SO, TALK TO ME: THE EFFECT OF EXPLICIT GOALS ON THE COMPREHENSION OF BUSINESS PROCESS NARRATIVES

By: Bill Kuechler
Department of Accounting and Information Systems
University of Nevada at Reno
Reno, Nevada 89557-0205
U.S.A.
kuechler@unr.edu

Vijay Vaishnavi
Department of Computer Information Systems
Georgia State University
35 Broad Street, Room 902
Atlanta, GA 30303
U.S.A.
vvaishna@gsu.edu

Abstract

Unstructured data, most of it text-based and computer-mediated, makes up a rapidly growing majority of the knowledge store of most organizations. Entire classes of information systems—knowledge management systems and enterprise content management systems—have emerged to monitor, manage, and support decision making from this primarily textual data.

IS research has treated text as a unitary variable. However, research from cognitive science strongly suggests that a deeper investigation of how text is comprehended would allow the development of more effective computer-based knowledge and communications systems. Our research extends IS research on the effects of information presentation on decision making by investigating the attributes of text rather than comparing text to other information presentation modes such as graphs or numbers. Our study also contributes to the sparse empirical IS research on problem formulation, the initial phase of decision making.

Informed by research on information presentation, decision making, and narrative comprehension, we designed a series of experiments that demonstrate that the explicit inclusion of goal information for activities in narrative descriptions of problematic business processes increases overall comprehension, decision-making confidence, and short and long term recall. Based on our experimental findings we propose that augmenting text-based IS to elicit and saliently present explicit goal information would significantly enhance the decision support capability of these systems especially for rapid, ad hoc decisions about business process situations.

Keywords: Decision support systems, decision making, human–computer interface, process comprehension

Introduction

Most of the information on which businesspeople base their sense-making and decision-making is unstructured text
(Weick and Browning 1986) and a rapidly increasing percentage of that data is computer mediated. Content management professionals estimate that 85 percent of an organization’s knowledge store is in the form of unstructured data, predominantly text files (Robb 2004) and the volume of unstructured textual data is increasing at a greater rate than traditional structured data (White 2003).

Some of the more common business computer systems that integrally depend on text or whose sole function is to disseminate text are

- E-mail
- Case-based DSS
- Group decision support systems
- Project documentation support systems
- Knowledge management systems including enterprise portals
- On-line instruction and operation manuals
- Help systems

In response to the increasing volumes of textual data and the increased understanding of its importance relative to traditional structured data (Peterson 2003), entirely new classes of computer information systems have recently entered the commercial marketplace. The primary function of these systems is to manage and support decision making from unstructured text. Enterprise content management (ECM) systems form the core of these new systems (Rosenblatt 2003); business intelligence systems (Betts 2004) and multiple data mining, monitoring (for legislative compliance), and knowledge management applications draw from the text in the ECM repositories (do Prado et al. 2004; Sullivan 2004). New forms of text-based decision support systems such as lessons learned systems (LLS) continue to be developed and have quickly gained wide acceptance (Weber et al. 2001).

In spite of this flurry of activity in the marketplace, there has been little research on improving the information systems presentation of captured text to support decision making. Not finding any formal study of text management systems, we surveyed the design descriptions of all text handling systems described in KM Magazine’s annual product review. We found that other than implementing some form of lexical analysis for categorization (Perrin and Petry 2003) or combining this technique with conceptual clustering of indices, the systems reviewed (approximately 150) treat text as a unitary data type, capturing and presenting it with no greater insight than paper filing systems.

To more concretely motivate our research, we present a typical organizational scenario that demonstrates the use of text-based information systems in the problem formulation phase of decision making. In the scenario, John, a sales support engineer, is thrust into a situation that will require him to make decisions that will affect his organization and a client organization. The decision areas include what products to propose and what level of support agreement to suggest. These decisions depend on John first accurately defining the problem situation he faces. His primary information sources are the textual documents provided by his company’s customer resource management (CRM) system.

[ringing phone] Hi. This is John.

[Sarah, John’s supervisor] Hi John. Look, I’ve got Randall [sales] in my office and we’ve been talking about this meeting with First Credit tomorrow. We think we’re going to need a bit more technical depth to convince them that our system solves all their problems. I’d like you to go with Randall and talk to their tech folks.

[John, rolling his eyes] Isn’t Leslie handling First Credit?

[Sarah] Leslie’s in Samoa for three weeks. I think most of the stuff is on line now.

[Sarah’s voice, muffled] Randall, all the First Credit history is in the new CRM system, right? Letters, e-mails, RFP? [Sarah’s voice, clear] Yeah, just log onto the CRM system, call up First Credit and click on Supporting Documents.

Key and common elements of this and the many similar scenarios which typify our research focus are (1) the sudden appearance of a problem solving situation requiring definition and context; (2) initial detailed information on the problem situation derives from computer mediated narrative descriptions; (3) the emphasis is on comprehending textual information rather than searching for it.


As our survey of current text-based support systems that have been developed for virtually all organizational functions including help desks (Roth-Berghofer 2004), market research (Marshall et al. 2004), accounting (Baker et al. 1998), and intellectual property management (legal) (Breitzman and Mogee 2002).

Research in IS on the effects of information presentation on decision making has an extended history. However, all prior IS research on information presentation modes has treated text as a unitary variable; the effects of varying text content and type have not been explored, despite a body of research from IS (Dilla and Stone 1997; Mao and Benbasat 2000) and the cognitive sciences (Lutz and Radvansky 1997; Simon and Hayes 1976) that suggests that problem formulation and thus problem solving and decision quality are strongly influenced by the alteration of specific aspects of text presentation. Our research extends prior information presentation research and suggests a new stream of information presentation research to explore the effects of text presentation on decision making. It also provides detailed design guidance for text-dependent systems. Our primary research question in this area is

RQ: How can the presentation capabilities of text-based information systems be enhanced to improve their decision support capabilities?

In this paper, we describe two experiments that demonstrate that the explicit inclusion of goal information for activities in narrative (a common type of text) descriptions of problematic business processes increases overall comprehension, decision-making confidence, and short and long term recall, thus greatly enhancing decision making.

Although the inclusion of goal information in narrative descriptions of process may seem intuitively beneficial, it is rarely done. First, many writers of process documentation, systems documentation, and even problem-describing narrative such as e-mails do not include goal information in their documents because it has become “transparent” to them. Such information becomes internalized and implicit (Nonaka 1994; Rulke and Zaheer 2001) and is no longer conscious information. In fact, as documented in the literature on knowledge engineering, this information can be the most difficult to extract from the experts on a given process or system (Diederich and Linster 1989; Steels and Lepape 1993). Also, a common school of technical writing stresses conciseness and precision and promotes laconic descriptions of things and actions over intentions (Houp 2002).

As our survey of current text-based commercial product offerings has shown, narrative-based information systems also largely ignore goal information. However, we believe that if strong enough evidence of the benefit of including goal information in narrative-based systems can be demonstrated empirically, then more developers and researchers will accept the challenges to gain the benefits. Based on our experimental findings, we propose that augmenting text-based IS to elicit and saliently present explicit goal information would significantly enhance the decision support capability of these systems.

In the next section of the paper, prior research on the effect of information presentation and text comprehension on decision making is reviewed in order to develop a research model for our study. We then describe our empirical study with reference to the model. Subsequent sections describe the experimental procedures, discuss the results, and conclude with a discussion of the implications of the results for research and practice.

Prior Related Research

IS research on information presentation (IP) has a lengthy history; the topic was broadly popularized by the Minnesota experiments (Dickson et al. 1977). Information presentation in this context has traditionally referred to the different means of expression and representation of information such as text, graphs, numbers, and diagrams; more recently the term has come to include different access modes such as hypertext or conceptually clustered indices (Cole et al. 2003). Various streams of IP research have emerged through the years, investigating different dependent variables. However, the intent of all IP research is to improve the decision support capability of information systems and the common core assumption behind the research is that the mode of information presentation has significant effects on decision making. Thus the research model shown in Figure 1 is implicit in all IP research.

Early “individual differences” research on IP sought to determine the interaction of information presentation mode with individual decision making style (Dickson et al. 1977; Lusk and Kersnick 1979). This research stream has been muted since 1983 (Huber 1983). Cognitive fit research seeks to match presentation mode to decision task to minimize cognitive load on the decision maker (Dunn and Grabski 2001; Jarvenpaa 1989; Vessey 1991, 1994). Cognitive load is significant because it alters decision strategy (Todd and Benbasat 1991, 2000) and potentially decision quality. Another ongoing IP research stream explores the effect of presentation mode on specific decision tasks such as risk determination.
Figure 1. General Information Presentation Research Model

(Dilla and Stone 1997) or base-rate decisions (Roy and Lerch 1996). IP effects on comprehension (Lim and Benbasat 2002; Lucas and Neilson 1980) are typical of still another research stream that explores the ability of information systems to present key aspects of information more saliently, thereby improving mental model formation and decision quality. Our research most closely follows this latter stream in that it is focused on comprehension of information in the problem formulation phase of decision making, rather than the problem resolution phase.

During problem resolution, solutions are sought for a well-defined problem. Information system support may be provided by information retrieval and presentation (see the previous paragraph), assistance in operational model construction (Sen and Vinze 1997), or through expert system consultation (Liao 2005). During problem formulation, a problem situation is initially comprehended and defined. It is at this phase of problem solving that a mental model of the problem situation is first constructed and an incorrect model can stall the problem solving process indefinitely. In Sanderson and Murtagh’s (1990) research on electronic circuit failure diagnosis, experimental participants who had formed incorrect mental models of the functioning of the circuit were never able to diagnose the problem (within the timeframe of the experiment) while all participants who formed a correct model made accurate diagnoses. Berthon et al. (1998) determined that although it is the least researched of problem solving activities, problem formulation is critical to successful problem solving and decision making. They indicate further that incorrect model formulation is not uncommon in organizational settings and misdirects the entire subsequent decision process.

Problem formulation has been shown to be highly dependent on the mode of problem presentation. Roy and Lerch (1996) and Dilla and Stone (1997), two IS information presentation studies that focused on problem formulation, found that varying problem presentation modes had significant effects on mental model formation. Even within a single mode of problem presentation, text, Simon and Hayes (1976) found that “innocent” changes in language had major effects on problem formulation. IS research on system generated explanations for expert system conclusions has proposed that different form and content for textual explanations significantly influences the understanding of and acceptance of system conclusions (Gregor and Benbasat 1999; Mao and Benbasat 2000).

As is evident from the scenario presented earlier, the focus of our research is to improve IS delivery of text-based information in a type of naturalistic decision making situation (Zsambok and Klein 1997) we term consultative: information is required quickly to define and diagnose a problem occurring outside the decision maker’s normal domain (problem formulation). For our research, we have constrained the general model of Figure 1 to correspond to the work scenarios that motivate this research: information delivery is via computer mediated narrative, the environment is that of a typical organizational knowledge worker, and the task is diagnosis and subsequent elaboration of an organizational problem situation for decision making.

Our research model (Figure 2) has been informed by an extensive survey of text comprehension research from the fields of discourse processing (see Gamez and Marrero 2001), cognitive (see Lutz and Radvansky 1997) and educational psychology (see Narvaez et al. 1999), and management and decision science (see Gettys et al. 1987; Weick and Browning 1986). The most salient research used to develop the model is shown in Table 1.

Summarizing that research, a cognitive model, the situation model, is formed when readers seek to understand textual material. A functional view of the situation model is as a mental analogue of a semantic network, linking clauses (facts) presented in the text with prior knowledge to form a coherent, nomothetic web; the new situation presented in the text is made intelligible by the situation model (Zwaan and Radvansky 1998). The strength and coherence of the situation model is affected by reader (attitude), material content (the
**Figure 2. Narrative Goal Presentation Research Model**

**Table 1. Material and Reading Environment Variables Shown to Affect Comprehension**

<table>
<thead>
<tr>
<th>Text or Reading Environment Attribute</th>
<th>Effect on Comprehension</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genre (type) expectations</td>
<td>Reading time, recall of situational and surface information</td>
<td>Zwaan 1994</td>
</tr>
<tr>
<td>Concreteness</td>
<td>Positively affects recall, comprehensibility, and interest</td>
<td>Sadoski et al. 2000</td>
</tr>
<tr>
<td>Text coherence/ambiguity</td>
<td>Delay in constructing situation model until ambiguity is resolved</td>
<td>Mani and Johnson-Laird 1982</td>
</tr>
<tr>
<td>Material type</td>
<td>Expository texts favor evaluation of items in isolation; narrative favors evaluation of item relationships</td>
<td>Einstein et al. 1990</td>
</tr>
<tr>
<td>Goals for actors in “story” texts</td>
<td>Recall interference: uncompleted goals interfere with the recall of goals mentioned earlier in the text</td>
<td>Lutz and Radvansky 1997; Maglaino and Radvansky 2001</td>
</tr>
<tr>
<td>Causal information in text</td>
<td>Alters analysis of situations and thus decisions; virtually eliminates “framing effect biases”</td>
<td>Jou et al. 1996</td>
</tr>
<tr>
<td>Reader goals; reading purpose</td>
<td>Differential processing resources allocated to construction of the different models, especially text-based versus situation</td>
<td>Narvaez et al. 1999; Schmalhofer and Giavonov 1986</td>
</tr>
</tbody>
</table>
Of the many text presentation aspects suggested for investigation by prior research, the potential for goal information in narratives about process to increase both retention and accuracy of concept formation and diagnosis of problems was especially salient for us. In our experiments, reader expectations and material type and content have been held constant, with the exception of the treatment—the inclusion or exclusion of goal information (independent variable) for activities in textual scenarios (narratives) of problematic business processes.

Our experiments are directed at some of the significant gaps in prior research. In the course of our extensive review of the IS, cognitive science, and discourse processes literature, we have discovered no studies of the effects of any of the aspects of text presentation on critical business decision quality variables. And, although some prior work has explored the effects of text comprehension on cognitive models, our experiments provide substantially more external validity than any prior work through the use of controls on subject attitude and more complex business process scenarios (see Dougherty et al. 1997; Huber et al. 1997; Jou et al. 1996; Kuhberger and Huber 1998). Task complexity is widely understood to have an effect on decision models and strategies (Payne et al. 1992; Todd and Benbasat 1991, 2000).

**Hypotheses**

Experiment 1 investigates the short-term effects of including goal information for activities in an e-mail that describes a business process and a problem that has occurred with the process. With reference to Figure 2, explicit goal information in a narrative has been shown to contribute strongly to forming cognitive linkages between textual clauses (Albrecht and O’Brien 1995). Textually presented facts that are linked by intentional information or other (usually) less effective means have more intrinsic explanatory power and also form more relationships to prior knowledge (van den Broek et al. 2000). This should increase the ability of the reader (the decision maker) to make inferences and should also lead to a more coherent model that is recalled more accurately (Zwaan and Radvansky 1998). The more coherent situation model, which integrates more aspects of the textually presented situation, should decrease uncertainty about the situation and may lead to greater confidence in decisions made about problems occurring with the described process (Goslar et al. 1986). Further, goal information for actions should increase the salience of interactions between process actors and of process state changes leading to increased comprehension and diagnostic ability. Finally, more accurate diagnosis should more concretely and specifically direct actions, decreasing the number of proposed solutions to a problem. Thus the hypotheses for Experiment 1 are

**H1a:** The inclusion of goal information for activities in a narrative process description will result in better recall of explicitly stated information from the description.

**H1b:** The inclusion of goal information for activities in a narrative process description will result in increased confidence in decisions and judgments made concerning the process.

**H1c:** Explicitly stated goals for activities in the process description will result in increased comprehension of the process as indicated by accurate problem diagnosis and solutions to the process problems that are more concrete and coherent.

**H1d:** Explicitly stated goals for activities in the process description will function as constraints during solution generation resulting in fewer solutions.

---

4As systems analysts in industry, we were well aware of the utility of goal information in system documentation. Moreover, for some years we have worked on the problem of automatically reconciling dynamic changes between two cooperating automated workflow systems and have developed a useful computational model that uses goal information in process description data structures to automatically reestablish coordination following changes to workflow activities (Kuechler et al. 2001). An interest in developing this model as a possible limited cognitive model of work process similarity led us to choose goal information effects on narrative comprehension as our experimental starting point.
will be the long-term decisions regarding that process. Hypotheses for the experiment, therefore, are

**H2a:** The inclusion of goal information for activities in a narrative process description will result in better long-term recall of explicitly stated information from the description.

**H2b:** The inclusion of goal information for activities in a narrative process description will result in increased confidence in recall made concerning the process over the long term.

**H2c:** Explicitly stated goals for activities in the process description will result in increased long-term comprehension of the process as indicated by accurate problem diagnosis and solutions to the process problems that are more concrete and coherent.

### Experimental Variables and Procedures

**Pilot Study**

As an initial assessment of our experimental procedures, we conducted a pilot study in which 15 subjects were given short business process scenarios to read, and were then questioned to determine their understanding, their inferences, their and decision processes. The session was recorded and transcribed, and an analysis of concurrent verbal protocols (Huber et al. 1997; Williamson et al. 2000) gave strong evidence that a detailed situation model was formed during the reading of business scenarios, and that the model was used to answer questions, draw inferences, and form conclusions about the material (Dougherty et al. 1997; Harte et al. 1994; Jou et al. 1996; Pennington and Hastie 1993). The pilot study gave evidence of the effectiveness of many of the specific data collection techniques and instruments used in our experiments.

**Experimental Design for Experiments 1 and 2**

The experimental design illustrated in Figure 3 is identical for both experiments. Both utilized a single independent variable with two levels of the factor: the presence or absence of sentences describing goals for activities in a business process description document. The four dependent variables were recall of stated process details, decision confidence in decisions made with respect to solving a problem that was described in the process description document, comprehension of (the ability to make valid inferences about) the process and the problem that was described, and solution count (the number of unique solutions proposed) for the problem described in the process description document. A within-subjects design was chosen to minimize subject differences; a randomly selected, counterbalanced presentation order of documents was used to control for order effects.

**Experiment 1: Immediate Effects**

**Subjects.** A total of 24 senior and graduate students enrolled in elective information systems classes participated in the experiment, 19 of whom were from a 14,000-student state university; the other 5 were from a 24,000-student state university. The average age was 24 years, and 42 percent of the subjects were female. Incentives for involved participation were $15 and partial credit toward class grade.

**Materials.** Two different process description documents were required for the within-subjects design, each in two versions: one with and one without treatment sentences describing high-level goals for activities. Goals (or intentions or rationale) describe why a specific activity is performed as it is, and are non-detail prescriptive. For example, not storing inventory on the manufacturing site (just-in-time ordering) in order to keep inventory costs down is an example of an explicitly stated high-level goal for a manufacturing process. In our experiment, the intentional information was deliberately chosen to be widely understood by our subject pool, and this was confirmed in our pilot study, our confirmatory study (described later), and by subject protocols.

The descriptions were presented in the form of printed e-mail messages, identical in format to those used in the pilot study, which consisted of salutations, closings, and step-by-step descriptions of the processes. Enough information was given to infer a reason for the problem. However, this was not made explicit in the narratives. The scenarios were similar in length for each version (approximately 350 words, no goal version versus 440 words, goal version) and identical in number of interactions between actors.

The other experimental materials were

- Two tests of 12 true/false and short answer questions for determining prompted recall, one for each narrative scen-
Table 3. Experimental Design

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Dependent Variables</th>
<th>Recall</th>
<th>Decision Confidence</th>
<th>Comprehension</th>
<th>Solution Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal information for activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity description only</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3. Experimental Design

- All questions involved information explicitly stated in the narrative.

- One set of five high-level probes used with both scenarios to determine retention and comprehension. In order of presentation to the subjects, they were: (1) describe the original process; (2) describe the problem that occurred; (3) describe what went wrong with the process; (4) describe as many solutions to the problem as you can; and (5) pick the best solution from the ones you have proposed and describe why it is optimum.

- An instrument similar to that used in Goslar et al. (1986) for measuring confidence in decisions made regarding ill-structured problems. The instrument contained seven questions, each rated on a seven-point Likert scale that measured decision confidence directly along with two factors that covary with decision confidence: willingness to take action on decisions and perceived clarity of decision related information. Some of the questions were included as validity checks as were negatively worded questions (to detect subjects circling all 5’s, for example).

Procedure. After brief preparation for the concurrent verbal protocol, subjects were advised that they were to play the role of an analyst from a consulting firm who had been flown in at the last minute to review material generated by a fellow analyst who had fallen ill.

All subject responses were audio recorded (Ericsson and Simon 1993; Harte et al. 1994; Huber et al. 1997). After a single reading, the five free recall probes and the instruments for prompted recall and decision confidence were administered. The second process description narrative was treated identically. Before leaving the session, subjects were scheduled for the follow-up session (Experiment 2: long term effects) one week later.

Data Parsing and Coding. The analysis of concurrent verbal protocols (CVP) (Ericsson and Simon 1993; Williamson et al. 2000) as it has been specifically applied to decision research is detailed in Harte et al. (1994) and Todd and Benbasat (1987). The verbal responses to the probes were transcribed and broken into clauses, defined as any unit that expresses a unified predicate (Berman and Slobin 1994; Trabasso and Magliano 1996). The transcriptions were parsed into clauses, as used in reading comprehension research instead of protocols (Ericsson and Simon 1993) because the intent was to discern idea units (Sadoski et al. 2000) in the transcription rather than to infer thought processes from it.

Measures. There are multiple perspectives on comprehension (Anderson and Krathwohl 2001; Lim and Benbassat 2002; Mayer 1991) that all tend to cluster around the dictionary definition of the word understanding. Tests of comprehension of textual material typically involve measurement of inferences, the extrapolation of the material to new contexts or judgments about meaning and the ability to infer solutions to problems stated in the text (Byrnes 2001; Jou et al. 1996). We use diagnosis and solution score (solution richness) to triangulate on this complex construct.

The ability to remember specific facts or phrases from text is typically termed recall in the text comprehension literature (Anderson and Krathwohl 2001; Zwaan 1994). Recall and comprehension result from distinct cognitive processes and may not be correlated, that is, high recall may be accompanied by minimal understanding (Anderson and Krathwohl 2001; Byrnes 2001).

Decision confidence and short answer scores (prompted recall) were measured with instruments. All other measures were derived from analysis of the concurrent verbal protocol of responses to the five high-level probes. The solution score measure was suggested by an analogous measure in Nissen (2000) for evaluating the utility of business processes, which
Table 2. Experimental Measures

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Decision Confidence</strong></td>
<td></td>
</tr>
<tr>
<td>Decision confidence</td>
<td>Three related factors: willingness to act, recall confidence, and recall clarity measured with a seven point Likert scale.</td>
</tr>
<tr>
<td>Comprehension</td>
<td></td>
</tr>
<tr>
<td>Diagnosis</td>
<td>The exact reason for the problem that occurred in the process narrative was never stated; thus this is a measure of an <em>inference</em> as to why the problem occurred. Scorings were 0 = no diagnosis, 1 = partial diagnosis, 2 = full, correct diagnosis.</td>
</tr>
<tr>
<td>Solution Score</td>
<td>Each solution received an integer rating: 0 (inconsistent, unworkably vague, or contradictory to stated facts in the narrative) or 1 (consistent and workable). Scores for all solutions were added to yield the solution score.</td>
</tr>
<tr>
<td>Solution Count</td>
<td>A count of the number of distinct, explicitly stated solutions to the problem given in the narrative.</td>
</tr>
<tr>
<td>Recall</td>
<td></td>
</tr>
<tr>
<td>Prompted recall</td>
<td>Measured with a 12-question short answer test for each process narrative. Scores were converted to the decimal fraction of correct answers (0.0 to 1.0) for the statistics.</td>
</tr>
<tr>
<td>Process Step Scores</td>
<td>A measure of how well the process was recalled during free recall. Each process was defined as series of nine steps. Each step was defined as (1) a communication (product or information) (2, 3) between two entities (4) occurring in a specified sequence and (5) resulting in a state change. Each step could be scored from 0 to 5 depending on whether and how well the elements of each step were recalled. Raw process step scores for each narrative ranged between 0 and 45; scores were converted to the decimal fraction of correct answers (0.0 to 1.0) for the statistics.</td>
</tr>
</tbody>
</table>

had been restructured in an experimental setting. The measures and their scoring are described in Table 2. Accuracy of recall and plausibility of inferences served as a manipulation check, assuring that observations were not the result of confusion or misunderstanding.

The first author coded all parsed transcriptions. Random samples of five subjects (20 percent) were scored by each of two other raters. Inter-rater agreement was measured with Cohen’s kappa. After discussions to resolve differences in rater scores involved multiple pages of transcribed protocols. Much of the resolution of differences in rater scores involved detection of overlooked items rather than interpretation differences.

Experiment 2: Long Term Effects

This experiment tests the long term (one week) effects of the treatment on many of the same decision attributes measured in the first experiment, which tested immediate effects.

Subjects. The same subjects from Experiment 1 participated in this experiment.

Procedure and Materials. Subjects were seated at a PC that was running common e-mail software and were instructed to assume the same consultant roles they had assumed during the prior week’s session (for Experiment 1). They were then instructed to read and type a reply to two urgent e-mail requests for information on the two scenarios, goal and no-goal, from the prior week’s session. The presentation order of the e-mails was randomly chosen. Subjects were prompted to include as much detail as they could recall and any insights they had formed concerning the scenario and solutions for the problems that had arisen with it and were then presented with the same short-answer quiz used in Experiment 1. The process was repeated for the second e-mail.

Measures: Since in this experiment subjects were not being asked to make decisions about the processes, but rather to recall the solutions they had thought through the prior week, for this session we constructed a *recall confidence* instrument designed to measure how confident subjects felt in their ability to remember facts and judgments made about the two
process descriptions. The same type of validity checks used in the decision confidence instrument were included in this instrument. The typed responses of the subjects to the e-mail requests for information were parsed and coded exactly as the transcriptions of the free recall sessions had been in Experiment 1, and so all other measures were identical to those described for that experiment.

Results and Discussion

The Shapiro-Wilk test (Mittlehammer 1996) was run on all data sets to confirm that they came from normally distributed populations and that t-tests were appropriate for all continuous variables. Since the data was correlated (measures on the same subjects), paired-t tests were used. Diagnosis and solution score are ordinal measures and so both t-tests and Whitney-Mann U tests were run for these measures due to the ongoing debate on whether t-tests or nonparametrics are appropriate for ordinal measures (Mitchell 1986). In Table 3, p-values for the Whitney-Mann test are shown in parentheses.

ANOVA was used to check for order and instrument effects. Identical analyses were performed for both experiments. No significant order effects were found except for diagnosis for Experiment 1; this required splitting the diagnosis data set into two groups: Scenario-1-first and Scenario-2-first. The results of t-tests on both groups are shown in Table 3. No other order, instrument, or interaction tests were significant.

The direction of all measures was consistent with the experimental hypotheses. Goal information for activities in the process narrative resulted in better recall of process details, greater confidence in solutions generated for the problem situation, and greater comprehension of the process—indicated most meaningfully by greater accuracy of diagnosis of the problem. The improvement in prompted recall scores resulting from the goal information treatment was significant at the .05 level (p = .027); recall improvement was corroborated by the process step scores which measure more detailed unprompted recall (means of .825 versus .735, p = .065).

Diagnosis is an inference and the strongest indicator of the understanding of both the original process and the problem that occurred as indicated by this subject’s goal treatment protocol: “The new fashion trend…decided they didn’t need the vests and…that created the problem because, umm, the New York folks were using that notification [of vest completion] to order the cloth for the coats.” The scenario never explicitly mentions the function(s) of the vest completion notification; however, the subject’s extrapolation from stated facts to problem diagnosis is typical of correct responses. The higher diagnosis scores correlate with the improvement in solution scores (concreteness and coherence of solutions: means of 2.25 versus 1.41; p = .002), as would be expected. The fact that decision confidence factors were significantly higher for the goal condition combined with the higher scores for recall and comprehension indicates that subjects not only had a greater understanding of the material, but also were more willing to act on that understanding. For example, contrast one subject’s responses to the decision confidence question on taking immediate action. For the goal treatment: “That’s all the way to a seven, because they have to fix that quick.” For the non-goal treatment: “Well, a four. [pause] That’s pretty wishy-washy…make that a five.” Considered in total, the results provide significant support for hypotheses H1a, H1b, and H1c.

H1d, the hypothesis that subjects would treat the goal information as a constraint on solutions and thus generate not only better but also fewer solutions was not supported (means of 2.75 versus 2.42, p = .15); goal treatment subjects actually generated slightly more solutions. Research on hypothesis generation and choice (Dougherty et al. 1997; Fisher et al. 1983; Gettys and Fisher 1979; Gettys et al. 1986) shows very robustly that subjects tend to generate very few hypotheses (solutions in our experiment are hypotheses) relative to any situation, even when extensively prompted to generate more. We saw evidence of this in the protocols for several subjects; one subject very cogently responded to our prompt for “Any other solutions?” by saying, “I’m not one to ramble on when I’ve come up with what seems a likely solution.” We had hypothesized that goal information would function as a constraint on the solution space and thus result in fewer solutions proposed. The constraining effect of the goal information was observed in the correctness of the solutions—almost no goal treatment solutions violated constraints implicit in the goals—however it may be that the richer understanding of the problem situation resulting from the goal treatment actually stimulated solution production. The statistics are inconclusive, but the increased problem-solving creativity hinted at by our findings is a significant enough effect to warrant further study.

Long Term Effects

For Experiment 2 also, both measures of recall (process steps and prompted recall scores) were higher for the process narratives that had included activity goal information (see Table 4). Prompted recall scores were more significant for this experiment (p < .001 versus p = .027), and we propose that this is due to the short time between the reading of the material and the administration of the test in Experiment 1. Short-term memory effects benefitted recall in Experiment 1.
### Table 3. Means, Standard Deviations, and p-values for Experiment 1

<table>
<thead>
<tr>
<th>Measure</th>
<th>p</th>
<th>Goals Mean</th>
<th>Std.</th>
<th>No Goals Mean</th>
<th>Std.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision Confidence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Willingness to Act</td>
<td>.002</td>
<td>11.0</td>
<td>2.24</td>
<td>9.50</td>
<td>2.48</td>
</tr>
<tr>
<td>Recall Clarity</td>
<td>.060</td>
<td>8.46</td>
<td>2.72</td>
<td>7.08</td>
<td>3.23</td>
</tr>
<tr>
<td>Recall Confidence</td>
<td>.015</td>
<td>4.96</td>
<td>1.27</td>
<td>4.01</td>
<td>1.31</td>
</tr>
<tr>
<td>Comprehension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis (scenario 1 first)</td>
<td>.036 (.004)</td>
<td>1.154</td>
<td>.92</td>
<td>.654</td>
<td>.94</td>
</tr>
<tr>
<td>Diagnosis (scenario 2 first)</td>
<td>&lt;.001 (.031)</td>
<td>1.18</td>
<td>.75</td>
<td>.09</td>
<td>.08</td>
</tr>
<tr>
<td>Solution score</td>
<td>.002 (.004)</td>
<td>2.25</td>
<td>1.41</td>
<td>1.31</td>
<td>.75</td>
</tr>
<tr>
<td>Solution Count</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Solutions</td>
<td>.15</td>
<td>2.75</td>
<td>1.42</td>
<td>2.42</td>
<td>1.38</td>
</tr>
<tr>
<td>Recall</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prompted recall</td>
<td>.027</td>
<td>.86</td>
<td>.15</td>
<td>.78</td>
<td>.15</td>
</tr>
<tr>
<td>Process steps</td>
<td>.065</td>
<td>.825</td>
<td>.21</td>
<td>.735</td>
<td>.18</td>
</tr>
</tbody>
</table>

### Table 4. Means, Standard Deviations, and p-values for Experiment 2

<table>
<thead>
<tr>
<th>Measure</th>
<th>p</th>
<th>Goals Mean</th>
<th>Std.</th>
<th>No Goals Mean</th>
<th>Std.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision Confidence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recall Confidence</td>
<td>.037</td>
<td>9.54</td>
<td>2.9</td>
<td>7.82</td>
<td>2.64</td>
</tr>
<tr>
<td>Comprehension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis</td>
<td>&lt; .001 (&lt; .001)</td>
<td>1.167</td>
<td>.83</td>
<td>.396</td>
<td>.76</td>
</tr>
<tr>
<td>Solution score</td>
<td>.078 (.087)</td>
<td>1.02</td>
<td>.63</td>
<td>.71</td>
<td>.67</td>
</tr>
<tr>
<td>Solution Count</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Solutions</td>
<td>.11</td>
<td>1.46</td>
<td>.66</td>
<td>1.21</td>
<td>.78</td>
</tr>
<tr>
<td>Recall</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prompted recall</td>
<td>&lt; .001</td>
<td>.695</td>
<td>.29</td>
<td>.44</td>
<td>.31</td>
</tr>
<tr>
<td>Process steps</td>
<td>.002</td>
<td>.746</td>
<td>.21</td>
<td>.60</td>
<td>.27</td>
</tr>
</tbody>
</table>
but once these had faded, those subjects who had formed a more coherent situation model due to the goal information for activities showed significantly better recall on all long-term measures in Experiment 2. Recall confidence for the two process descriptions was significantly higher for the goal treatment (mean scores of 9.54 versus 7.82; p = .037).

Note that the measures, number of solutions and solution score, have far less variation for Experiment 2 than for Experiment 1 (compare Tables 3, 4). This was due to the tendency discussed earlier for subjects to propose few solutions under any conditions, and once a viable solution had been proposed, even strong prompting rarely resulted in additional contributions (see the discussion above for Experiment 1). For Experiment 2, subjects typically recalled only the solution they felt was best from the prior discussion (average number of solutions recalled = 1.46/1.21). Thus, since few solutions were recalled, and the ones recalled tended to be viable, the number of solutions and solution score measures tended to equalize across treatments in Experiment 2.

The results from Experiment 2 indicate that the inclusion of goal information for process activities in a process description narrative increases the strength of the situation model substantially, and this results in statistically significant long-term effects. The understanding of the process is increased according to two distinct criteria: recall of the explicitly stated facts of the process description, notably the steps of the process, and comprehension of the process as measured by the ability to correctly diagnose problems and propose effective, coherent solutions. Moreover, the treatment resulted in increased confidence that the process material and previously formed insights about it were being recalled correctly. The fact that the correct diagnosis was spontaneously communicated in descriptions of the situation to others much more often for the goal treatment is a meaningful effect. It appears that appropriate treatment of narrative not only allows readers to generate more accurate insights, but also fosters dissemination of this critical information in an organizational context.

A Confirmatory Study

Following the two experiments, a confirmatory study was performed in order to (1) check the validity of the manipulations, (2) rule out an alternative explanation for the effects found in the main experiments: that the differences in length of the narratives (the goal narratives averaged 90 words longer than the non-goal) were responsible for the effects, and (3) confirm our earlier findings in an experiment with a much higher N (60).

To validate our manipulations, questions were asked for each intentional sentence in each narrative which would be answered correctly only if the information were correctly interpreted by the subjects as goals that constrain the process. For example, one goal sentence (found only in the goal version of the narrative) contained the information “This cloth [from Milan, Italy] is expensive, but it’s necessary to preserve New Man’s quality image.” The probe for the understanding of this goal was the question: “Could New Man save money by using cloth for the coats from Taiwan?” The vast majority of non-goal treatment subjects gave the answer “yes,” while the vast majority of the goal-treatment subjects answered “no,” and explained their reasoning using information from the goal sentence similar to this subject’s response: “They could, but their marketing campaign calls for the Italian cloth to set a quality image.” Overall, 100 percent of all subjects correctly perceived at least two of the goal sentences, 80 percent correctly perceived at least three of four goal sentences, and 70 percent correctly perceived all goal sentences indicating the manipulation was interpreted as intended by the subjects in the main experiments.

To address the possibility that differences in narrative length provide an alternative explanation for our findings, our confirmatory study held the amount of information constant across goal and no-goal versions of narratives and performed several of the tests from the two primary experiments. The results were consistent with our original findings. They are supported as well by the behavioral decision research that has shown that simply including more information about a topic that is not related to a specific decision about that topic results in a poorer decision and in greater confidence in those fallacious decisions (Davis et al. 1994; Oskamp 1965; Paese and Sniezek 1991). We conclude, then, that the difference in length of narratives is not a likely cause for the effects seen in the original study.

Table 5 displays the results of two tests of comprehension from the confirmatory study, which are statistically significant at the p = .01 level and corroborate the results of the main experiments.

Final Discussion

Table 6 outlines the hypotheses and results for the entire series of studies. This data in combination with the qualitative results from the verbal and written protocols provides substantial support for our theoretical model (Figure 2), and also makes readily apparent that the inclusion of intentional information in narrative has a significant positive effect on
Table 5: Results of the Confirmatory Study

<table>
<thead>
<tr>
<th>Measure</th>
<th>Goals</th>
<th>No Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std.</td>
</tr>
<tr>
<td>Problem Description</td>
<td>.94</td>
<td>.231</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>.33</td>
<td>.476</td>
</tr>
</tbody>
</table>

Table 6: The Study’s Hypotheses and a Summary of the Results of the Experiments

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Pilot</th>
<th>Experiment 1</th>
<th>Experiment 2</th>
<th>Confirmatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0a</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>H1a, H2a</td>
<td>Not tested</td>
<td>Supported (short term)</td>
<td>Supported (long term)</td>
<td>Supported (short term)</td>
</tr>
<tr>
<td>H1b, H2b</td>
<td>Not tested</td>
<td>Supported</td>
<td>Indirectly supported</td>
<td>Not tested</td>
</tr>
<tr>
<td>H1c, H2c</td>
<td>Not tested</td>
<td>Supported (short term)</td>
<td>Supported (long term)</td>
<td>Supported (short term)</td>
</tr>
<tr>
<td>H1d, H2d</td>
<td>Not tested</td>
<td>Not supported</td>
<td>Not tested</td>
<td>Not tested</td>
</tr>
</tbody>
</table>

business decision making. Since the experiments used narrative descriptions only, the results may not generalize to other text genres such as literary stories or argumentation.

The sample size of 24 is consistent with similar studies in multiple areas (Mackay and Elam 1992). We note also that the within-subjects design yields two measures per subject, and provides much stronger results than the same N in a between-subjects design. Given the triangulation and manipulation checks we gained from protocol analysis, we believe the tradeoff in statistical significance was justified for this essentially exploratory study. The confirmatory study with N = 60 further mitigates sample size concerns.

The use of students in this study does not seem to prevent generalization to a target population since the students fit the target demographics of nonmanagerial knowledge workers quiet well. The average number of years of nonacademic
work experience was 5+, and 20 (out of 24) of the subjects were working as knowledge workers more than 15 hours per week during the study. Examination of the protocols for both experiments points out the effectiveness of the role-playing suggestions in generating work-appropriate motivation toward experimental tasks.

Finally, although the study was more realistic than any previous laboratory experiment we have reviewed, many business processes are far more complex than the ones described in our materials. However, with nine departmental interactions each, our experimental process descriptions are as complex as many in-use business processes. Furthermore, complex processes of any sort are frequently decomposed by managers into subprocesses of lesser complexity (Simon 1977). Thus, although additional research focused on more complex processes is an obvious extension of this study, the results are immediately applicable to a subset of in-use work practices.

**Implications for Practice**

IS practitioners have a near-term, pragmatic focus; the implications for them from this research derive almost entirely from the strong empirical support given to the benefits of elicitation and inclusion of goal information in narrative-based systems. As discussed in the motivation for our experiments, even though the inclusion of goal information in narrative seems intuitively desirable, it is, with few exceptions, ignored by commercial systems for managing textual information or those that use textual information to support systems development. We propose that our experimental results are strong enough to justify, even for developers who as a group are traditionally concerned with efficiency, the addition of a number of functional modules to narrative-based systems such as those enumerated in the introduction of the paper: (1) a narrative parsing module for automatically determining actors, activities, and stated goals (if any) for the activities; (2) a goal elicitation module for automated assistance in explicating the rationale for actions if left unstated; (3) provision for storage of elicited goal information; (4) the ability to index and retrieve narrative material by goal; (5) mechanisms to link goals to narrative and vice versa and to display narrative(s) by goal or to display goals associated with narrative(s).

The technical aspects of all of these five modules have been previously studied; automatic parsing is well documented in the research literature of education (Landauer et al. 2003), computer science (Datta 1998), and information science (Wong and Yao 1993). Automated goal elicitation has been widely discussed in the expert systems literature (Diederich and Linster 1989), and probably the richest current technology for automated questioning of computer system users can be found in descriptions of medical systems for symptom elicitation (Smith et al. 2000). Given this prior work, initial progress in the suggested directions could be rapid.

Perhaps more interesting are the capabilities gained from these functional modules. The obvious extension from the work described in this paper is the elicitation of goal information and its presentation with retrieved narrative so that the information is made more comprehensible and memorable. However, indexing and retrieval by goal permits types of analysis that are difficult now but which have very significant benefit. Consider the ability of a manager to query a text-based thread (of e-mails) on an international financial project by goal and find that significant effort was being expended on “trying to finalize transactions before the French banks close.” Many problem areas and process bottlenecks are immediately visible by scanning the intentions for actions, as managers who mine customer relationship management databases have found (Larivière and Van den Poel 2004). The same type of query could expose (for example) misallocations of effort in a programming project where many design decisions were linked to the activity goal “to minimize storage” in a project where storage had ceased to be an issue due to hardware changes.

**Implications for Research**

The implications of the results of this study for research are broader than for practice to the degree that the results suggest a new information presentation research stream on narrative presentation based on a generalization of our research model. We have redrawn Figure 4 as a generalization of Figure 2 to illustrate some of the possibilities for future research in this area. Our empirical results suggest this is a rich area of study offering substantial benefit to practice and academic understanding alike, as well as one that is virtually untapped.

In addition to goal information (why an action is taken), prior comprehension research implies additional aspects of narrative could significantly affect decision making. They are actors (who), activities (what is being done), temporal information (when), and means-ends (strategic information). Like goal information, these aspects of a problematic situation are often implied rather than explicitly stated by those closest to a situation (the domain experts) and so are missed or ignored by systems consultants. Mode of presentation, for example, flat (extended narrative) or hierarchical (synopsis hyperlinked to supporting detail), is also a potential area of investigation. Also, the cognition phase of Figure 4
makes clear that both the problem formulation and problem resolution phases of decision making can potentially be enhanced by content and mode of text presentation and thus each constitutes a separate subject for empirical investigation.

Our study, in and of itself, generalizes to a number of systems of interest to information systems.

1. **Commercial information systems that capture narrative information for decision support**, such as lessons learned systems (Weber et al. 2001), text mining repositories (Callaghan 2003), business intelligence gathering tools (Betts 2004), and other knowledge management systems. None of these tools currently elicit, store, or use goal information (including, potentially, goal information as an index to that information).

2. **Design rationale systems** for automatically documenting system development decisions. Several researchers have long suggested benefits from the explicit eliciting of goal information. However, many DR systems do not explicitly capture this information (Potts et al. 1994).

3. **Requirements elicitation processes**. Many manual requirements elicitation methods currently elicit goals for processes (Browne and Rogich 2001); however, others do not (Anton and Potts 1998), or do so only indirectly. We are aware of no automated requirements elicitation support systems with provision for goal elicitation and storage.

4. **Automated workflow management systems**. No workflow automation systems, either commercial systems or research prototypes, elicit and include rationale for documenting formal logic-based process descriptions.

IS design researchers (Hevner et al. 2004) would find challenging projects in the design and validation of any of the five narrative-goal subsystems mentioned above in the “Implications for Practice” section. Since the research model for this study (Figure 2) has been substantially validated, experimentalists could derive testable hypotheses from any of the dependent variables in the existing model or from extending that model based on its sources in reading comprehension research, hypothesis and choice research, and qualitative decision making research. Researchers who prefer field work could provide rigorous follow up and extension studies to the industry initiatives exploring beneficial aspects of narrative in organizational communication7 and textual analysis of the WWW.8

---


Research into the types of information that are best encoded and communicated as narrative, research into the content of narrative for most effective information transfer, and research into the synergy between narrative information presentations and formal information presentations are obvious extensions of this study. Since narrative descriptions of business processes are the foundation of most IS development as well as the basis for much management decision-making, research in narrative comprehension is applicable to both the development of information systems and the understanding and effects of information systems in organizations.

We plan to extend this study in two directions: (1) to explore the synergistic effects of narrative used in conjunction with formal techniques for programmer-level specification of function (see Kim et al. 2000; Storey et al. 1999), and (2) to explore the synergistic effects of narrative used in conjunction with formal techniques for communication of high-level requirements between multiple stakeholders in large scale system development projects (see Browne et al. 1997; van Lamsweerde 2000; Weiser and Morrison 1998).

**Conclusion**

This study has begun to lay an empirical foundation for quantitative improvement of decision support from text-based knowledge capture and management systems. The general model of information presentation research was specialized to an investigation of the effects of a specific aspect of text presentation on decision factors. Our study demonstrated substantial benefit from the presentation of explicit goal information in narratives. The results of the experiments specifically demonstrate the potential value to IS researchers of extending this study to the myriad other aspects of computer mediated text presentation. Given the enormous and growing quantity of computer generated and mediated textual material, research results from this stream translate readily into benefits for practice.

**Acknowledgments**

David Kuechler, a doctoral student in the CIS program at Georgia State University, contributed greatly to earlier versions of this paper before his untimely death in November 2002. We wish to thank the editor, the associate editor and the anonymous reviewers for their detailed and constructive comments on earlier versions of the paper. This work is partially supported by NSF Research Grants IIS-9811248 and IIS-9810901, and by a research grant to the second author from the Robinson College of Business, Georgia State University.

**References**


Storey, M., Fracchia, F., and Muller, H. “Cognitive Design Elements to Support the Construction of a Mental Model during


**About the Authors**

**William L. Kuechler** is an associate professor of Information Systems at the University of Nevada at Reno. He holds a BS in Electrical Engineering from Drexel University. Following a career in business software systems development, he received a Ph.D. in Computer Information Systems from Georgia State University. His research interests include interorganizational workflow and coordination, and the cognitive bases of information systems effectiveness and information systems development methods. He has published in *IEEE Transactions on Knowledge and Data Engineering, Decision Support Systems, Information Technology and Management, IEEE Transactions on Professional Communications, Information and Management, Decision Sciences Journal of Innovative Education*, the proceedings of WITS, HICSS, and other international conferences and journals. Dr. Kuechler is a member of IEEE, and a member of the ACM.

**Vijay K. Vaishnavi** is Board of Advisors Professor of Computer Information Systems at Robinson College of Business, Georgia State University. He holds a PhD from Indian Institute of Technology, Kanpur, and has conducted postdoctoral work at McMaster University, Canada. His research covers several areas including process knowledge management, semantic interoperability and information integration, virtual communities and directory services, interorganizational coordination, and object modeling and design. He has authored numerous research papers in these and related areas. The National Science Foundation and private organizations including IBM, Nortel, and AT&T have supported his research. His papers have appeared in *IEEE Transactions on Software Engineering, IEEE Transactions on Knowledge and Data Engineering, IEEE Transactions on Computers, SIAM Journal on Computing, Journal of Algorithms*, and several other major international journals and conference proceedings. Dr. Vaishnavi is an IEEE Fellow, a member of the IEEE Computer Society, a member of the ACM, and a member of the AIS.
SO, TALK TO ME: THE EFFECT OF EXPLICIT GOALS ON THE COMPREHENSION OF BUSINESS PROCESS NARRATIVES

By: Bill Kuechler
Department of Accounting and Information Systems
University of Nevada at Reno
Reno, Nevada 89557-0205
U.S.A.
kuechler@unr.edu

Vijay Vaishnavi
Department of Computer Information Systems
Georgia State University
35 Broad Street, Room 902
Atlanta, GA 30303
U.S.A.
vvaishna@gsu.edu

Appendix A

Demographic Information Sheet

ID #

Name: __________________________________
e-mail: ________________________________
Possible M@____________ W@____________ F@____________
Times T@1:00 Th@1:00
Age: _________________
Sex: (M) (F)
SSN: _____________________
Education High School Circle highest completed 1 2 3 4
College 1 2 3 4 MS PhD
If College Specify Degree (Example: BA Journalism): ______________________________________
Appendix B

Experiment 1 (Short-Term Recall) Instruments

Consultant Briefing: **New Man Company**

In the situation described below multiple independent businesses in different countries (an offshore manufacturing operation) cooperate to produce a single product – men’s suits. Originally, all businesses are working together efficiently. Then, due to an unexpected event, one of the businesses changes its process. That is, they change the way of working that the other companies had become familiar with. Temporarily the overall work becomes uncoordinated. It becomes less efficient than it had been.

Think of your role during this session as a business analyst for a consulting firm such as Anderson Consulting. The original analyst for this project is recovering from food poisoning. You have been flown to the corporate headquarters on an emergency basis and in a short time you must make a presentation to a group of executives. Your presentation should contain:

1. Your analysis and understanding of the original process
2. Your analysis and understanding of how one of the departments changed and how it caused problems with the overall process
3. Multiple possible solutions to the problem and your analysis of which solution is the best solution

The description of the business process is short to make it easy to read. It may not be complete. If you feel you need information that is not in the write-up, **do not ask for the information**. Simply approach that information need as a sub-problem. Talk aloud as you reason through why you need that information. If, after reasoning, you still feel you need that information then assume a value for it based on your life experience. Any answer you think is reasonable is OK. Using the information you have just supplied you will then proceed with the original train of thought.

It is NOT a trick question in any way. Common sense should be sufficient to find an answer – and any answer that you think is correct is a right answer.

The description of the process is in a narrative format – an e-mail memo describing how the process works as might be captured in a current knowledge management system.

---

**Scenario 1n (no goals)**

Hi -

Since I’m the one that’s worked most closely on the project, Jack asked me to send you an e-mail describing the New Man situation. Here goes.

New Man, Inc. is one of our divisions, a clothing company headquartered here in the New York. They do their own design work, and then outsource the actual manufacture of the clothing to factories outside the US. The specific process I’ve been looking into is pretty typical and it’s for the manufacture of a design of men’s suit. Originally the suit consisted of a vest, a pair of pants and a coat.

The process starts with a production order that gets sent from New York to Taiwan, which is one of their big manufacturing shops. Everything’s computerized, so when Taiwan’s manufacturing system gets the order, they start making the suit beginning with the vests. When they finish...
that, the system sends New York a message saying they’re done with the vests, and then they start on the pants. It takes about as long to do
the pants as it does for New York to get some Italian group in Milan (I think) to send this exclusive cloth to Taiwan so they can make the coats.

OK, so Taiwan starts on the pants, New York sends Italy a PO to have the cloth shipped to Taiwan and about the time it gets there they start
manufacturing the coats. When they get everything together, they ship the whole batch of completed suits to New York.

So New York decided just to eliminate the vest and have the Taiwanese factory make the outfit consisting of coat and pants only.

Now, about the problem that’s come up.

The first time this new order was sent to Taiwan, they started work on a batch of pants and then waited for the cloth to get there for the coats.
After a while they quit waiting and started working on orders for other manufacturers. Eventually New York called Taiwan, all ticked off and
demanding to know when the suits were going to arrive.

So that’s where things stand now till we get it straightened out. Sorry I couldn’t be there myself. Good luck with the presentation!

Beth

---

**Scenario 1g (goal information in italics)**

Hi -

Since I’m the one that’s worked most closely on the project, Jack asked me to send you an e-mail describing the New Man situation. Here goes.

New Man, Inc. is one of our divisions, a clothing company headquartered here in the New York. They do their own design work, and then
outsource the actual manufacture of the clothing to factories outside the US. Profit margins are slim in this business so minimizing labor costs
is essential. The specific process I’ve been looking into is pretty typical and it’s for the manufacture of a design of men’s suit. Originally the
suit consisted of a vest, a pair of pants and a coat.

The process starts with a production order that gets sent from New York to Taiwan, which is one of their big manufacturing shops. Everything’s
computerized, so when Taiwan’s manufacturing system gets the order, they start making the suit beginning with the vests. When they finish
that, the system sends New York a message saying they’re done with the vests, and then they start on the pants. It takes about as long to do
the pants as it does for New York to get some Italian group in Milan (I think) to send this exclusive cloth to Taiwan so they can make the coats.

Using Italian cloth is vital to the sales campaign positioning New Man clothes as quality products. The cloth is not ordered until just before
it’s needed because it’s so expensive. Since it comes from Italy so it has to be shipped well ahead of the time it is needed.

OK, so Taiwan starts on the pants, New York sends Italy a PO to have the cloth shipped to Taiwan and about the time it gets there they start
manufacturing the coats. When they get everything together, they ship the whole batch of completed suits to New York.

Recently a leading fashion consultant reviewed their designs and told them that vests are out, but that the rest of the suit is OK. So New York
decided just to eliminate the vest and have the Taiwanese factory make the outfit consisting of coat and pants only.

Now, about the problem that’s come up.

The first time this new order was sent to Taiwan, they started work on a batch of pants and then waited for the cloth to get there for the coats.
After a while they quit waiting and started working on orders for other manufacturers. Eventually New York called Taiwan, all ticked off and
demanding to know when the suits were going to arrive.

So that’s where things stand now till we get it straightened out. Sorry I couldn’t be there myself. Good luck with the presentation!

Beth

---

**Consultant Briefing: Effingham Corporation**

In the situation described below multiple independent departments in an insurance company cooperate to process a customer claim. Originally,
all groups work together efficiently. Then, due to a business reorganization, the process changes. That is, they change the way of working
that the other departments had become familiar with. Temporarily the overall work becomes uncoordinated. It becomes less efficient than it had been.

Think of your role during this session as a business analyst for a consulting firm such as Anderson Consulting. The original analyst for this project is recovering from food poisoning. You have been flown to the corporate headquarters on an emergency basis and in a short time you must make a presentation to a group of executives. Your presentation should contain:

1. Your analysis and understanding of the original process
2. Your analysis and understanding of how one of the departments changed and how it caused problems with the overall process
3. Multiple possible solutions to the problem and your analysis of which solution is the best solution

The description of the business process is short to make it easy to read. It may not be complete. If you feel you need information that is not in the write-up, do not ask for the information. Simply approach that information need as a sub-problem. Talk aloud as you reason through why you need that information. If, after reasoning, you still feel you need that information then assume a value for it based on your life experience. Any answer you think is reasonable is OK. Using the information you have just supplied you will then proceed with the original problem.

It is NOT a trick question in any way. Common sense should be sufficient to find an answer—and any answer that you think is correct is a right answer.

The description of the process is in a narrative format—an e-mail memo describing how the process works as might be captured in a current knowledge management system.

Scenario 2n (no goals)

Hi,

Since I’m the one that worked most closely on the project, Jack asked me to send you an e-mail describing the Effingham situation. Here goes.

Effingham Ltd. is one of our companies and they specialize in automotive insurance. When a customer makes a claim against an insurance policy, a whole host of people within the company are involved in checking the claim to determine the amount of damage accurately and prevent fraud. It’s pretty standard stuff, but if you don’t know the insurance biz it can seem complex at first.

Everything starts when a customer sends in a claim to the company. Claims get sent to the Claims Processing department (what else) and something called and Investigation Request is sent to a Claims Investigator. When the investigator gets the Investigation Request, he goes out and views the automobile. Then he writes up a report on what he’s seen and sends it back to Claims Processing. When they get it they look it over and if it’s OK, it’s approved for payment. Then they send notice of payment authorization to the Accounts Payable department and the Customer Service department.

Customer Service sends a letter to the customer to let them know the claim has been approved. Meanwhile Accounts Payable processes the payment authorization and cuts the customer a check for repairs during the next payment cycle.

Now, about the problem that’s come up.

Basically, as a result of a business process reengineering project, it was decided that Investigators could approve claims themselves. So now Investigators send their reports directly to Accounts Payable for processing.

But not long after they put the change in place customers began to call in and demand to know whether or not their claims had been approved. Sometimes this was weeks after sending in their claims. They were ticked off and I can see why.

So that’s where things stand now till we get it straightened out.

Beth.
Scenario 2g (goal information in italics)

Hi,

Since I’m the one that worked most closely on the project, Jack asked me to send you an e-mail describing the Effingham situation. Here goes.

Effingham Ltd. is one of our companies and they specialize in automotive insurance. When a customer makes a claim against an insurance policy, a whole host of people within the company are involved in checking the claim to determine the amount of damage accurately and prevent fraud.

Everything starts when a customer sends in a claim to the company. Claims get sent to the Claims Processing department (what else) and something called an Investigation Request is sent to a claims Investigator. Using an investigator is an expensive part of the process, but otherwise Effingham is at the mercy of the repair shops, so they have to do it. When the investigator gets the Investigation Request, he goes out and views the automobile. Then he writes up a report on what he’s seen and sends it back to Claims Processing. When they get it, they look it over and if its OK, it’s approved for payment. Then they send notice of payment authorization to the Accounts Payable department and the Customer Service department.

It’s good for customer relations to let the customer know as soon as his claim has been approved – people like to be kept advised of the process of the claim. Customer Service sends a letter to the customer to let them know the claim has been approved. Meanwhile Accounts Payable processes the payment authorization and cuts the customer a check for repairs during the next payment cycle. Effingham is investigating a newer computer system but that’s a massive job and they’re stuck with once-a-month batch checks till they can replace their system.

Now, about the problem that’s come up.

Basically, as a result of a business process reengineering project, it was decided that Investigators could approve claims themselves. So now Investigators send their reports directly to Accounts Payable for processing.

But not long after they put the change in place customers began to call in and demand to know whether or not their claims had been approved. Sometimes this was weeks after sending in their claims. They were ticked off and I can see why.

So that’s where things stand now till we get it straightened out.

Beth.

Solving the problem:

Use the next five pages (and scratch paper if necessary) to prepare your presentation to the executive meeting.

You may “talk out” the answer rather than writing it. You may make sketches or drawings or take notes on the pages if you’d like. Just remember to keep talking as you write. Answer the questions using the actual names of the actors and the names of the communications between them as given in the e-mail process description whenever possible.

Remember to give as thorough answers as possible.

1. Describe the original process.

3. Describe what went wrong with the process.

4. Describe as many solutions to the problem as you can.
5. Pick the best solution from the ones you have proposed, and describe why it is the optimum.

Scenario 1 Short Answer Questions (New Man)

1. What part of the process was performed in Taiwan?
2. Italy supplied cloth for the coat and pants ( T  F )
3. When the vests are finished, Taiwan sends Italy an e-mail ( T  F )
4. An e-mail from Taiwan to New York starts the whole process ( T  F )
5. When the Italians finish the coats, they ship them to Taiwan ( T  F )
6. What is the US name of the clothing company?
7. In what way did the suit design change?
8. In the changed process, Taiwan phoned New York to get them to order cloth ( T  F )
9. Why didn’t Taiwan finish New York’s order?
10. In the changed process, when the vests are finished, they are shipped to Italy ( T  F )
11. Cloth is shipped from Italy because it is cheap there ( T  F )
12. Italy was annoyed when New York called them ( T  F )

Scenario 2 Short Answer Questions (Effingham)

1. When did Accounts Payable send the customer a check?
2. Claims Processing personnel go to look at the automobile damage. ( T  F )
3. Accounts Payable sent the customer a letter of claim approval. ( T  F )
4. The Site Investigator let customers know if their claim was approved. ( T  F )
5. Customer Service sent the customer a check and letter of approval. ( T  F )
6. Payment Authorization went from Claims Processing to Accounts Payable. ( T  F )
7. Why was the original process changed?
8. The process change eliminated the need for the Site Investigator. ( T  F )
9. In the changed process the Supervisor sends the customer the notice of approval. ( T  F )
10. In the changed process no one needs to examine the automobiles. ( T  F )
11. In the changed process, customer claims go directly to the Supervisor. ( T  F )
12. In the original process who approved payment?
**Appendix C**

**Experiment 2 (Long-Term Recall) Instruments**

**Session 2 Briefing**

For the next fifteen minutes or so you will resume the role of senior analyst for an international consulting company that you assumed for the experimental session last week.

A co-worker at the consulting company, another analyst, has been flown into the companies you consulted with last week on an emergency basis. The stockholders have heard about the problem and are demanding a resolution.

Your fellow analyst has e-mailed you for information about the company. Take a seat at the PC, open the e-mail and read it, and then reply to it by typing in your e-mail response on the same PC.

This session is not a "talk aloud" session. Just be as helpful in response to the e-mail as you would be in a real consulting situation.

The third e-mail is actually a session comments sheet. Please type in your responses to it just as you answered similar questions last week and sent it as an e-mail.

[page break]
Good Morning,

Sorry to drag you back into this, but things have exploded here and I need all the help I can get. They told me they flew you in here last week for a day, and they seemed impressed with your analyses.

PLEASE e-mail me back as soon as possible and tell me everything you remember about New Man. Describe in as much detail as you recall:

The process that was described to you.
The problems they were having.
What you thought caused the problem.
Any solutions you came up with.
ANYTHING else you think will help me solve this mess!

Thanks!!

Ralph

[page break]

Good Morning,

Sorry to drag you back into this, but things have exploded here and I need all the help I can get. They told me they flew you in here last week for a day, and they seemed impressed with your analyses.

PLEASE e-mail me back as soon as possible and tell me everything you remember about Effingham. Describe in as much detail as you recall:

The process that was described to you.
The problems they were having.
What you thought caused the problem.
Any solutions you came up with.
ANYTHING else you think will help me solve this mess!

Thanks!!

Ralph

[page break]

1. I am confident of most of the information I sent in the e-mails.
   (1 Strongly disagree ______________________________________ Strongly agree 7)
   (1  2  3  4  5  6  7)

2. I had an easier time recalling the insurance company information.
   (1 Strongly disagree ______________________________________ Strongly agree 7)
   (1  2  3  4  5  6  7)

3. I forgot a lot of what I read last week.
   (1 Strongly disagree ______________________________________ Strongly agree 7)
   (1  2  3  4  5  6  7)

4. The clothing-manufacturing scenario was harder to remember.
   (1 Strongly disagree ______________________________________ Strongly agree 7)
   (1  2  3  4  5  6  7)

5. I would have done MUCH better if I could have reviewed last week’s e-mails.
   (1 Strongly disagree ______________________________________ Strongly agree 7)
   (1  2  3  4  5  6  7)

6. I couldn’t explain the Effingham insurance approval situation very well.
   (1 Strongly disagree ______________________________________ Strongly agree 7)
   (1  2  3  4  5  6  7)
7. The processes were clearer to me this week than last week.
   (1 Strongly disagree 2 3 4 5 6 7) Strongly agree 7)

8. I communicated the key points of New Man’s manufacturing process well.
   (1 Strongly disagree 2 3 4 5 6 7) Strongly agree 7)

Please comment on the recall task. Was it easy, hard, frustrating? Compare it to last week’s session.

**Appendix D**

**Protocol Parsing and Coding Rules**

**Protocol Coding Rules**

<table>
<thead>
<tr>
<th>Code</th>
<th>Rule</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>Rule</td>
<td>Citation</td>
</tr>
<tr>
<td>Causal inference (ci) – see inferences section</td>
<td>Such phrases as “that was done because…” or “I guess they do that in order to…”</td>
<td>Kahneman and Tversky 1982</td>
</tr>
<tr>
<td>Schemata(s)</td>
<td>Reference to event sequences not explicitly given in the process description but commonly encountered in the real world (such as ordering from a restaurant, loading a truck, etc.)</td>
<td>Jou et al. 1996                Schank and Ableson 1977</td>
</tr>
<tr>
<td>Flexible temporal recall (playback) (ftr)</td>
<td>Spontaneous, correct answers to questions of the form: &quot;what happened after the &lt;event&gt;&quot; and &quot;what actions preceded &lt;event&gt;&quot;</td>
<td>Klein and Crandall 1995 Beach (image theory) 1996</td>
</tr>
<tr>
<td>Counterfactuals (cf)</td>
<td>Phrases such as “on the other hand…” or “but, if you think about…”</td>
<td>Dougherty et al. 1997 Kahneman and Tversky 1982 McCloy and Byrne 2000</td>
</tr>
<tr>
<td>Verbatim (v)</td>
<td>Phrases identical to the scenario</td>
<td>Large et al. 1994 Sadoski et al. 2000</td>
</tr>
<tr>
<td>Paraphrase (p) / Gist (g)</td>
<td>Factual phrases of scenario fact in different wordings</td>
<td>Large et al. 1994 Sadoski et al. 2000</td>
</tr>
<tr>
<td>Elaboration - Consistent (ec)</td>
<td>Phrases consistent with facts in the scenario but not mentioned in it (ec, ei, and e are evidence of evoked schemas)</td>
<td>Large et al. 1994 Sadoski et al. 2000</td>
</tr>
<tr>
<td>Elaboration – Inconsistent (ei) / Distortion (d)</td>
<td>Phrases inconsistent with facts in the scenario and not mentioned in it</td>
<td>Large et al. 1994 Sadoski et al. 2000</td>
</tr>
<tr>
<td>Error (e)</td>
<td>Phrases indicating beliefs about scenario events or actors that are counter to the scenario; mistaken recall of facts stated in the scenario (Ex. New York called Italy to start the process – when in fact New York called Taiwan)</td>
<td>Large et al. 1994 Sadoski et al. 2000</td>
</tr>
<tr>
<td>Goal Information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td>Reference explicit goal (reg)</td>
<td>Reference to goal information stated explicitly in the scenario</td>
<td>Gamez and Marrero 2001</td>
</tr>
<tr>
<td>Reference implicit goal (rig)</td>
<td>Reference to goal information not stated explicitly in the scenario (evidence of evoked schema)</td>
<td></td>
</tr>
<tr>
<td>Analogies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural analogy (sta)</td>
<td>structural = similarity in the relationships between elements; Ex. Relationship between NY and Taiwan is contractor/subcontractor and so is analogy</td>
<td>Blanchette and Dunbar 2000</td>
</tr>
<tr>
<td>Superficial analogy (spa)</td>
<td>References only surface elements. Ex. Scenario mentions clothing companies, so does analogy</td>
<td>Blanchette and Dunbar 2000</td>
</tr>
<tr>
<td>Inferences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explanation (cip)</td>
<td>“(I think )They did that because &lt;so that&gt;…” (meaning for past events)</td>
<td>Trabasso and Magliano 1996</td>
</tr>
<tr>
<td>Association (cic)</td>
<td>“They’re doing that, I believe in order to &lt;so that&gt;…” (current inference)</td>
<td>Trabasso and Magliano 1996</td>
</tr>
<tr>
<td>Prediction (cif)</td>
<td>“I believe that as a result what will happen is…” or “I would expect…” (future inference)</td>
<td>Trabasso and Magliano 1996</td>
</tr>
</tbody>
</table>

**Session 1 Decision Confidence Scoring**

1. (+) I am confident of my answers to most of the questions.
2. (+) My solution to the problem was workable.
3. (-) I would like to review my answers to the questions.
4. (-) The description of the process was somewhat confusing.
5. (+) I recommend the company take action as specified in my problem diagnosis as soon as possible.
6. (+) The way the process was described was clear and complete.
7. (-) More study of the situation is advisable prior to committing to a course of action.

Invert scores for the negatively worded questions: 3, 4, 7 (i.e, 1 <-> 7, 2 <-> 6, and so on). Then compute the factor scores: Recall confidence<1>; Recall clarity <4 + 6>; Willingness to act <5 + 2>; Caution <3 + 7>

**Session 2 Recall Confidence Scoring**

1. (G+) I am confident of most of the information I sent in the e-mails.
2. (2+) I had an easier time recalling the insurance company information.
3. (G–) I forgot a lot of what I read last week.
4. (1–) The clothing-manufacturing scenario was harder to remember.
5. (G–) I would have done MUCH better if I could have reviewed last week’s e-mails.
6. (2–) I couldn’t explain the Effingham insurance approval situation very well.
7. (G+) The processes were clearer to me this week than last week.
8. (1+) I communicated the key points of New Man’s manufacturing process well.
Invert scores for the negatively worded questions: 3, 5, 4, 6 (i.e. \(1 \leftrightarrow 7\), \(2 \leftrightarrow 6\), and so on). Then compute the overall recall confidence score as follows: \(\frac{1+7}{2} + \frac{3+5}{2}\). For Scenario 1 recall confidence: \(\frac{8}{2} + \frac{4}{2}\). For Scenario 2 confidence: \(\frac{2}{2} + \frac{6}{2}\). Overall confidence is a manipulation check: numerically it should rank above the non-treatment confidence and below the treatment confidence.

Parsing Transcriptions into Clauses

Rules and Examples

From Trabasso and Magliano (1996):

The analysis of a protocol began by first parsing the utterances made at each text sentence into clauses. A clause contained a unified predicate that expressed an event activity or state. Each predicate was a main verb. Infinitives and complements were included with the main verb as single clauses (Berman and Slobin 1994; for similar criteria used to parse narrations of picture stories into clauses, see Trabasso and Nickels 1992). An utterance that had two verbs and one or more agents was treated as having two separate clauses.

Example utterance 1:

As expected Ivan being a warrior and caring about people will want to kill the giant.

Clausal parse:

1. As expected
2. Ivan being a warrior
3. and [Ivan] caring about people
4. [Ivan] will want to kill the giant

Example utterance 2:

When the giant came Ivan shot an arrow at him and tried to kill him.

Clausal parse:

1. When the giant came
2. Ivan shot an arrow at him
3. and tried to kill him.

Scoring Rules: New Man and Effingham Process Scoring Sheets

For all scoring, record the page and line in the transcription that indicates the rationale for the score.

Process Steps:

Each process step consists of:

1. a communication (product or information)
2. between two entities,
3. occurring in a specified sequence, and
4. resulting in a state change.

One point is given for each correctly recalled communication, entity, etc. Thus, the maximum possible score for each step is 5. The maximum possible raw score for each process is \((9 \text{ steps} \times 5 \text{ points per step}) = 45 \text{ points}\). Scoring rules:

• If the step is completely omitted, score 0.
• If the entities are correctly recalled, score +1 for each (2 possible).
• If the *communication* is correctly recalled, score +1.
• If the *sequence* (timing) is correct, score +1. (Note that the activities do not need to be *recalled* in sequence providing the ultimate process description, when all 5 comprehension recall questions have been answered, is sequentially correct when viewed as a whole.
• If the *state change* is correctly recalled, score +1. (State changes are usually implicit, i.e. in the case where the investigator sends report back to claims processing, state change = CP informed and ready to proceed to next step. Thus, if the participant recalls the next activity appropriately, then score the state change correct.)
• Record detail errors in any of the above in the appropriate section.
• The final score is a percentage (%): the total of the process step scores divided by the maximum recall for each process (45 for New Man, 45 for Effingham.)

Give full credit to *functionally correct* recall. Detail errors in recall (as opposed to functional; for example: recalling the country of manufacture as “Vietnam” instead of “Taiwan,” the exact term for the communication mentioned in the scenario) are recorded in the final section of the scoring sheet.

### Diagnosis:
• No diagnosis: score = 0
• If the diagnosis is consistent with facts and goals add 1 (+1).
• If the diagnosis is complete, add 1 (+1).

**For New Man:** The elimination of vests removed the manufacturing step that triggered the communication to NY that caused NY to order cloth from I for the jackets

**For Effingham:** Originally CI notified CP who approved claim and notified BOTH CS for approval letter and AP for check at end of cycle. When CI directly sends approval to AP, CS does not get the trigger to sent the letter of approval so clients don’t know of approval till they get the check.

### Number of Solutions:
• Score +1 for each distinct, explicit solution.

### Solution Score:
• Score +1 for each distinct, explicit solution UNLESS
  □ The solution contradicts an explicitly stated fact: score = 0.
  □ Or, the solution contradicts an explicitly stated goal: score = 0.
  □ Or, the solution is unworkably vague or incomplete: score = 0.
• Add the individual solution scores together to get the final score

---

**New Man Process Recall Scoring Sheet**

<table>
<thead>
<tr>
<th>Entities:</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New Man a clothing company (NY)</td>
<td>A Taiwanese manufacturing shop (T)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italian fabric supplier (I)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Process Steps: (45)**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>NY → production order → T</td>
</tr>
<tr>
<td>(2)</td>
<td>T makes vests</td>
</tr>
<tr>
<td>(3)</td>
<td>Vests finished</td>
</tr>
<tr>
<td>(4)</td>
<td>Status message to NY</td>
</tr>
<tr>
<td>(5)</td>
<td>T begin pants</td>
</tr>
<tr>
<td>(6)</td>
<td>NY → cloth order → I</td>
</tr>
<tr>
<td>(7)</td>
<td>I → cloth → T</td>
</tr>
<tr>
<td>(8)</td>
<td>T makes coats</td>
</tr>
<tr>
<td>(9)</td>
<td>T → completed suits → NY</td>
</tr>
</tbody>
</table>
**Effingham Process Recall Scoring Sheet**

Subject ID _____ Goals/No Goals _____ Session (1/2)/ Presentation Order (1/2) _____

Entities:
- Effingham – automotive insurance co.
- Customer (C)
- Claims Processing (CP)
- Claims Investigator (CI)
- Customer Service (CS)
- Accounts Payable (AP)

**Process Steps:** (45)
1. C → claim → CP
2. CP → investigation request → CI
3. CI views auto
4. CI → report → CP
5. CP → authorization → CS
6. CP → authorization → AP
7. CS → letter → C
8. AP → check → C
9. Payment cycle

**Process change:**
1. CI → report → AP

**Change rationale:**
1. (g+ng) – business process reorganization
Problem state description:

C call in wondering if claims approved

Analysis:

(d) Diagnosis (correct = consistent + complete)

(i) Consistent solutions:

(g) Goal inconsistent solutions:

(f) Fact inconsistent solutions:

(v) Verbatim phrases:

(r) Goal recalls (process (p) or solution (s)):

(i) Inferences:

(e) Detail errors

Goal Information Defined

We use the terms “goal information” and “intentional information” in our paper as they are used in the reading research literature: phrases that either explicitly or implicitly provide the reason for the intended effect of an action in a narrative (Albrecht and O’Brien 1995; Gamez and Marrero 2001; Lutz and Radvansky 1997; Magliano and Radvansky 2001). For example, in the sentence: “John stuck his thumb out in order to hitch a ride,” the phrase “in order to hitch a ride” is the explicitly stated goal (the intended effect) of John sticking out his thumb. Intentional information can also be strongly implied by passages of text. Consider the example: “As the snow began to stick to the road, John pumped the breaks whenever he stopped the car.” In this sentence the phrase “the snow began to stick to the road” supplies the rationale for why John pumped the breaks while bringing the car to a stop: he wished to avoid skidding on the snow. That is, the goal for the action of pumping the breaks is implicitly supplied by the information given about snow sticking to the road. Understanding is always contextual and so there is a possibility that in this case someone from a tropical climate might miss the implication. However, in our experiment, the intentional information was deliberately chosen to be widely understood by our subject pool (business school students with several years of work experience) and the understanding of that group was confirmed by a confirmatory study, described below, that tested for the understanding of the intentional information phrases. Further evidence of understanding was demonstrated in the verbal protocols taken during the experiment.

Appendix F

Post Experiment Confirmatory Study

In order to confirm that the manipulation of the experiments, the additional text we term “intentional” or “goal” information, was actually perceived by the subjects as intentional information, we performed a confirmatory study. The study also sought to duplicate some of the findings of enhanced comprehension and retention due to intentional information that were found in the original experiment.

Materials: Each subject was presented sequentially with two narratives one of which contained the goal sentences treatment, one of which did not and sets of questions for probing their understanding of the material.

The narratives were descriptions of the same two business processes used in the original experiment. There were two versions of each narrative, one containing intentional information and the other containing “neutral” information tangential to the actual function of the process. The “goal” narrative for each process was identical to the “goal” narrative used in the original experiment. The non-goal narrative was identical to the goal narrative except the intentional sentences were replaced by “filler” sentences with the same number of words; goal and non-goal narratives were identical in length for each of the two processes.
Three types of questions were presented to the subjects. The first question set was the manipulation check which elicited responses indicating:

1. that the subjects had read and recalled the intentional sentences and
2. that they understood the information as a goal or sub-goal for the process. If the subjects understood the goal information as a constraint on possible solutions (that is, as a goal to be preserved as a solution to the problem was sought) then both recall and understanding were considered to have been demonstrated. These questions were specific to each of the two basic narratives (one on clothing manufacturing, one on auto insurance). A single question, identical for all treatments, asked for the problem described in the narrative. Questions asking subjects to recall the activities in the process and the reasons why the activities were performed was common to all treatments.

Subjects: Sixty students from graduate and upper division undergraduate information systems classes participated in the experiment; 38 subjects came from a large (25,000 student) urban university, and 22 subjects came from a medium sized (17,000) western university. Subject demographics: average age: 28; average years of work experience: 5.5; percentage of students working 20 hours or more at the time of the experiment: 78 percent; 55 percent male.

Procedure: Subjects volunteered for the experiment and were offered an incentive of $100.00 for best performance. Best performance was explicitly defined as the number of correct answers divided by total time taken for the experiment; subjects understood that time and accuracy were equally important.

In a within-subjects design, each subject was given two narratives to read and answer questions about, one with goal information, one without. Subjects were randomly assigned to one of four groups (two process narratives X two versions) based on the order of presentation of the material. First, a one-printed-page narrative was given to the subjects to read. When they finished reading they returned the narrative sheets and were given question sheets about the narrative. When subjects finished the question sheet, they turned it in and received the demographics sheet to fill out (a distractor task between the two experimental treatments). After completion of the demographics sheet, the second narrative/question set was administered. The time taken for each sheet for each subject was recorded on that sheet.

Results: We performed four analyses on the data, each intended to explore a point raised by one or more of the reviewers concerning the manipulation or interpretation of the original experiment: percentage of subjects recognizing intentional information, t-test of the number of correct problem diagnosis for goal vs. non-goal narratives, t-test of number of correctly defined problem descriptions for goal versus non-goal narratives, t-tests of the numbers of activities and reasons for activities listed for goal versus non-goal scenarios.

Six subjects (of an original 66) were discarded for gross omissions (one confessed to being hung-over, another admitted he left early to get to his next class) or due to obvious misunderstanding of the process, as indicated by their responses.

Manipulation check: For the “insurance company” scenario three intentional sentences were probed. For the “clothing manufacturing” scenario four intentional sentences were probed. For example one goal sentence (found only in the goal version of the narrative) contained the information “This cloth [from Milan Italy] is expensive, but it’s necessary to preserve New Man’s quality image.” The probe for the understanding of this goal was the question: “Could New Man save money by using cloth for the coats from Taiwan?” The vast majority of non-goal treatment subjects gave the answer “yes,” while the vast majority of the goal-treatments subjects answered “no,” and explained their reasoning using information from the goal sentence.

All of the subjects correctly identified at least two of the intentions and 57 percent correctly identified all three. All of the subjects correctly identified at least one, 92 percent correctly identified two or more, 77 percent identified three or more, and 31 percent identified all four. We conclude from these results that when the manipulation (goal information) was recalled at all, it was correctly understood by the majority of subjects as intentional information.

t-tests: the results of the t-tests are shown Table F1. Although a diagnosis was not specifically probed for, many subjects spontaneously reported a diagnosis in the course of answering other questions. Please note that five of the subjects (9 percent) provided correct diagnoses for the non-goal scenarios, three for the “insurance company” narrative, two for the “clothing-manufacturing” narrative; this demonstrates that there was sufficient information in all narratives to make a correct diagnosis. This strengthens the conclusion that any difference in the rates of successful problem diagnosis for goal and non-goal scenarios in the original experiment was due to the treatment.
Table F1. Results of the Confirmatory Study

<table>
<thead>
<tr>
<th>Measure</th>
<th>p</th>
<th>Mean Goals</th>
<th>Std. Goals</th>
<th>Mean No Goals</th>
<th>Std. No Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Description</td>
<td>.010</td>
<td>94.0</td>
<td>.231</td>
<td>80.0</td>
<td>.407</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>.002</td>
<td>.33</td>
<td>.476</td>
<td>.09</td>
<td>.293</td>
</tr>
<tr>
<td>Number Recalled Activities</td>
<td>.060</td>
<td>5.37</td>
<td>2.122</td>
<td>4.78</td>
<td>2.212</td>
</tr>
<tr>
<td>Number Recalled Reasons (for activities)</td>
<td>.098</td>
<td>1.39</td>
<td>1.156</td>
<td>1.109</td>
<td>15.4</td>
</tr>
</tbody>
</table>