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Analyzing Non-Observable Work Behavior

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The concern for functional methods of analyzing jobs has been in the minds of persons engaged in work force planning, utilization, and training for many years (Fine, Holt & Hutchison, 1975). Well defined job and task analysis procedures are regularly utilized by a variety of professionals in the pursuit of their work. Included among these are plant level skills trainers, university psychology professors, vocational educators, and vocational teacher educators.

Difficulty arises in that all work behavior does not lend itself to the widely accepted job analysis techniques. This is more often true of management tasks involving higher cognitive and affective behavior. Often the range of work tasks within a management job can be identified through job analysis techniques, but, the precise details of each of the tasks cannot be directly observed. For example, while managers may spend a large portion of their time in decision-making, counseling, and delegation of work behaviors, it may be impossible to directly observe and identify the "correct" mental contortions or procedural details for any of these work tasks.

The burden of proof ultimately falls back on the analyst. Surely there are experts in specific management work tasks. These persons are no less expert because analysts cannot exactly determine what it is they do. It is precisely this discrepancy between known performance and the inability to analyze the behavior that causes problems for persons involved in designing training programs in areas of non-observable work behavior. The reactions of many directors of management training to this problem is to hire consultants to deliver training or to purchase training packages. In both cases the analysis work is left to someone else and the trainer is "selecting", rather than analyzing and designing, training.

This leads to the realization that there are those who are better at analyzing complex non-observable work behavior than others. The extension of this thought

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is the query as to what it is that they do and how such skills might be taught to others.

Purpose of This Study

The purpose of this study was to address the two previously stated questions. Specifically, it was the intention of this researcher to (a) obtain an understanding of the process of analyzing non-observable work behavior and to (b) develop a system for analyzing subject matter related to non-observable work behavior for use by management training personnel.

Summary of the Literature

In reviewing the literature in the areas of analyzing non-observable work behavior and related disciplines such as information processing, cognitive psychology, decision making, and personal psychology, one is reminded of the famous words . . . "It was the best of times, it was the worst of times." Theories abound. So does a great interest in the cognitive functioning required in analyzing and synthesizing research, theories, and observations surrounding subject matter related to non-observable work behavior. Unfortunately for the task at hand these efforts tend to be aimed at searching for a basic understanding of higher level cognitive functioning rather than the methods required to be a more efficient and effective analyst. Thus, in the midst of the high interest a paucity of technique exists.

Those interested in the more theoretical issues are directed to works by Gagne and Smith (1962), Keen and Scott-Morton (1978), Simon (1973 & 1977), Trerzky and Kahneman (1974), and Wilson (1963).

Method

The problem under investigation is concerned with designing a more efficient system for analyzing non-observable work behavior. In that the literature is dominated by theoretical issues, its usefulness was limited to establishing constructs of cognitive functioning rather than suggesting specific human models or techniques for analyzing non-observable work behavior. Thus, looking to the literature for a methodology was rejected in favor of a bottom-up strategy. This strategy involved modeling what trainers actually do and how they do it as determined through unstructured interviews with 30 experts. These professionals were selected for their expertness in the analysis process.

The sample of professionals included training and development personnel, professors, managers, and researchers. All were persons who regularly engage in collecting information and sythesizing information as part of their work.

The unstructured interview revolved around the following statement: "When you have think or write about a complex topic, how do you gather information and how do you deal with that information?"

The analysis of the interview data provided fodder for developing a system to analyze subject matter related to non-observable work behavior. The first major

observation was that there were two important stages of the task. They were (1) collecting information and (2) synthesizing information. Within 'collecting information' it became apparent that the sources for the collection stages were of two types. They were labeled library (print material) and behavorial (direct or indirect observations). It also became apparent that the worries of these experts in the "collecting information" stage had to do primarily with efficiency and completeness. Most felt competent in a variety of collection techniques and felt comfortable with the methods presently available to them.

Synthesizing information, the second stage, produced more unexpected responses. One outcome was the repeated observation that the experts were not conscious of the synthesis processes that they used. Next, even though there were quite a few diverse styles among the experts, the repetoire within any individual was found to be limited. Most often it was restricted to one general synthesis strategy. In essence, each expert had developed a single powerful information synthesizing technique that they applied to most of their problems.

One additional observation on the synthesis stage emerged from the interviews. Several experts noted that they were often required to express a non-linear information synthesis in a linear format such as outlines or prose. Thus, this conceptual transposing work demanded an extra communication problem for synthesizers of knowledge.

The analysis of the interview data provided a basis for establishing a technology (organization and technique) for analyzing subject matter related to non-observable work behavior.

Results

The findings of this study are expressed in the form of a model and a discussion of the parts of the model. One of the more arbitrary elements of the study was to decide what to call this intellectual process that training and development personnel do in the analysis of non-observable work behavior. A brainstorming session resulted in the term "Subject Matter Analysis". While the analysis work under scrutiny in this study was limited to a trainer's analysis of non-observable work behavior, the applicability of what was being explored exceeded that application. Thus, "Subject Matter Analysis" (SMA) was deemed an acceptable general label to describe the process.

It is appropriate for the reader to be aware that SMA is but a piece of a larger Training Technology System (TTS) developed by the researcher. An overview of the TTS is graphically portrayed in Figure 1 (Swanson, 1980). Subject Matter Analysis is one of the three analysis techniques used to scrutinize work behavior and is located under "1.0 Analyze" of the TTS. "Work Analysis 1.4" is the technique concerned with direct observation of worker behavior and generally encompasses human and machine interactions of a manipulative or procedural nature. "1.5 Process and Troubleshooting Analysis" is also concerned with human and machinery interactions, but, those of a non-linear nature and those that require diagnostic behavior. "1.6 Subject Matter Analysis" is concerned with non-observable work

behavior typically associated with human to human interactions, decision making, and problem solving. It is a process of taking an area of work behavior and carefully selecting from *or* synthesizing the many theories, practices, and models into the most appropriate knowledge or approach. It results in a paper form containing a detailed outline or narrative of the subject matter along with a list of those references and sources that were used in supporting the subject matter.

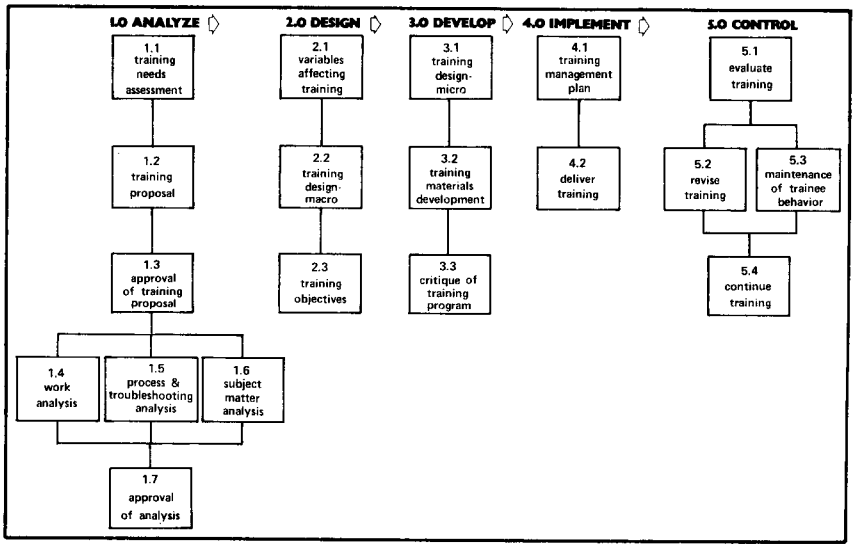

Figure 1. Training technology system.

From the intent of SMA and viewing Figure 1, one can see that SMA is not a trainer's lesson plan. In a structured format it contains all the details of the information to be taught. It does not indicate how the subject matter is taught or the sequence in which it is to be taught.

The Model

The final model of SMA is presented in Figure 2. As one might assume, the model was evolutionary. Rather than discuss the evolutionary process, time will be spent presenting the finalized model and its relationship to the data analysis.

"Subject Identification 1.61" originates at the "1.1 Needs Assessment" level of the TTS (see Figure 1). Of course, in a training and development situation there is always the possibility of a training subject getting re-defined by management at the training proposal approval step (see 1.3 of Figure 1).

The core of the SMA model was based on the findings that there is a collection stage and synthesis stage to SMA. Also, that these two stages are present in both library analysis and behavior analysis of the subject matter.

Specifically then, "1.62 Behavior Analysis of Subject Matter" involves directly or indirectly observing workers that have known performance levels (good and bad). Appropriate collection methods include interviews, questionnaires,

on-site observations, and operations or worker performance records. Appropriate data collection practices in each of these methods have been discussed thoroughly in the literature and therefore will not be discussed in this article. Moreover, these methods were not perceived as a problem by the experts that were interviewed.

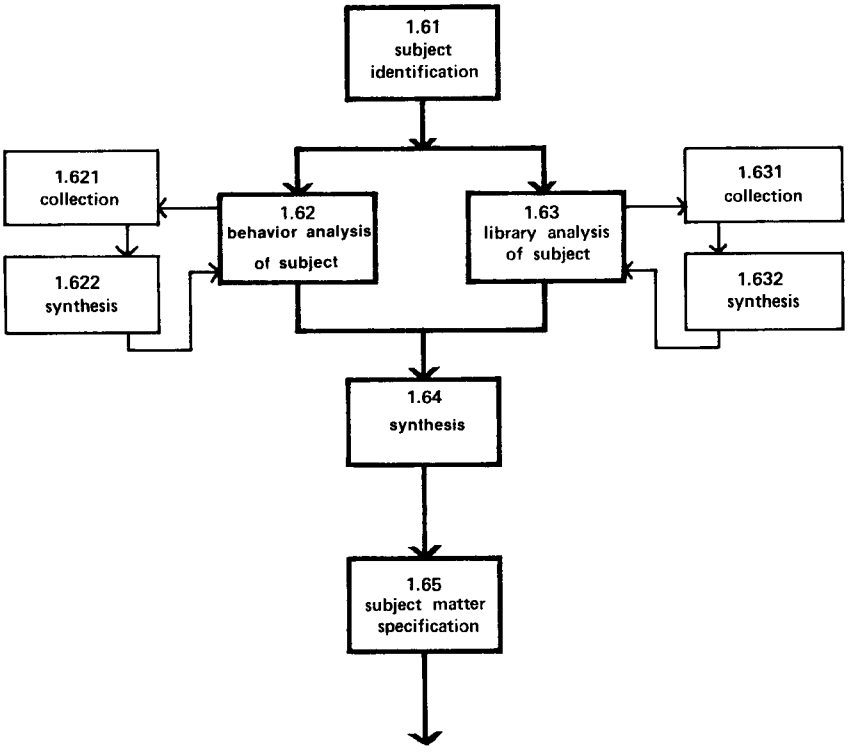

Figure 2. Subject matter analysis—1.6.

"Library Analysis 1.63", on the other hand, utilizes all that is written about the subject matter. Card catalogs, indexes, and computer searches are typical retrieval methods for the textbooks, journals, articles, monographs, and existing training materials. Again, the experts that were interviewed expressed general satisfaction in the library analysis collection tools that they had at their disposal.

Synthesis within the SMA model (see 1.622, 1.632 and 1.64 of Figure 2) requires answers to tough questions such as: What does it all mean? What pieces are good? What pieces are bad? How do the pieces fit? Without a doubt, so said the experts, synthesis is the most difficult aspect of SMA. The curious finding from the data analysis of this study was the heavy reliance that individual experts had on a single powerful information processing technique that they applied to most of their problems. It is the purpose of the following pages to overview the techniques that the experts sampled in this study relied upon in their synthesizing efforts.

Parts of the Model

The information synthesis techniques that emerged were identified and categorized. They include the following:

1. Two-Axis Matrix
2. Three-Axis Matrix
3. Information Processing Flowchart
4. Program, Evaluation, Review Technique (PERT)
5. Graphic Modeling
6. Dichotomy
7. Argumentation
8. Introspection

It was found that seven of the eight synthesis methods that emerged allowed this investigator to capture the technique on a paper form or worksheet to aid subject matter analysts. One sub-group of the experts was unable to describe what it is they did when synthesizing information other than report such actions as "to sit and think," "get away and think," "curl up, turn out the lights, and noodle it out." While they may in fact be expert, their technique doesn't go beyond the advice to make the time and take the time to think. One might argue that given our hectic lives, those that followed this advice would automatically catapult to a higher level in synthesizing subject matter. This method was labeled "Introspection" and is Number 8 on the list.

Worksheets for items 1-7 on the list were designed as process aids in carrying out subject matter synthesis. Otherwise, it is expected that training and developing personnel that have been informed of the 7 methods and have worksheets for each available at their desk would utilize them in their work. In this vein, each of the worksheets will be discussed.

The Two-Axis Matrix Worksheet, shown in Figure 3, captures the most prevalent technique used by experts in valuing masses of information for the purpose of selecting or synthesizing. Many put their two-axis information on grid

paper, a chalkboard, and/or easel pad. A few experts reported constructing two-axis matrices in their heads and their ability to run across the rows or down the columns to retrieve information. As an example of a two-axis matrix one can easily see management job titles on the vertical axis and job activities on the horizontal axis. Completion of the matrix then yields commonalities, differences, interactions, voids and patterns. The two-axis matrix is useful for managing a mass of information within two major variables with each having several sub-categories.

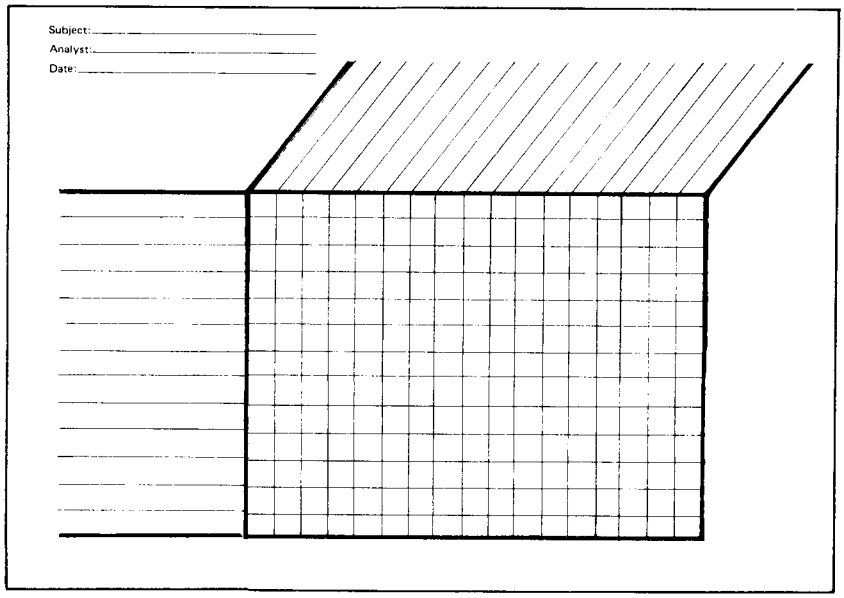

Figure 3. Two-Axis matrix worksheet—subject matter analysis.

The Three-Axis Matrix Worksheet, represented by Figure 4, does not have the flexibility or familiarity of the two-axis matrix, but can be applied to more abstract concepts or issues. The experts that utilize this model were judged to be more visual. An example of the application of the three-axis model would be to analyze the change that would result from alternative work functions, equipment needs, and type of employee retraining. The sub-components of each of the three

areas would be entered on their respective axis. The individual cells produced by the many interactions would provide a powerful method of breaking down a very complex subject into workable units. In stepping back one could also view the three-axis matrix as slices of horizontal and vertical two-axis matrices for analysis purposes.

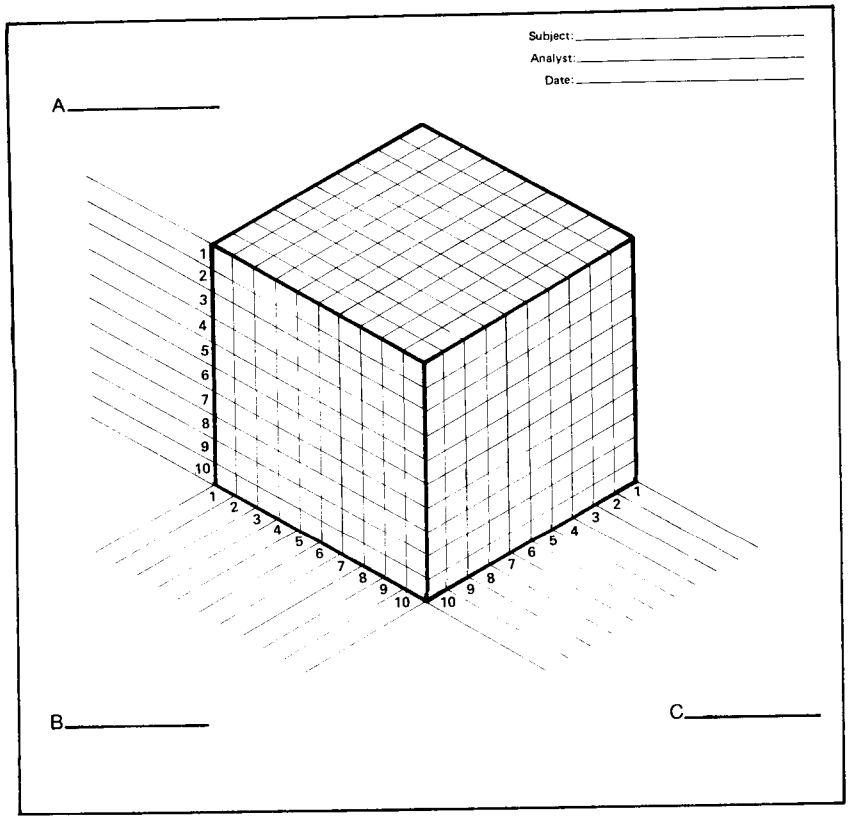

Figure 4. Three-Axis worksheet—subject matter analysis.

Within the sample of experts there was a group that could be considered process oriented. Whether it be a machine, a decision, or counseling an employee, they tended to synthesize information through a process model. Figure 5, the Information Processing Flowchart Worksheet, was used to capture this perspective and it portrays standard flowcharting procedures. If one were to categorize subject matter as being dynamic or static, dynamic subject matter would probably be best synthesized through flowcharting. Flowcharting can be used to mentally and visually "walk through" or test-out specific concepts.

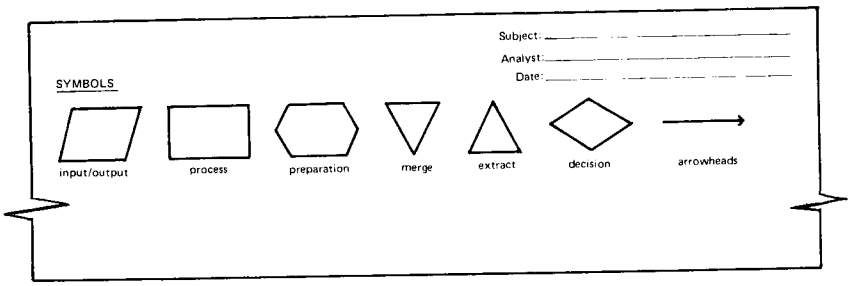

Figure5. Information processing flowchart—subject matter analysis.

With an objective in mind and no clear process at hand, analysts could rely on the Program, Evaluation, Review Technique Worksheet (PERT), shown in Figure 6, as a means of synthesizing a great deal of information. Unlike flowcharting, in which the process can be easily drawn out from the sub-conscious or extracted from existing practice, PERT lends itself more to what can be rather than what is. The commonalities between flowcharting and PERT are superficial. The reliance on one or the other as an analysis tool appears to be somewhat revealing of the overall personality of the analyst. From interviewing the expert analysts one is tempted to generalize that both are tools of realists, but that flowcharting is more likely the skeptic's tool and PERT, the tool of the optimist. PERT is an assertive tool that claims to result in an identified goal, a breakdown of the work, the events, activity leading to the events, and their relationships.

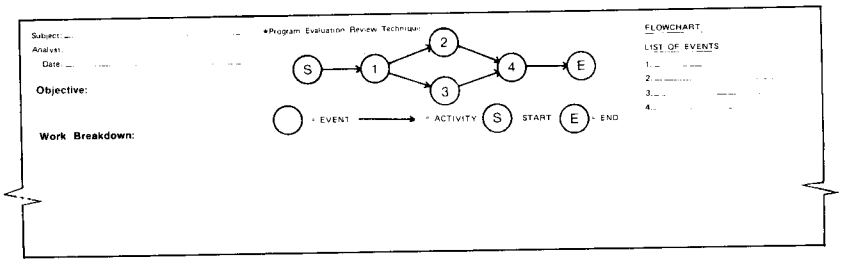

Figure 6. PERT* Worksheet—subject matter analysis.

Figure 7, the Graphic Modeling Worksheet, illustrates four of the visual techniques used by the experts. Some of the techniques revealed by the experts bordered on doodling, as though one's racing mind was dragging the pen about the

paper. The linear modeling described by one expert was the linking of carefully selected key words in a logical order. In his case each was circled and lines drawn to illustrate connections.

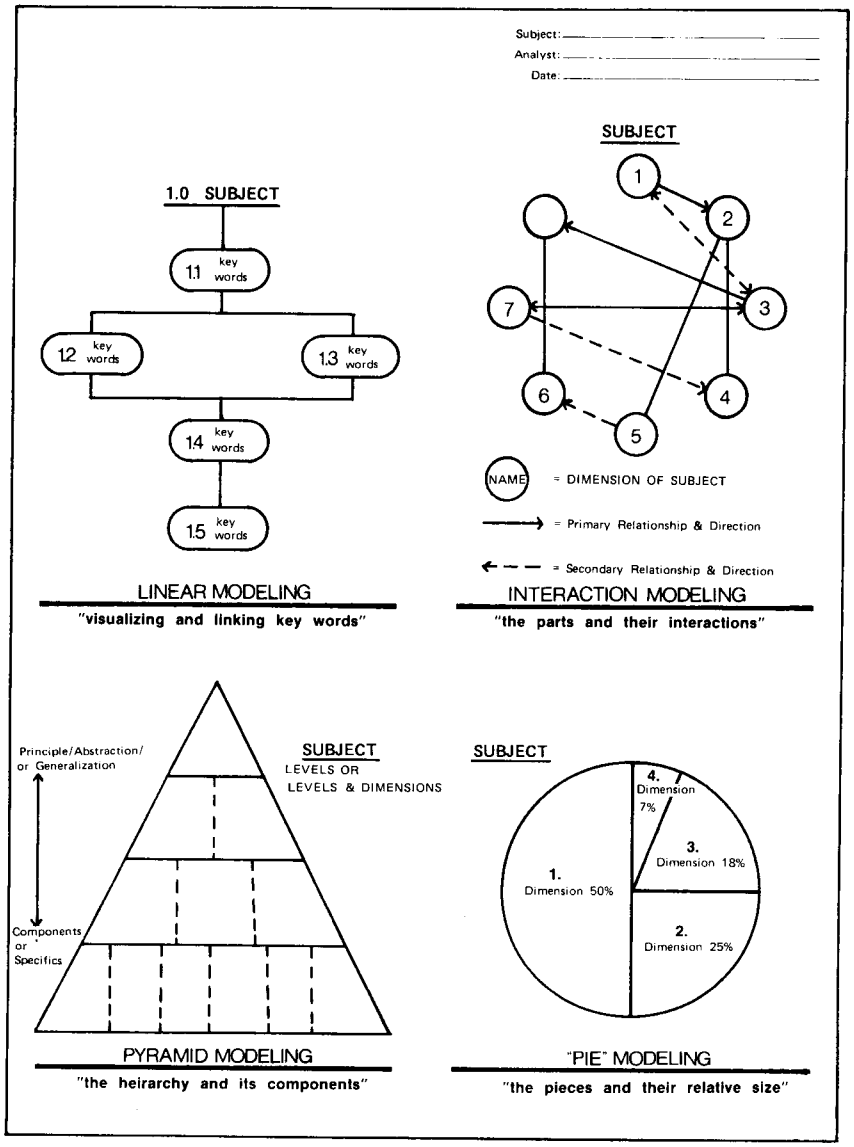

Figure 7. Graphic modeling—subject matter analysis.

The interaction model portrays a much freer style. First, the parts or dimensions of the subject matter are identified. They are organized like satellites in a common orbit. Each is labeled and the interactions between the parts are graphically portrayed with arrows. For example, one could think of employee performance appraisals and the many dimensions of the situation. Included among others might be the direct supervisor, co-workers, work tasks, and work environment. Through interaction modeling one comes to see other perspectives or sources of information.

Figure 8, the Dichotomy Worksheet, represents a technique utilized by one of the experts interviewed. His technique was simple but powerful. In this method each issue is divided into a good-bad or more-less dichotomy. Each extreme is then carefully defined and analyzed. Extracted from the process is a clearer perspective of the complex issue. For example, one might talk about management skills by taking the position that there are good managers and there are bad managers. Exactly what is a good manager? A bad manager? Carefully defining the extreme terms can bring focus to a very complex issue.

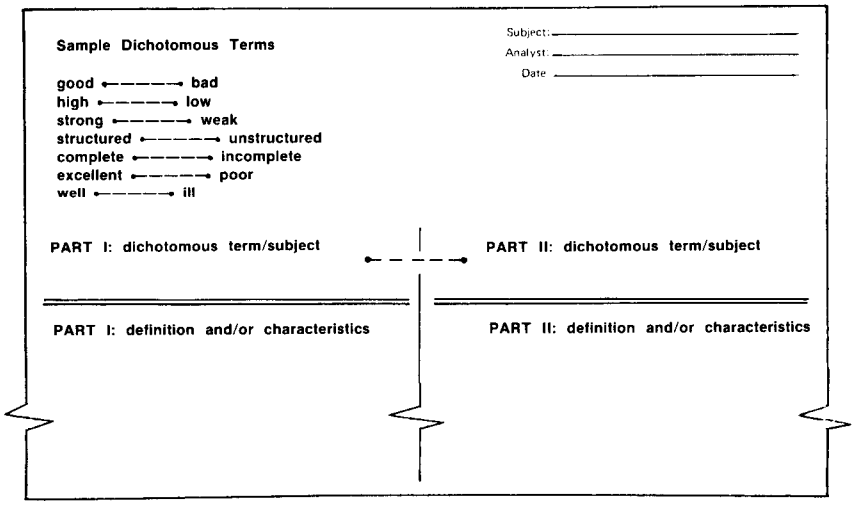

Figure 8. Dichotomy worksheet—subject matter analysis.

Figure 9, the Argumentation Worksheet, illustrates another strategy used by several of the experts. In some ways it yields output similar to the black-white method. Argumentation first requires the posing of a hypothesis and supporting logic. Second, it requires that the person disengage from the hypothesis and become the best possible critic of that hypothesis. This argumentation, then, becomes the test of the synthesis of knowledge. Hoisting the hypothesis before a group of critiquing peers is also a part of argumentation.

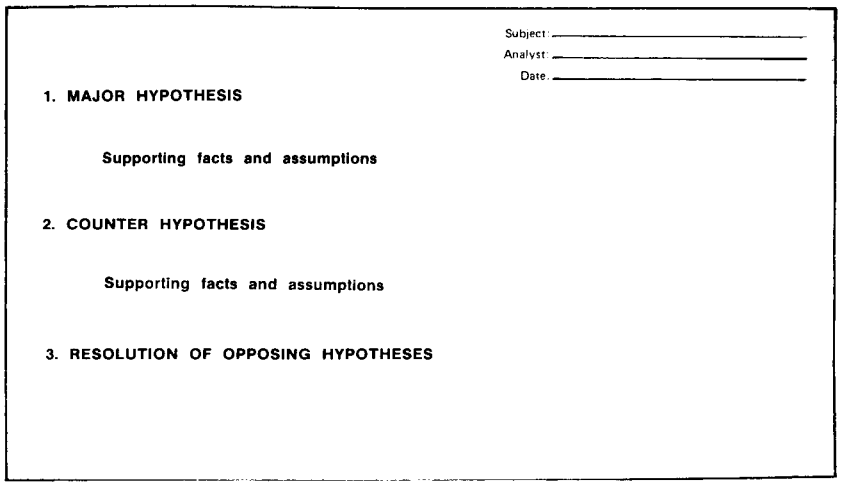

Figure 9. Argumentation worksheet—subject matter analysis.

These seven techniques, all grounded in common sense and the world of the practical, provide a repertoire of subject matter synthesis methods for persons in the field of training and development.

Discussion

It was the purpose of this study to develop a better understanding of the process of analyzing non-observable work behavior and to develop a system for subject matter analysis (SMA).

The SMA model and the specific information collection and synthesis techniques discussed in this article have been taught to several groups of management trainers. The in-class SMA performance of these management trainers has been very good as has been their receptivity to the synthesis techniques. While this has been encouraging, a more highly structured SMA training experience with a comprehensive and valid evaluation component is a needed and natural follow-up to this research effort.

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