% of all words). Her personal new/given index score from the conferences was .638.
- Diego - Diego was the senior member of the team being the most credentialed and having the most tenure. He contributed 10 postings- the least amount of all participants- totaling 1,019 words (this represented 13% of all postings and 15% of all words) to the two conferences. However, his postings were generally succinct summations of previously discussed ideas and clear combinatory plans. His personal new/given index for the two conferences was .765
- Jackie - Jackie was viewed by herself and others as the person that brought the group back on task when they strayed. She consistently quoted others in

the eDiscourse conferences and face to face meetings. On numerous occasions she brought the group to focus by reiterating objectives or asking clarifying questions. She contributed 28 postings consisting of 1,819 words (this represented 35% of all postings and 26% of all words) to both eDiscourse conferences and her personal new/given index was .35

- MaryAnn – Maryann, by her own admission, “sometimes just blurts things out”. She possesses high energy in the group and was a constant source of new ideas and topics. She often rallied the group and encouraged others to develop ideas and finish tasks. She contributed 13 postings consisting of 985 words (this represented 16% of the total postings and 14% of all words.) Her personal new/given index was .963

The coarse granularity of the new/given index (as illustrated in the qualitative analysis section of this work) must be taken into consideration before any attempt is made to pair human behavioral traits and actions with a reflective new/given index computed from their writings. Although it seems appropriate to explore behavioral correlation associated with what a person writes, any serious attempt to do so is certainly beyond the scope of this study. At best, these data and the new/given index can highlight similarities between a very generalized communication style and a style of writing in the electronic medium. This type of comparison also raises important questions for exploration in future studies.

The new/given index measures the amount of information available for grounding and may measure the degree of efficiency that information is actually resolved and grounded in discourse. Since reliable statistical differences exist in the new/given index for different types of text it can be

suggested that certain new/given index values are associated with "successful" verbal communication, eDiscourse or writing. Verbal communication with an inordinately high (>1.5) new/given index may be incomprehensible to most participants. eDiscourse with a low range new/given index ($<.40$) may be boring to participants and appear bogged down. These are both examples of *interactive* communication situations. In the case of the clinicians that created this data set, their individual new/given indices calculated from the eDiscourse sections of the data set are somewhat out of context. They reflect merely what a person wrote at one point in time and not any of the unique and complex interactivity that characterizes asynchronous eDiscourse. Still, there are some interesting connections to be considered.

Jackie had the lowest new/given index of the group at .35. In the eDiscourse conferences and the face to face meetings she characteristically quoted and reiterated what others had said. She reminded people of the task at hand and was usually "all business". Yet, her willingness to repeat given information whether in the face to face or eDiscourse conference never served to bog the group down. In fact, her group "maintenance" behaviors allowed the group to remain on task and finish given material before progressing to new. Without her attention to the given material, the group may not have been as successful as they reported.

Diego and Bette had new/given indices of .765 and .638 respectively. Both were seen as the synthesizers of ideas. Both also participated in prolonged monologues and soliloquies involving variations of new ideas. They often took the floor to summarize and finalize an issue. Their writings in the eDiscourse conference were of a similar style, however Bette had more postings and was

more interactive. Diego shared with the interviewer that he developed the solution for the final eDiscourse conference by printing out a significant number of conference postings, laying them down on his floor, determining what was important to everyone and then combining them into one, final posting.

MaryAnn had the highest new/given index at .963. Her postings were the least grammatically correct and often consisted of a series of five or six questions. In face to face meetings she always came prepared with a list of questions or ideas that she felt needed to be addressed and was assertive about having her issues heard. In face to face meetings she would often "think out loud" and offer spontaneous comment. Her energy regularly charged the group particularly toward the end of meetings.

These observations may well point in the direction of confirmation of the three hypotheses presented at the beginning of this section. However, several obvious confounding variables must be accounted for before any conclusions can be reached. The first is the lack of independent measures that could be quantitatively assigned to traits addressed in the hypotheses and then compared with a new/given index value. These missing measures could assign a value to traits like "seeking assurance", "remaining on-task" and other behaviors surrounding the resolution of issues in a group. Without them, any correlation with an individual new/given index is purely intuitive and speculative. Secondly, the special nature of the persons involved (experienced, professionally trained, Doctoral and Masters level psychotherapists) as well as the small size of the data sample preclude any judgement of hypothesis validation. The new/given index provides a reliable measure of the presence of

new and given information and the efficiency that information is grounded or available for grounding in an interactive discourse. As tempting as it might be to link it with a personality or trait inventory, to do so at this time would be premature.

CHAPTER 3

LIMITATIONS AND FUTURE APPLICATIONS

Limitations and new research questions

The new/given index is an elegant measure that lends itself well to automated analysis of electronic text. When built into a software product it provides useful information by performing the error-prone (to humans) operation of parsing for instances of the definite and indefinite articles and performing calculations once it has found these words. Since the manual analysis of the definite and indefinite articles is highly inclined towards error and the contextual analysis of new and given clauses is subjective, it is likely that the new/given index will be useful exclusively in software products built to monitor persistent eDiscourse and all its variants. This inviting future will be on hold however until the zero problem is solved.

The zero problem accounts for why the new/given index does poorly with short sections of text. The problem has nothing to do with length and more to do with the absence of an "a", "an", or "the". The definite and indefinite articles appear in all English communication, whether spoken or written, at a frequency of between four and eight percent. In most texts and spoken discourse, the probability of one of the articles being present is high. eDiscourse however is characterized by short, grammatically incomplete sentence fragments. When these short bursts of text are asynchronously isolated, the probability of an article not being present is increased. Sentence fragments where an article is absent are very problematic for the new/given index parser.

Dividing the sum of the "new" articles by the sum of the "given" articles creates the index. When the sum of the new articles equals zero, the index value becomes zero, regardless of the value held in the given variable. When the sum of the given variable holds zero or both the new and given variables contain zero, the index value returns a NAN (not a number) error, as division by zero is illogical and impossible. In either case, the index value returned is not a true reflection of the data. In the former case there is a preponderance of given values and in the latter a majority of new or possibly no articles at all. The solution to this problem used in this study was to not use the data where it was problematic. Exclusion of this data was not a large detriment to the integrity of the data set as the problem appeared in less than 5% of the eDiscourse corpus. The new/given index performs reliably on larger data samples and returns a useful aggregate function in its present state, however, this researcher will continue to explore methods to either accurately code zero-type information or reserve it from the larger sample for independent study.

An additional item of interest that appeared early on in this study was the issue of the question mark. Using the new /given construct to code questions is tricky at best. Clark (1977) states that all questions are essentially given and their answers are new. For instance, in the question "What are we going to have for lunch?" Clark states that the given or mutually shared portion of the sentence is essentially, "We agree that we must have something for lunch," and the new part of the sentence is actually a request for new information, that is, the new part is the "wh" word in the question. The question is answered with new information ("sandwiches"). Often times however, in collaborative meetings, a participant will utter a rhetorical question that is totally new to the

context. They will then proceed to verbally list suggested answers to their question. Their initial question may be coded as *new* and their answers, which refer directly to their question, can be logically coded as *given* (since they refer to an entity presumably known and understood by all parties). These and other inconsistencies surrounding questions led me to wonder if the question mark, as it appears in text, may be a new/given flag similar to the definite and indefinite articles. Anecdotally I have observed that question marks often appear in short sentences that do not contain instances of the indefinite or definite articles. I am confident that the data set developed for this study will allow me to formally address these questions in the future.

The New/Given Index—Its eDiscourse Future

This research started with the simple notion that it would be instructive to observe a set of people solve a problem in a live meeting and then observe the same people solving a problem via asynchronous computer conferencing. In my attempt to actualize the aforementioned “simple notion” it quickly became clear that the two problem solving mediums were far from simple on their own terms and extremely complex when combined.

The need for a linguistic construct that would allow measurement across the spoken, written, and electronic environment was obvious from the start. Asynchronous eDiscourse environments are environments where tried and true temporally based linguistic constructs (ex: turn taking and adjacency pair analysis) just did not work. As I learned more about the deep structure of language I encountered the innocent enough sounding new-given construct. From there, a simple idea and associated formula – the new/given index was developed. I now believe that this index provides the foundation for a much

needed analysis tool for the analysis and management of the terabytes of existing and future eDiscourse communication.

The new/given index is a tool that can provide conference and list moderators, online educators, and anyone involved in the asynchronous flow of text across the network with an automated means to improve online communication and the online experience. The index reports on the efficiency that new and given information is processed in an electronic conference. It can be used to isolate bottlenecks in communications as well as provide insight when discussions are moving too fast. It can be incorporated into existing software to provide an easily accessible and computable history of an existing conference or can be fine-tuned to report on the online activities of individuals or sub-groups. The new/given index provides a primary, automated tool that will allow educators to identify areas for support or intervention in their online courses.

eDiscourse conferences, persistent electronic discussion groups, and electronic communication have become a part of everyday life in a manner that was unimaginable just several years ago. As high bandwidth connections become commonplace, we can only expect this trend to continue. The creation of the new/given index is, I believe, a small but important contribution towards realizing the full potential of these developments.

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