

Information Technology Augmentation of The Skilled Facilitator Approach

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Abstract

Work in the new millennium requires globally distributed organizational members to collaborate in groups and make decisions. In general, research has shown that groups that use facilitators and group support systems make high quality decisions in less time. The Skilled Facilitator approach is a values-based systemic methodology that helps facilitators and groups interact successfully. Today's facilitators are being asked to work with groups that range in size from ten to five thousand, meet twenty-four hours a day seven days a week, and are located around the globe. Clearly no facilitator could be available to the group for this period of time much less effectively. This paper proposes an operational view of an information technology system based on current state of the art natural language processing technologies that will augment the Skilled Facilitator approach and allow effective facilitation of large distributed meetings twenty-four hours a day seven days a week.

Introduction

The work environment today requires employees to interact with a number of people across time and space to make critical decisions. In general, there is research that supports the independent claims that facilitation (Frey, 1995; Hirokawa, 1992; Hirokawa & Gouran, 1989; Phillips & Phillips, 1993; Schwarz, 1994; 2002) and group support systems increase group effectiveness (Coleman & Khanna, 1995; Jessup & Valacich, 1992; Poole, 1995). Also there is support for the general claim that a facilitator using a GSS will increase group effectiveness as well (Adkins, Burgoon, Nunamaker, in press; Bostrom, Anson, Clawson, 1993; Brashers, Adkins, & Meyers, 1994; Nunamaker, Dennis, Valacich, Vogel, & George, 1991). To produce effective group decisions with large groups across time and space, the thesis for this paper is that the values and behaviors outlined in the skilled facilitator approach can be augmented with a specialized group support system that utilizes natural language processing technologies.

Purpose of facilitation

The purpose of facilitation is to increase group effectiveness. By helping a group improve its process, it can increase the quality of its decision making, increase group member commitment to the decisions, and decrease time for effective implementation (Adkins, in press). Traditionally, the facilitation role has been filled by a substantively neutral third-party facilitator who is an advocate for effective group process while simultaneously avoiding interventions that would influence a particular content of a group's decision (Schwarz, 2002).

Types of facilitation

Schwarz (2002) distinguishes between two types of facilitation. In basic facilitation, the goal is for the facilitator to use his process skills to help a group address a substantive issue or problem. In developmental facilitation, the goal is for the facilitator to help the group address a substantive issue or problem while simultaneously teaching the group to manage their process. Consequently, in developmental facilitation, over time the group increases its capacity and becomes less dependent on the facilitator.

The Skilled Facilitator Approach

Schwarz's (2002) Skilled Facilitator approach, is a values-based systemic approach to facilitation that consists of a number of integrated elements. It includes a:

- 1) normative model for diagnosing group effectiveness;
- 2) set of facilitative roles (e.g., facilitator, facilitative leader, facilitative consultant) from which to help groups;

- 3) set of models that identify effective and ineffective core values and assumptions underlying facilitator and group member behavior;
- 4) set of behaviorally specific ground rules for establishing effective behavior and diagnosing ineffective behavior;
- 5) diagnosis-intervention cycle for intervening on ineffective behavior;
- 6) process for the facilitator and group to reach agreement on whether and how they will work together.

Objectives

The objective of the Skilled Facilitator approach is reflected in its four core values: to help groups create a common pool of *valid information* from which they can make *free and informed choices* that generate *internal commitment* to those choices, in a way that demonstrates *compassion* toward others and self. The first three core values are from the work of Argyris and Schön (1974). The ground rules are behaviorally specific strategies that enable group members (and the facilitator) to act congruently with the core values. In the Skilled Facilitator approach, the facilitator uses the core values and ground rules to help the group improve its process. Group members may also choose to take responsibility for using the core values and ground rules themselves.

Ground Rules for Effective Groups

1. Test assumptions and inferences.
2. Share all relevant information.
3. Use specific examples and agree on what important words mean.
4. Explain your reasoning and intent
5. Focus on interests, not position.
6. Combine advocacy with inquiry.
7. Jointly design next steps and ways to test disagreements.

8. Discuss undiscussable issues.

9. Use a decision-making rule that generates the level of commitment needed.

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Even when group members state their intent to adhere to the core values and ground rules, they often act inconsistently with them as they engage in conversations in which they have a significant stake, especially when they are just learning the core values and ground rules. In this case, one role of the facilitator is to help group members become aware of the gaps between their desired and actual behavior and to help them produce the desired behavior.

Diagnosis and Intervention

The Skilled Facilitator approach uses several diagnostic tools to assess the effectiveness of group process including the core values, models of theories-in-use, a normative group effectiveness model, a diagnosis-intervention cycle, and the ground rules. In same-time, same-place meetings, the mode for which the Skilled Facilitator approach was originally developed, the facilitator uses the diagnostic tools to observe the group and infer that specific members are acting inconsistently with the normative behavior prescribed by the approach.

When this occurs, and the consequences of the behavior may have a significant negative impact on the group process, the facilitator intervenes with the specific group members. The intervention has three parts. The facilitator: 1) describes the group member's behavior (i.e., verbal and nonverbal behavior) and checks to see that he observed it accurately; 2) shares his inference about which ground rules and/or core values the group member has acted inconsistently with, and checks to see that the group member agrees with the inference; and 3) asks the group member to redesign his behavior to be consistent with the ground rules and/or core values.

Integrating the Skilled Facilitator approach with the power of GSS

Integrating the Skilled Facilitator approach with Group Support Systems has synergistic effects. The Skilled Facilitator (TSF) approach creates significant improvement in group process, thereby contributing to higher quality decisions and improved working relationships. However, to date the TSF approach has been used, with few exceptions, in same-time, same-place settings, with relatively small groups. Group Support Systems enables larger groups to work

effectively, even when group members are operating in different places and at different times.

When integrated, the gestalt of TSF and GSS approaches become more powerful.

The Skilled Facilitator approach can add value to GSS by improving the quality of conversation among group members within any particular task. Currently GSS increases the quality of group decision making by providing a logical structure within which group members input data. The Skilled Facilitator approach increases the quality of the data that members input and the quality of the interaction among members regarding their viewpoints.

Similarly, GSS can add value to the Skilled Facilitator approach. Group Support Systems has the capability to extend the Skilled Facilitator approach to groups that are geographically and temporally distributed (Adkins & Schwarz, 2002). In addition, GSS has the capability to embed some of the Skilled Facilitator diagnostic and intervention functions in the GSS software, thereby enabling groups to increase their effectiveness without a human facilitator.

Geographically and temporally distributed groups

Distributed environments provide several challenges for participants, facilitators, and technology developers. First, there are technological challenges in the area of communication. In distributed environments there is a requirement for back channel communication media. Back channel communication is needed by co-located facilitators to determine how the interaction is proceeding and plan for the next step in the process or interventions. In many distributed environments the participants in an open forum are using all communication media in the facility. That is, the phone line is used for the teleconference, the video channel is used to display the group, and the computer-mediated channel is used by the group to exchange ideas.

Participants need back channel communication to ask "private" questions of other meeting participants and to inform the facilitator on how the session is progressing. In face-to-face environments people whisper in a colleague's ear to get feedback on an issue and talk with a facilitator during a break to provide analysis of the session. In distributed environments back channel communication is difficult given the communication media available in most distributed environments.

Second, facilitators are faced with the challenge of influencing the process in a way that improves the quality of the groups' decisions without influencing the specific content of the decisions.

On one hand, facilitators are substantively "neutral" parties in the meeting and on the other hand facilitators

impact the "content" of the session. The message contribution by the facilitators influences the substance of the discussion (Brashers, Adkins, & Meyers, 1995). Facilitators have a significant impact on the participants' ability to make sense of the environment. Aakhus, Adkins, and Glynn (1997) created two distributed environments to explicitly direct the content of the discussion in a particular manner and found the task more of a challenge in a distributed session than a face-to-face meeting. The challenge is greater in a distributed environment because there is less data for the facilitator to assess how the process intervention affects the content.

Third, there is a multitude of technical challenges associated with distributed collaboration (Albrecht & Lee, 2002). These challenges include getting distributed sites connected to a common server or internet site, establishing consistent audio, video, and data connectivity, setting up a session on a specialized environment (i.e., Citrix server, Microsoft Terminal Server, Collaboratus, etc.), establishing the appropriate "privileges" for users and getting the appropriate "plug-in" components on individual users' work stations. The connectivity issue revolves around different types of network protocols, security requirements (firewalls) organizations use, and "standards" used in the communications industry. Also bandwidth is a commodity in some distributed environments (Briggs, Adkins, Mittleman, Kruse, Miller, & Nunamaker, 1999). Consistent audio, video, and data connectivity is a constant challenge even today and has a critical impact on distributed collaboration. Dropping a video teleconferencing (VTC) session happens more often than one would like and reconnecting is often not a trivial task when 30 participants are now disconnected. Also the staff and resources required to set up a VTC is often larger than one anticipates. Setting up a distributed meeting requires technical expertise, understanding of security requirements of participating organizations, and knowledge of the requirements for the participants privileges that often exceed a facilitators expertise level.

Recently, researchers at the University of Arizona's Center for the Management of Information (CMI) ran several experiments and field studies exploring distributed collaboration. Aakhus, Adkins, and Glynn (1997) did two studies with students in a communication class. In both studies students were in group support system rooms (3 separate locations) across campus. The rooms were connected using teleconferencing and data exchange.

The first study, had a "lead" facilitator in one room with participants and the second facilitator was in another room. In study two, the "lead" facilitator was in a room alone and two co-facilitators were in separate rooms with ten to fourteen participants guiding the

interaction. Also, CMI researchers have organized several field studies (Briggs, Adkins, Nunamaker, Mittleman, & Miller, 1999) in distributed collaboration with U.S. Navy's Commander Third Fleet and Battle Groups around the globe (Adkins, Kruse, Damianos, Brooks, Younger, Rasmussen, Rennie, Oshika, & Nunamaker, 2001).

In general, these studies have involved connecting 70 or more individuals across the ship's LAN, NIPRNET, or SIPRNET. The individuals are located all over ships, across multiple decks (floors), time zones, and distances. The distributed locations include Korea, Japan, Canada, Australia, Middle East, Alaska, Hawaii, Arizona, California, Rhode Island, and Washington, DC. Also CMI researchers and a large Northeastern healthcare organization explored the concept of bring nearly 5,000 participants together for a collaborative session.

Researchers have engaged in a number of distributed collaboration field studies (Adkins, Shearer, Nunamaker, Simcox, 1997; Adkins, Shearer, Nunamaker, Simcox, & Romero, 1998; Lee, Hickey, Zhang, Santanen, & Zhou, 2000) with the U.S. Air Force and U.S. Army. In general, three types of field studies have been done. One, an intranet located at an Air Force base was used to facilitate numerous strategic planning sessions with data only exchange (Adkins, Burgoon, Nunamaker, forthcoming). Two, an Air Force base in Idaho and a depot in Georgia were synchronously connected using audio conferencing, video conferencing and data exchange to develop a process model to improve aircraft repair.

Third, an Air Force base, depot, headquarters, and project managers located in five different states collaborated asynchronously using data and telephone exchanges to verify the process model created in the second study (Lee, Hickey, Zhang, Santanen, & Zhou, 2000). Researchers (Adkins, Reinig, Kruse, Nunamaker, & Mittleman, 1999; Lowry, Albrecht, Nunamaker, and Lee forthcoming) report on the develop of and use of a distributed groupwriting tool used with the U.S. Army to develop regulations and field manuals.

Schwarz and Adkins (2002) report experiences and requirements to effectively facilitate a distributed collaboration session. As the requirements for distributed collaboration become clear, appropriate technologies will be found or developed to support distributed collaboration. The research effort should continue to investigate distributed collaboration in laboratory studies where variables can be controlled so organizations can understand the impact of distributed collaboration on meeting effectiveness.

In sum, the research indicates that there are a number of challenges to distributed collaboration that are based in technical and human behavior. These results are not

surprising but require understanding as both technical and human behavior challenges are increased by distributed interaction. But all the research results showed that distributed work was possible with limitations.

The results of the laboratory studies are valuable to organizations, facilitators, and information systems researchers so they can address the impact distributed collaboration has on meeting productivity. Systems, processes, and facilitation intervention cannot be developed without knowledge of the variables that impact distributed collaboration productivity. Field studies need to be continued to keep researchers up to date on how actual organizations are implementing prototypes and processes. The results from field studies should continue to modify prototypes, improve processes, and develop laboratory studies to develop in depth knowledge on which variables impact distributed collaboration.

Information Technology and Augmented Facilitation

Information technology has advanced sufficiently to consider the development of augmented facilitation tools that can mitigate problems of distribution and enable facilitation of large, co-located or distributed (geographically and/or temporally) groups. Specifically, the Skilled Facilitator approach to diagnosis and intervention can be augmented with information technology because the ground rules for effective groups can be used to identify patterns in group members' language (i.e., input text) that are inconsistent with the structure of language as prescribed by the ground rules. In this way, the ground rules provide a template that can be used to identify group member input that deviates from the ground rules.

GSS and Natural Language Processing

As mentioned earlier, large groups, and/or groups distributed geographically or temporally present unique problems to the facilitator and to group members. GSS with incorporated language understanding technologies can prompt group members to conform to the ground rules while concurrently alerting the facilitator(s) and other group members when intervention may be required. Human language technologies also provide the means for group members to participate even though they may have nothing more than a telephone with which to do so. By utilizing speech as the interface and natural language understanding (NLU) as the enabling technology, group members can participate even though not in their offices and without access to a computer.

Organizational memory (Nunamaker, et. al., 1991) has always been a productivity multiplier for GSS usage. The permanent record of the meeting means that the meeting is self-documenting. Though the future of human language technologies (HLT) clearly includes language transparent, voice-based human dialogue between humans and information systems, and with other humans, there are a number of technology issues that remain to be solved. Currently, automatic speech recognition (ASR) on clean speech such as a news broadcast is approaching 98% in such systems as BBN Technologies System called OnTAP (Online Text and Audio Processing).

This example showing approximately 95% accuracy is from NPR News. Words in [word] are the actual words from the recorded audio. Empty brackets [] indicate a word inserted in the text that was not a part of the audio. Broadcast news has the highest accuracy because professional speakers using scripts in studios with control on extraneous sound and high quality audio equipment deliver it.

Ad hoc speech recognition, as encountered in meetings is substantially lower, in practice as low as 70%. This limitation has to be addressed if voice-enabled GSS systems are to be practical and valuable. There additionally is support in the current state of art for speaker recognition, topic detection and tracking, event and named entity detection, natural language understanding and summarization, and domain-specific,

Natural Language Processing (NLP) technologies provide a means of interacting with information systems for group members. Since language processing in information systems relies on text, spoken language must be converted to text to enable subsequent processing. This initial step is the role of automatic speech recognition (ASR).

There are a number of considerations that determine the quality of the output from ASR processing; the quality of the audio signal, background noise, disfluencies in speech, and the sheer size of the system's vocabulary. ASR systems rely on a statistical model for determining what word was spoken. Though ASR systems do not make spelling errors, ambiguity can lead to the wrong word being used in the text. The tradeoff occurs between providing the system with a large vocabulary, resulting in more opportunities for ambiguity; and a small vocabulary with limited capability for natural interaction. Modern NLP systems combine natural language models to virtually eliminate common problems such as the homonyms of "there." Noun and verb substitutions are the more common errors, with named entities (people, places, etc.) having the highest error rate due usually to non-inclusion in the vocabulary and the statistical grammar rules. The method utilized to process out-of-vocabulary, or partially understood words is a variable that can have a positive effect on accuracy, but a negative effect on the naturalness of the interaction for the human participant

CNN obtained videotapes do [through] a source in Afghanistan and has been airing them since the weekend and [] the network is not saying how would [it] get [got] a [] hold of the material the tapes some of them several years old include some footage of O'sullivan Lott [Osama bin Laden] and there are also pictures about tighter trading [training] operations including the on camera deaths of dogs following exposure to poison gas a spokesman for the White House office of homeland security told the associated press that the tapes are consistent with previous information adding that this is further evidence of why the war on terrorism is necessary the president has long maintained that outside [al Queda] it [] would not hesitate to use chemical weapons in terrorist attacks CNN says most of the tapes were made prior to september eleventh though some do contained [contain] images of news coverage of the attacks of that date time [Don] Tonya [Ghandi] NPR news the White House .

Figure 1 Example of 95% accuracy voice to text

mixed-initiative interaction. Here is an example from OnTAP illustrating topic detection, event detection, and named entity detection (Shepard, Colbath, Egan, & Kubal, 2002). Each of these technologies can provide the basis for a more natural utilization of GSS for group members as well as for facilitators. These technologies are also being researched for application in courts and meetings where an accurate record is required that includes speaker identification and can show concurrent speech and interruptions.

Natural Language Processing

due to the large numbers of corrections and clarifications required.

The problems with vocabulary, grammar rules, and the consequential ambiguity results in most commercial-use NLP systems being built for particular, usually narrow subject domains, such as airline flight status and reservations; or weather reports. Even broad-based commercial ASR systems for input to word processing programs have separate vocabularies for specific domains, such as scientific, medical and legal; and also provide the user with the ability to add words and subsequently train the system to understand those new words. Domain dependence allows systems to predict what a word might be based on statistical probability

given the words around it. This implies a measure of language understanding even as the system is generating the text from the speech.

Additional trade-offs appear in the form of speaker independence versus training the system for a specific individual in a particular environment. Commercial text-input systems rely on substantial training and consistency of environments, even requiring separate training for different environments. Other systems such as OnTAP for broadcast news and the systems that create the ad hoc captioning for television are required to operate across multiple speakers and rely on rapid training algorithms and speaker change detection that utilize more generalized speaker models rather than the extensive training that learns how a particular speaker

systems is possible, and for the purpose of this paper, that GSS can provide groups with augmented facilitation capabilities while enabling group members to interact naturally using voice and/or the keyboard/mouse.

Though the state of art does not permit replacing the facilitator with a computer system, it can provide group members and the facilitator with structured input capabilities, clues and reminders, and alerts.

Mixed-Initiative and Structured Input

Assuming group members agree with the core values of the TSF approach and are willing to modify interaction behavior in accordance with the TSF ground rules, augmented GSS can provide the framework in

male 1	As the an obscure group took over Iraq's embassy in Berlin today the group which calls itself the democratic iraqi opposition in Germany and said it was liberating iraqi soil .	Politics and government : Foreign relations with the United States : Middle East peace negotiations : Israel : Jewish-Arab relations : Middle East : Iraq : Paleslinian self-rule areas
female 2	It's tuesday august twentieth and this is all things considered and then beyond this .	
male 1	And also these stories kurds in Northern Iraq are nervous about joining forces with the US to topple sit down was .	
female 2	Saying the egyplian man accused of selling lake ID is september eleventh hijackers is arrested checked .	
male 1	No college or reading lists for Incoming freshmen a .	
male 3	A lot of places are your only beginning to restrict all of our rights in this country and we just want to remind people that reading is really one important thing and that people are quite willing to ban them .	
female 2	Any art and science and getting dance out of two sides first .	
male 1	This summary of the day's top news stories from NPR news in Washington I'm Craig Windham german commandos stormed the iraqi embassy in Berlin to free two captives and bring a hostage standoff there to an end no shots were fired five people were taken into custody the building had been taken over by dissident groups seeking the overthrow Saddam Hussein White House press secretary Ari Fleischer called the takeover unacceptable he said such actions undermine legitimate efforts inside and outside Iraq to bring about a regime change a former chief UN Weapons inspectors says it's time for the Bush Administration to make public some solid evidence to back up suggestions that Iraq is developing	

Figure 2 BBN Technologies System called OnTAP

pronounces different sounds and particular words.

Though some measure of language understanding has taken place during the conversion of speech to text in order to resolve word ambiguity, the majority of the processing occurs on the text itself. As recently as ten years ago this processing occurred at 10+ times real-time. Batch processing was the norm. However, improvements in the algorithms and substantial improvements in computer processing capability have enabled NLU systems to operate at near real-time. The implications are that natural dialogue with information

which group members can structure their inputs and responses. The information technology augmentation can furthermore recognize inputs that deviate from the ground rules and alert the submitter, or other group members and/or the facilitator that intervention is perhaps required. At a simple level travel systems perform this by knowing that place names go in certain database fields, times go in other fields, and dates go in their respective fields. Seat numbers, flight numbers, hotel rooms, and all the other information necessary to

make travel arrangements is similarly organized and processed.

The systems that are commercially in use rely on directed initiative; that is, the system requests certain item-by-item information with prompts such as, "where do you want to go?" Information technology is unprepared at that point to take a date as input, and will simply respond with a correction and then re-query for a place name. Or, the system may misunderstand and substitute a place name, such as "June Lake" if the user responded to the initial query with "June 8th."

Systems capable of actively augmenting group meetings and assisting with facilitation will require what the Human Language Technology (HLT) research community refers to as mixed-initiative interaction. In theory this means that either the human or computer can initiate an interaction and can provide or request a number of elements of that transaction in a single statement. Using the travel example, in practice this would mean that a person could provide their complete itinerary in one statement with the system subsequently parsing that statement into the appropriate data items for further processing; providing as feedback a natural summary of what it understood the user wanted, and then processing multiple corrections also as a single statement. Though a far more natural or human means of interaction, the language understanding and response generation elements of this scenario have made this particular interaction a benchmark in several sponsored HLT research projects.

Information Summarization

Though undoubtedly a normal part of face-to-face conversations and discussions in meetings, it will be unacceptable to provide as input to the group's interactions a stutter-for-pause-for-restatement text record of a group member's input. Just as with the travel scenario, regardless of the order, or how it is input, the mixed-initiative system will take the elements of an itinerary and, for instance, restate them to the traveler as, "you want to go from Boston to San Diego on Tuesday morning on United Airlines and rent a mid-sized car from Avis. You want to stay one night at the Hyatt Regency and return to Boston on Wednesday night."

Language understanding and summarization technologies must similarly be used to interpret the statements group members make, reform them into natural appearing text, and organize them into the elements of a ground rules-conforming input to the meeting. This summary then serves as the basis for a dialogue with the submitter to elicit missing elements; and as a verification of the group member's intent; correctable with either voice or keyboard. Utilizing

mixed-initiative dialogue interaction in a collaborative, group scenario provides the system the capability to parse the group member's input into the elements of a ground rules conforming response and provide the user with feedback regarding missing or misunderstood elements. The system could then prompt the user for elements of the response that were inconsistent with the ground rules. Provided the member intends for their participation to conform to the ground rules, the system actually improves on their inputs by promoting a review and check on conformance to their agreement to conduct the meeting in accordance with the core values and ground rules. Though the system would not preclude a deliberate input or response that doesn't conform to the ground rules, it does serve to minimize inadvertent violations.

System Interaction

A typical (though grossly oversimplified for purposes of illustration) process for interaction within the group might proceed as follows:

1. Reading through the previously submitted inputs, Bill defensively writes a comment regarding Sue's opinion from yesterday. Sue's statement was somewhat vague, but on first reading seemed indirectly to place some measure of responsibility for an undesirable situation within the company on Bill's group. Referencing Sue's comment, his initial submission is, "That's not true, we had nothing to do with it."
2. The NLP system, analyzing the draft input recognizes that Bill's statement does not ask Sue to verify what she meant; does not make explicit what Bill means by "that;" takes a position rather than explaining what his interests in the issue are; nor does he provide any examples or supporting information.
3. The NLP system says to Bill, "It looks to me like you're taking the position that your group had nothing to do with the situation. Is that correct? If so, before taking that position, would you be willing to make explicit what you think Sue said?"
4. Bill could at this point restructure his statement, conforming to the ground rules, and submit it for a response by Sue. However, that scenario does not serve to illustrate the capability of the system to alert the group and the facilitator of a requirement to intervene, so we'll have Bill just submit his comment as originally written.
5. One option the facilitator might have for groups just learning the core values and ground rules would be to

have comments inconsistent with those values submitted first to the facilitator(s) rather than to the entire group. The facilitator could then concurrently submit both the comment and intervention to the entire group, giving Bill the opportunity to revise his comment, and the group as a whole the opportunity to learn more about the application of the core values and ground rules to effective groups. This approach at intervention may also have substantial value to even experienced groups whose members are temporally displaced, since it places the comment and the intervention together in the thread of the meeting. Of course, in keeping with the ground rules, this process at intervention would be part of the initial agreement the facilitator would make with the group. In other words, Bill would know that because he submitted his comment inconsistent with the ground rules, it was first going to the facilitator. He would also know that it would eventually be submitted to the entire group just as he had written it.

6. Finally, comments and inputs that conform to the ground rules, at least as far as the NLP can ascertain, will be submitted to the group.

In addition to an appropriate user interface, a number of tools for users to interact with the system will be required; among them (1) the ability to define phrases as particular elements conforming to the ground rules, (2) the capability to sort inputs by users, time, location, and etc., (3) the ability to attach or to reference documents, (4) tools to make lists and summaries that are available to all group members (and the ability for the facilitator to control editing of those lists). The system must be capable of learning new vocabulary and phrases with simple, intuitive prompts from the users.

Contingency

As reliable as dialogue interaction has become, there will certainly be people in groups who have accents for which the system does not yet have a model; or for whom the language in use is not natural; who do not feel comfortable speaking with a computer; who just prefer to type; who because of disabilities, or for whatever other reason do not have the capability to reliably interact with the system using spoken language. There will also be group members who do not have the technical system capacities or other capabilities to incorporate speech processing. Recalling that text is the basis upon which NLU systems operate, the means by which that text is derived, whether from ASR or from typed text, is irrelevant. The language understanding elements remain operative regardless the mode of input, and the analysis, summarization, and prompting

mechanisms described above for spoken language interaction perform as well or better on typed text

Limitations

The most obvious limitation given the emphasis on technology augmenting effective groups arises from the current limitations of natural language understanding (NLU). These current limitations will oblige users to conform their language to accommodate the system's understanding of the ground rules. Provided the system merely provides recommendations and alerts and does not absolutely prevent users from submitting comments this becomes a system learning issue that over time will conform to the language and vocabulary of the specific groups (Jurafsky & Martin, 2000).

Less obvious are the limitations of large and/or dispersed (geographically or temporally) groups. In spite of the limitations the GSS may have, these groups should operate far more effectively than they would without the GSS.

System Architecture

A number of architectural approaches are available to develop systems that enable numerous people to interact as a group though geographically and/or temporally dispersed.

One approach is the use of client-server applications, with each client licensed and registered, usually for a cost. This approach has the advantage of enabling substantial functionality to be deployed at the client level. There is also enhanced security with this approach.

Another approach is the use of a web-based server with the more ubiquitous client of a web-browser. For organizations with established groups and managed information-systems, the client-server approach may serve well, and would prevent problems inherent with Java applets and network firewalls. On the other hand, for ad hoc groups from a variety of organizations, and for small or moderate sized companies that often establish ad-hoc groups, utilizing the web-browser as a client provides substantial advantages. Additionally, it enables group members to participate regardless of time and place, whether in their office, an airport, a cyber-café, or a hotel. The use of a web-browser interface does not prevent co-located users from working together, neither does it require they be co-located.

Future Capabilities

In addition to incremental, and substantial improvements in NLP one major hurdle to effective dispersed groups remains unsolved, that of multilingual

transparency. The ability to participate in groups, regardless of language will be a significant step as we move to a global perspective in business and governmental interactions.

Machine Translation

As smaller businesses become increasingly engaged in global marketing, a significant advantage will be available to those who can work in effective teams regardless of the language of the group's members. Machine translation (MT) will facilitate these capabilities in a few (five for major languages) years. The state of art for MT is insufficient to enable group members to effectively communicate in their own language with members who do not speak or write that language. For groups to be effective MT capability must exceed gisting, or recognizing named entities. The current capabilities serve businesses and the military to identify documents and conversations that should be translated by a human translator.

Though major languages for international commerce or military requirements will dominate the research, the lessons learned and tools created for developing machine translation capabilities will provide a substantial jump when moving to other languages.

Conclusion

The goal of this paper was to propose the development of an information technology system based on current state of the art natural language processing technologies to augment the Skilled Facilitator approach and allow effective facilitation of large distributed meeting twenty-four hours a day seven days a week. Experiences gleaned from facilitating hundreds of groups technology and developing information systems for large organizations and the military have guided this effort. Hours of debate between those trained in technology development, human communication and social psychology lead to a unique balance between the limits of technology and the needs of a facilitator.

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