INCOSE Spring 09

A Pragmatic Complexity Framework

Joseph J. Simpson
Mary J. Simpson

Systems Concepts

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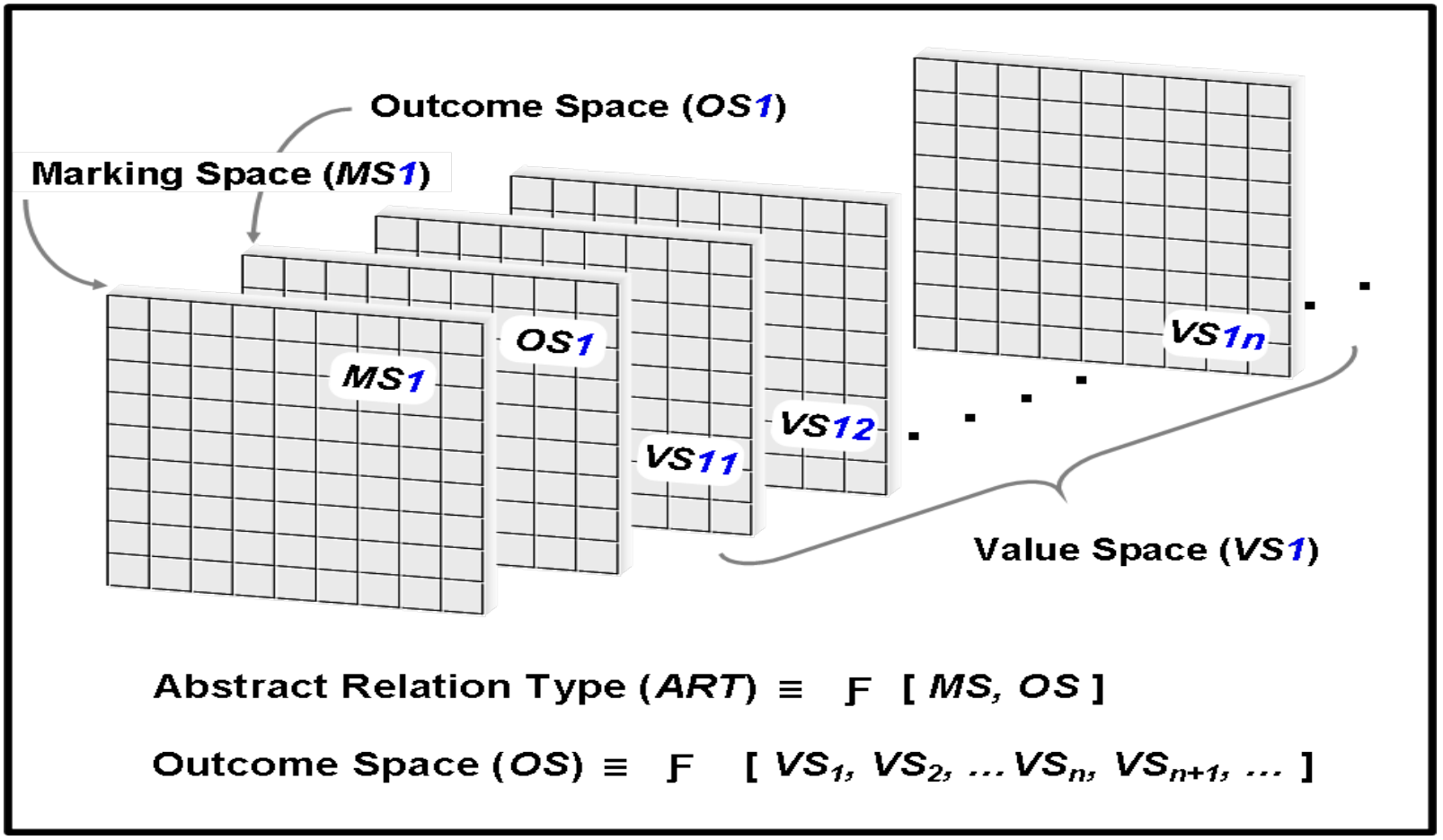
Introduction

- Definitions
- Assumptions
- Abstract Relation Types
- Warfield Relationships – Relations
- N-Squared Charts
- Design Structured Matrix
- Summary and Conclusions

Definitions

- Complexity – three basic kinds
- System – different views
- Relationship – real-world natural language relationship
- Relation – Mathematical relation
- Pattern – Specific encoding of a problem solution

Abstract Relation Type

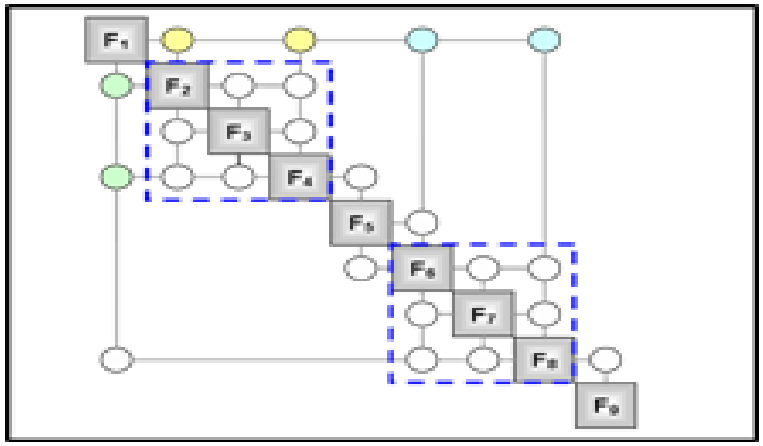


Relationship - Relation

- Science of Generic Design
- Natural Language Relationship (Meta-language)
- Mathematical Relation (Object Language)
- Relationship Types: Definitive, Competitive, Influence, Temporal, Spatial, Mathematical
- Relation – Universal, Reflexive, Transitive, Symmetric, Hybrid

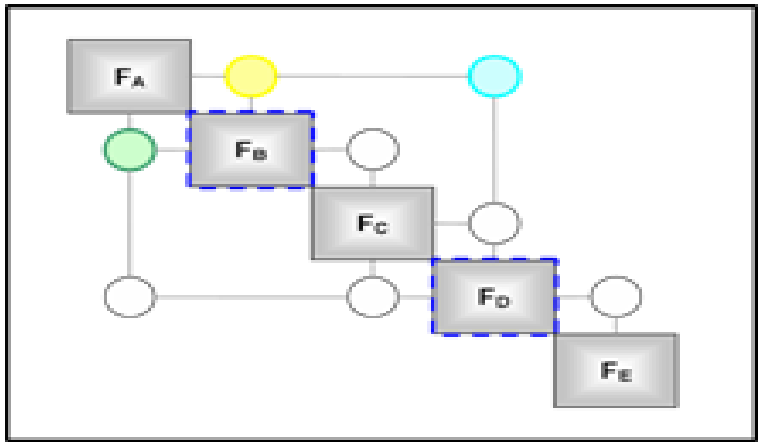
N-Squared Charts

Nine Functions and Twenty-three Nodes



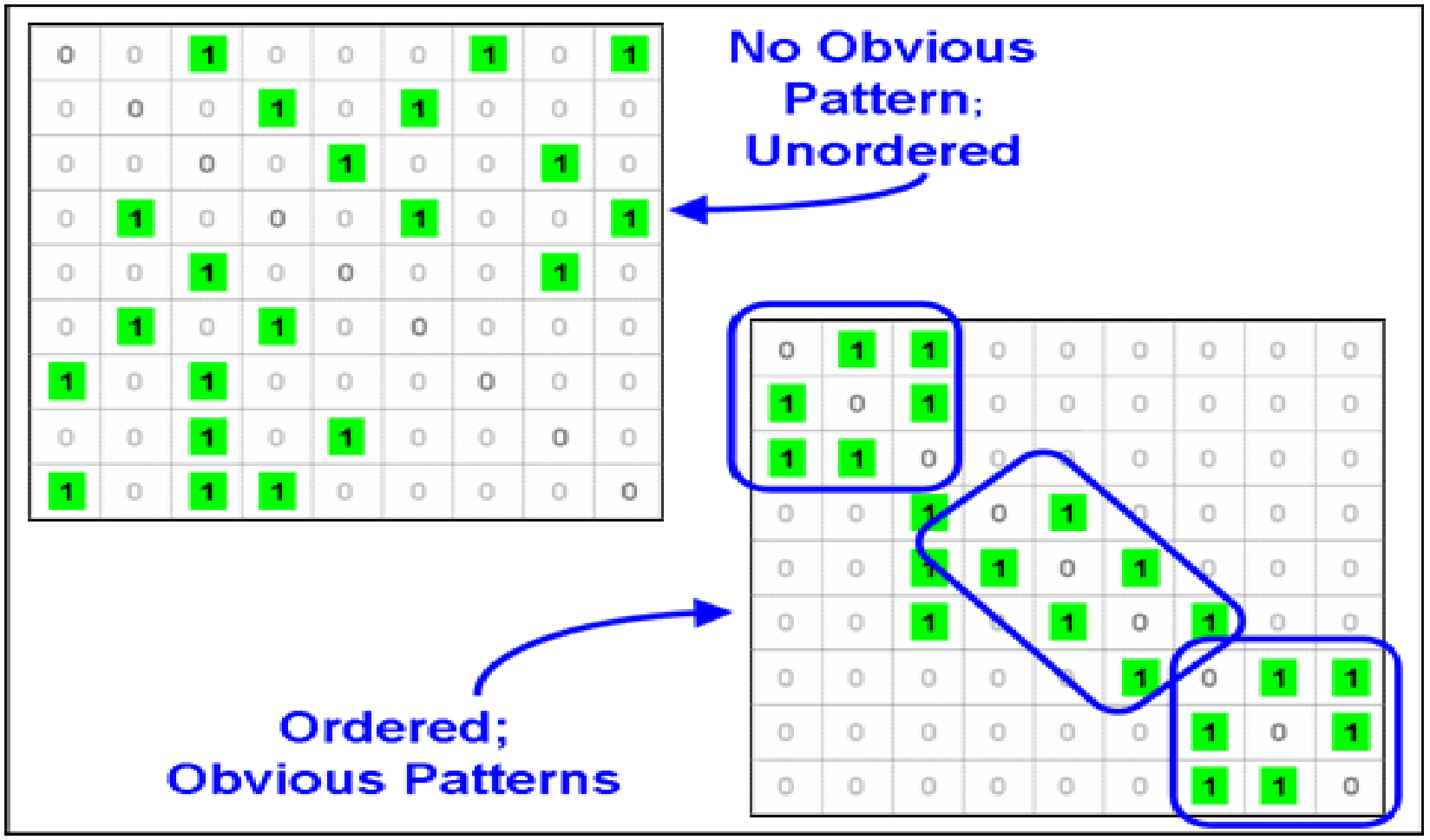
Five Functions and Eight Nodes

$F_A = F_1$
$F_B = F_2 + F_3 + F_4$
$F_C = F_5$
$F_D = F_6 + F_7 + F_8$
$F_E = F_9$



Adapted from Figures 2-17A and 2-17B in
A Technique for Software and Systems Design by R. J. Lano

N-Squared Charts



Design Structure Matrix

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Initial ART Marking Space

0	0	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	1	0	0	0	0	0	1
0	0	0	0	0	1	0	1	0	0	1	0
0	1	0	0	0	0	0	0	0	1	0	1
0	1	0	0	0	0	0	0	0	0	1	0
1	0	0	1	0	0	0	0	0	0	1	0
0	0	1	0	0	1	0	0	0	1	0	0
0	1	1	0	0	1	0	0	0	0	1	1
0	1	1	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1	1	1	0

Final ART Marking Space

0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0	0	0	0
0	0	1	1	0	1	0	1	0	0	0	0
1	1	0	1	1	0	1	0	0	0	0	0
1	0	0	0	0	1	0	0	0	0	0	0
0	1	0	0	0	1	1	0	0	0	0	0
0	0	0	1	0	0	1	0	0	0	1	0
0	0	0	0	1	0	1	0	1	0	0	0
0	0	1	1	0	0	0	1	0	1	0	0
1	0	0	1	0	0	0	0	0	0	0	0

Summary and Conclusions

- Abstract Relation Types (ART) represent a pragmatic method to address cognitive complexity.
- ART methods are based on classical systems engineering and management techniques.
- More research needs to be accomplished to develop an ART based systems engineering language.
- More research needed to address the area of computational complexity reduction.

Questions?

Joseph J. Simpson
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jjs-sbw@eskimo.com
mjs-sbw@eskimo.com