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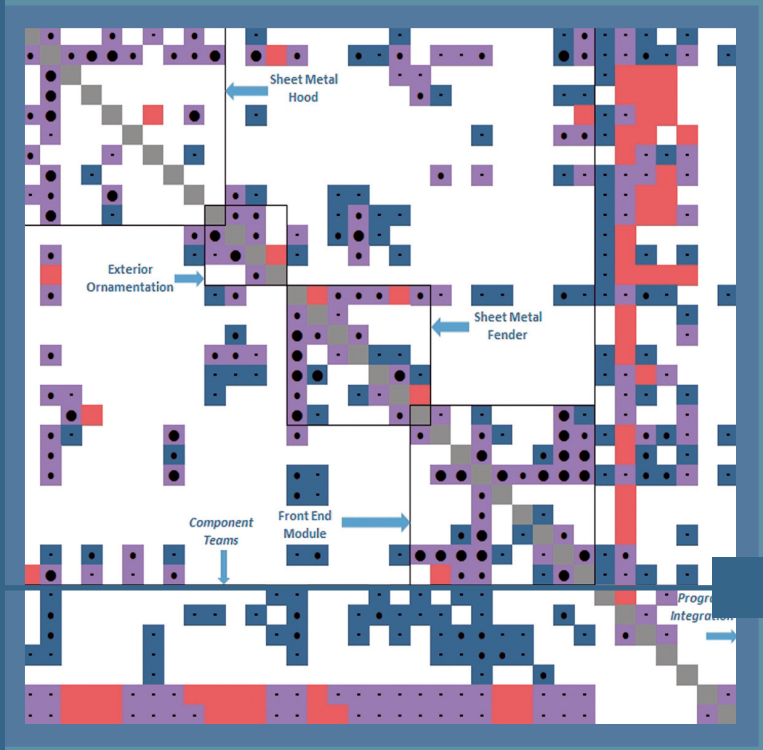
Modeling and managing complex systems

Proceedings of the 17th International DSM Conference
Fort Worth (Texas, USA), 4-6 November 2015



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Tyson R. Browning
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(editors)

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The Editors:
Tyson R. Browning
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Danilo Marcello Schmidt
Udo Lindemann

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Foreword

Welcome you to the 17th annual International Dependency and Structure Modeling (DSM) Conference. The 2015 conference is hosted by the Neeley School of Business at Texas Christian University (TCU) in Fort Worth, Texas, USA, November 4-6. It is organized in collaboration with Technische Universität München (TUM).

This year's theme is "Modeling and Managing Complex Systems." Complex systems pervade our products, processes, organizations, projects, and environment. Modeling them can lead to valuable insights about their structure and behavior, which in turn can increase our understanding and capability to manage (or at least co-exist with) such systems.

The design structure matrix has proved useful for modeling, analyzing, visualizing, and understanding complex systems. Over the last 25 years in particular, DSM researchers, practitioners, and software developers have designed and enhanced many varieties of DSM methods, tools, and applications. That work continues at this conference and in these proceedings.

The International DSM Conference provides an annual forum for practitioners, researchers, and developers to exchange ideas and experiences and showcase results and tools. This year's conference begins with two parallel sessions the afternoon of November 4. The first of these is a DSM Industry Special Interest Group (DSMiSIG) meeting, where industry participants will discuss the challenges of complex systems in their particular arenas and opportunities for DSM models and tools to support improved engineering and managerial decisions. The second of these is an introductory tutorial for those new to design structure matrix methods and models.

Each of the papers submitted for this year's conference was peer-reviewed by at least two members of the Scientific Committee, who made acceptance/rejection recommendations and provided helpful guidance for revisions. The accepted papers appearing in these Proceedings have each been improved based on that feedback.

This volume contains 24 peer-reviewed papers that describe the recent advances and emerging challenges in DSM research and applications. They advance the DSM concepts and practice in seven areas:

1. DSM Methods and Complexity Management
2. Analyzing and Managing Organizations, Teams, and Individuals
3. Project Management
4. Managing Failures and Risks in Complex Systems
5. Modeling Functions and Functionality of Complex Systems
6. Process and Change Management
7. Systems' Architectures and Modularities

These Proceedings represent a broad overview of the state-of-the-art on the development and application of DSM. There are a significant number of papers with industry authors or co-authors, reflecting this balance and synergy between conceptual development and real-life industrial application, which are in the genes of the DSM Conference series.

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The International DSM Conference is an endorsed event of the Design Society.

Part I: DSM Methods and Complexity Management

DSM Foundations and Applications, and an Update on the Explainer
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17TH INTERNATIONAL DEPENDENCY AND STRUCTURE MODELING CONFERENCE, DSM 2015
FORT WORTH, TEXAS, USA, NOVEMBER 04 – 06, 2015

DSM Foundations and Applications, and an Update on the Explainer

Donald V. Steward

Problematics LLC, Napa, California, USA

Abstract: DSM can be used as an autonomous organization. It can also be used to manage risks. Frustrated and irrational people cannot solve problems, and when people cannot solve the problems that adversely affect them, they become frustrated and irrational. To escape this trap, it is necessary to solve the problems that got people into this trap. The Explainer can be used to extend people's limited capabilities to solve such complex problems. It can be used to find explanations for specific behaviors. And it can also be used to design systems to satisfy a given behavior by turning an explanation for the behavior into the design. Examples are shown for how the Explainer can be used to shed light on how to solve problems that befuddle Congress and cause such animosity and useless squabbles.

Keywords: Autonomous organizations, risk management, problem solving, frustration and irrationality traps

1 DSM as a new paradigm

In modern enterprises people must work together to solve problems. This problem solving process involves internal communications that go on within each head and external communications that go on between heads.

In the past, problems were generally solved by a reductionist approach that assumed that large problems could be broken down into smaller problems. This breakdown structure took the form of a tree. This has led to the familiar hierarchical organization.

But now DSM is a new paradigm that works from the structure of the information flow inherent in the problem (Steward, 1981a & 1981b). DSM has made it clear that the information flows required to solve many of today's complex problems don't have a simple tree structure. The DSM is a non-reductionist approach where the communications involve information flows that don't take a tree structure.

The reductionist approach assumes that a thing can be broken into parts and the parts broken into parts and so forth. It is based on interactions that occur by adjacency The DSM non-reductionist approach based on information flows involves assumptions and iterations to determine how things are put together.

2 DSM as an autonomous organization

It has been suggested by some that the organization be structured using the information structure revealed by the DSM. However, as the problem solving proceeds, we may learn more, causing our perception of that structure to change. And the problem itself may

change. But the organization is relatively static. It is not easy to change the organizational structure as quickly as our understanding of the structure of the information flow changes.

Instead of deriving the organizational structure from a DSM analysis, we should consider the DSM to be the organization.

The technical people are the best able to understand the information flow inherent in the problem. They, with the help of the DSM displayed on their desks can work as an autonomous organization. They are best able to manage the project with a minimum intervention from higher management.

By adding the status of each task to the display, each member of the team can see how and on whom they depend for the information they need to perform their task. They can also see who else depends on their task for the information to do their tasks. They can see the status of the process that will supply the information they need and have some gauge of when they can expect to receive that information.

Each member of the team can see when someone is struggling, is likely to be behind schedule, and needs help. They can then see that that person receives the help he needs.

There is still a need for management outside the autonomous team. Management's responsibility is to supply the resources that the autonomous team needs to do their work. And management may also be responsible for the interface between the team and the client. Otherwise, management's responsibility is largely to stay out of the way and let the autonomous team get on with their work.

Making the DSM be the autonomous organization seems obvious to me, and has undoubtedly been obvious to others as well. I would like to hear about your experience with using the DSM as an autonomous organization.

3 DSM and the management of risks

Assumptions are risks. The DSM can be used to constantly keep track of which assumptions have been resolved and which assumptions have not yet been resolved. Knowing what assumptions are still open is a measure of remaining risk. The strategy should be to resolve assumptions as quickly as possible to drive out the remaining risks.

Projects often fail because just when it is thought that the project is almost finished, it is realized that some assumptions have not yet been resolved. Then resolving these assumptions causes the project to take longer than originally planned. This should not occur when DSM is used to keep track of open assumptions all through the project.

4 The Explainer

The Explainer solves problems that can be stated as: Given a behavior and a set of cause-and-effects that includes those pertinent to the problem, find the various explanations for that behavior. An explanation consists of a Boolean function of assumptions using ANDs, ORs, and NOTs.