

White Paper:
Sense-Making and Knowledge Collaboration Tools¹

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Summary: A new class of intelligence problems, “wicked situations,” demands a new approach to intelligence analysis which includes tools for sense making and collective intelligence. This paper describes a family of tools and methods, Compendium, which offers this capability. This paper has seven sections: Introduction, The Challenge, Compendium, Experience and Expertise, Resources, Relationships, and References.

INTRODUCTION

Coping with fragmentary information is a particularly compelling challenge facing the Intelligence Community today as it focuses on the inherently tough nut of terrorism. Tools that help intelligence analysts, intelligence collectors, and law enforcement specialists gain the fullest understanding of the hidden meanings in the limited information we have are essential. So too are tools that help the array of subject matter experts understand the strengths and weaknesses of the various “ints” in evaluating this complex set of issues, and that help representatives of the superset of departments and agencies working these issues overcome their organizational cultures

¹ A more detailed version of this white paper with references, *Making Sense of Fragmented Information*, is available at <http://www.cognexus.org/makingsense.pdf>.

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and communicate effectively. These people need tools that give them perspective – that help them achieve an integrated sense of what is known and what remains unknown.

We do not need to make people smarter -- we have the best and smartest people in the world. We do not need to give them more information -- there is plenty of information already, and intelligence analysis failures are almost never due to a lack of information. What is missing are the *cognitive tools* that would help smart people efficiently collaborate about what they know, develop and test theories that make sense of massive and conflicting information, and create compelling and accurate analysis products.

There is such a cognitive tool, *Compendium*, which facilitates substantive discussions, helps identify gaps and action items for follow-up, and leaves behind a record of the meeting so that the next meeting can build on it, not rehash old issues. Compendium is inherently well suited to dealing with issues where there is no objective problem definition but there are a lot of interpretations, there is no right answer but there are lots of tentative next steps, and information we do have ages rapidly. Compendium is based on the concept that collaboration among those who understand the issues generates a richer, more robust product for our customers than if we all work in our stovepipes.

Compendium is a family of communication techniques and computer support tools for knowledge collaboration. Part of Compendium is a facilitation approach to synchronous (generally face-to-face) meetings that focuses the group on the collaborative construction of multi-dimensional models. Another part of Compendium is off-line refinement of these models and semi-automatic production of customized reports which are essentially specialized “views” of the hyperbase (hypertext database). This unusual integration of synchronous and asynchronous collaborative activity provides *value now and value later*.

THE CHALLENGE

It is now clear that US national security depends on our developing a vastly greater capacity to analyze complex and dynamic situations. These “**wicked situations**,” which have elsewhere been described as “wicked problems,” (1) have characteristics which make them different from earlier, more linear problem solving and analysis situations:

- There is *no objective problem description*. The situation can be viewed from many perspectives, and each perspective has its own set of interlocking issues. “There is no agreement on the problem or its solution.”
- No one person has, nor can have, all of the relevant fragments of information. Not only does the information come from a wide variety of sources, each of which has its own biases and credibility factors, but the way in which the information is encoded, represented, and presented is a matter of *interpretation*.
- Decisions, solutions, and responses to the wicked situation are always tentative and *interim*. Actions must be taken, but such actions primarily serve to illuminate concealed aspects of the wicked situation, not necessarily to resolve or conclude the problem.
- “*Information rot*” is a significant factor. Some kinds of information, such as the location or description of a person or vehicle, lose validity over time. The faster information fragments can be brought together and synthesized, the more likely the fragments can be fit together into an accurate and coherent theory.

Whether the information fragments come from electronic sources, human sources, automatic analysis engines, or human analysts, the foremost challenge is bringing all of the pieces together into one coherent space and piecing them together into a few compelling theories (interpretations). Therefore, analysis of a wicked situation is, above all, a *collaborative* effort whose success hangs on the “collective intelligence” of a group of analysts and experts (2, 5). Individual analysts can have important insights; they may even have their own theory about how

it all hangs together. But, in the current environment, with huge numbers of fragmentary pieces of evidence and information and immense complexity of possible links between them, only analysts and other experts working at the highest levels of *intellectual teamwork* can possibly create accurate and actionable theories about a wicked situation. While computers must help us gather, search for, and filter information, *only well-informed humans working together can make it make sense*. Compendium closely integrates with automatic and semi-automatic search, filtering, and reasoning approaches, using them to *augment* human reasoning and sense making.

COMPENDIUM: COMPUTER-AUGMENTED COLLABORATIVE MODELING

Hypertext can be an immense aid in this analysis and synthesis process, because it is a technology ideally suited to combining many fragmentary bits of information into models, maps, and diagram. We are not referring to the kind of hypertext represented by the World Wide Web, however; we are referring to a kind of “graphical hypertext” (exemplified by such tools as QuestMap and Compendium², see Figure 1) which has the following properties:

- The primary browser shows the *network*, not the node. Nodes may be created and edited, but the main interface presents a visual map or diagram of the hypertext network to the user(s).
- The process of creating, editing, linking, and indexing nodes is extremely *fast* and lightweight – the system behaves like a word processor for diagrams.
- The system supports advanced linking capabilities, such as “*transclusive links*” (which allow a single node to be embedded in any number of alternative maps or views).

The key to knowledge collaboration – to making sense of large amounts of fragmentary information – is to combine a *collaborative approach* with *hypertext tools* via a “shared display” computer projector and a skilled operator/facilitator.

² Formerly called “Mifflin”

This approach owes its power to several familiar elements:

- Over 60% of human cortex is *visual cortex*. A high proportion of human cognition is visuo-spatial, and dynamic maps and diagrams projected on a display screen naturally allow visualization of large amounts of information and complex relationships.
- The *linkages* are as important as the chunks of information.
- The process is highly *interactive*. As the group discusses the information and possible theories in a meeting, the operator captures key elements of their interaction, putting them into the dynamic hypertext map, and validating and elaborating points with the group (2,5).

The meeting process itself produces a product.

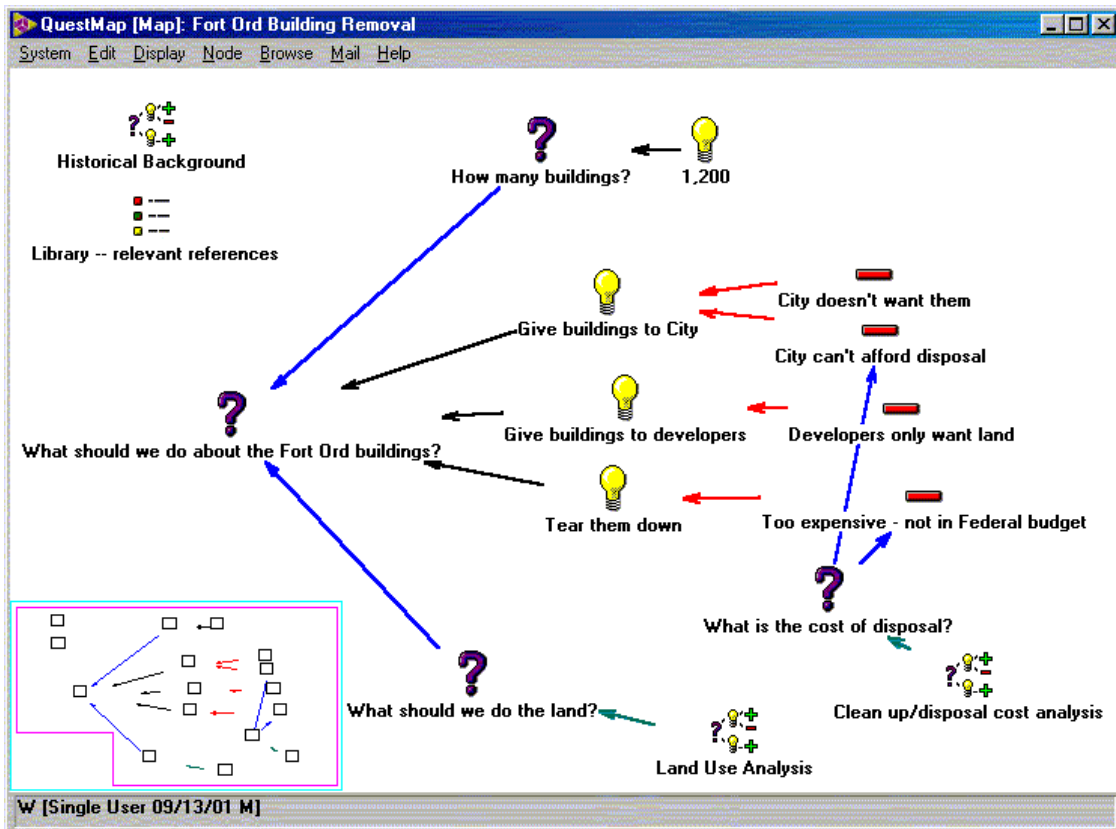


Figure 1: Screen shot of browser-oriented graphical hypertext system

- The approach creates an effective *group memory* for a network of analysts and experts.
- The approach exploits several light-weight *formalisms*, principally IBIS, which provide flexible but disciplined structure for the linkages and models.

- The use of a skilled facilitator/practitioner *removes the burden* of learning new methodologies and interfaces from analysts and other expert participants, leaving their energies focused on applying their skills and expertise to the intelligence problem at hand.

Compendium is a family of tools and methods (see Figure 2). It includes the Dialog Mapping method, which is a *facilitation technique*. The Compendium software is an offspring of QuestMap. IBIS (Issue Based Information System, (3)), the foundation for the whole approach, is a rhetorical grammar (explained below).

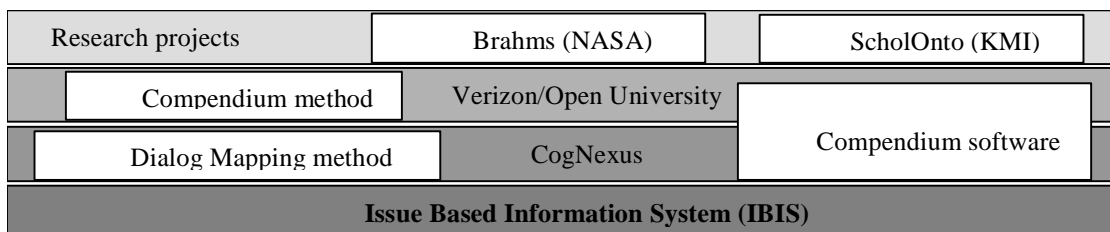


Figure 2: The Compendium family of tools and methods

This “Compendium” approach and members of its family such as Dialog Mapping have been successfully used in hundreds of system design and problem solving settings (4). Dialog Mapping uses IBIS to capture and collaboratively explore a discussion. Compendium expands on this by adding certain hypertext structuring techniques and an additional modeling formalism, the “World Modeling Framework” (2).

Compendium is both a tool and a service for knowledge collaboration. Part of Compendium is a technique for facilitation, especially for face-to-face meetings, that focuses a group on the collaborative construction of multi-dimensional models. Another part of Compendium is off-line refinement of these models both in terms of content and structure. A third part of Compendium is the semi-automatic production of customized reports which are essentially specialized “views” of the hyperbase, as well as automatically importing complex documents into the hyperbase. This unusual integration of synchronous and asynchronous collaborative activity is captured in the Compendium slogan, “*Value now and value later.*”

One key difference between Compendium and other collaborative support systems for analysis is that Compendium specifically targets *synchronous interactions*, often face-to-face meetings, as the highest leverage setting for collaborative sense making. The information that is brought to the meeting will come from a variety of experts, tools, and documents. Before the meeting a high level of analysis, theory building, and sense making will naturally have already taken place. Nonetheless, in the process of committing to an interpretation or theory about the wicked situation, and committing to an action or recommendation in response to it, there is no substitute for eye contact, body language, voice tone, and all of the other characteristics of real-time personal interaction³. To these face-to-face meetings Compendium brings an effective augmentation of collective intelligence – a power tool for sense making and crafting shared commitment.

EXPERIENCE AND EXPERTISE

CogNexus Institute has over a decade of experience in both research and practical application of *cognitive tools* for structured argumentation and analysis of complex and dynamic problems known as “wicked problems.” Dr. Conklin, the Director, is a pioneer in the fields of hypertext and groupware, and has brought those fields together to create tools and methods which help individuals and small groups to efficiently share diverse and conflicting knowledge, visualize and model complex relationships, and rapidly produce theories.

At the heart of this approach is the structured argumentation system Issue Based Information System (IBIS). IBIS is a rhetorical “grammar” which defines the basic elements of all analysis and design. IBIS consists of three basic elements, Questions, which pose a problem or issue, Ideas, which offer possible solutions or explanations to the Questions, and Arguments, which

³ For some less critical kinds of interactions, the group members do not need to be collocated – “virtual meeting” technology has come a long way in the last few years.

state evidence, facts, and viewpoints that either support or refute Ideas. The power of IBIS stems from three properties: it maps complex thinking into arbitrarily large *structured* analytic maps; it is based on asking the right *questions*; and it is simple and intuitive enough to be learned and used with *minimum cognitive overhead* (making it an ideal cognitive encoding formalism).

Dr. Conklin is internationally known as the leading expert in using and teaching IBIS and IBIS-based software tools. He met and worked with the inventor of IBIS, Horst Rittel, in the 1980's. He designed the first graphical hypertext software for creating IBIS networks, "gIBIS," at MCC in the late 1980's. In the early 90's he founded a software company and created the first and only commercial IBIS system, "QuestMap™." For the past eight years he has been applying IBIS to analyses of complex and dynamic problems in government and commercial organizations, including the United Nations, the World Bank, and many branches of the US military. Several groups from the DI at the CIA have participated in his workshops, and several DI analysts use the QuestMap™ tool.

RESOURCES

Experience has shown that, although IBIS is simple enough to learn in a few minutes, effective application to complex problems is a skill, comparable to speaking a language or playing a musical instrument. The immense power of IBIS for augmenting the analytic process, then, depends on the capacity to efficiently teach this skill. Dr. Conklin teaches a two-day "*Dialog Mapping Workshop*" that is designed to rapidly transfer IBIS fluency to a wide variety of learners. This highly-acclaimed workshop is the only IBIS skills training in the world. Dr. Conklin also teaches the "Compendium" approach.

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Dr. Conklin is an expert in the fields of hypertext modeling and collaborative technology (i.e. groupware). He is currently teaching an advanced degree course on *collaborative technology* at George Mason University (MNPS 703), where he is an adjunct faculty member.

Dr. Conklin has nearly completed a book, *Dialog Mapping: Making Sense of Project Fragmentation*, which distills 15 years of experience with using IBIS on complex, non-linear, dynamic problems. Draft copies of the book are available immediately.

Dr. Conklin is expert in the use QuestMap™ and Compendium, the two major software tools for IBIS modeling and analysis.

RELATIONSHIPS WITH OTHER ORGANIZATIONS

Dr. Conklin has close ties, including co-authored papers, with the researchers (principally Al Selvin) at Verizon Communications who have, over the past decade, developed the Compendium approach. CogNexus Institute is the distribution outlet for Verizon's "Compendium" software tool (pending).

Similarly, Dr. Conklin has worked with and co-authored papers with a scientist at NASA (Dr. Maarten Sierhuis) who is building agent-based simulation methods using IBIS and Compendium tools and methods.

Dr. Conklin has also collaborated with Dr. Simon Buckingham Shum, at the Knowledge Management Institute of the Open University (in the UK), on research combining "structural computing" with IBIS and Compendium to automate discovery of new knowledge.

CogNexus Institute also has close ties to Touchstone Consulting Group, a Washington, DC based consulting and facilitation firm that provides Compendium practitioner services.

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