26th annual INCOSE international symposium
Edinburgh, UK
July 18 - 21, 2016

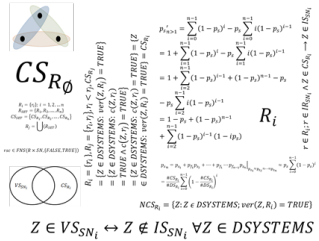
Painting Systems: From Art to Systems Architecture

Dr. A. Salado – Virginia Tech
Dr. L. Iandoli, Dr. G. Zollo – Stevens Inst. of Tech.

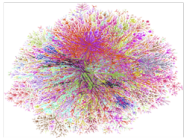
SE TRANSFORMATION LAB

Alejandro Salado

What are the **SCIENTIFIC** foundations of SE?



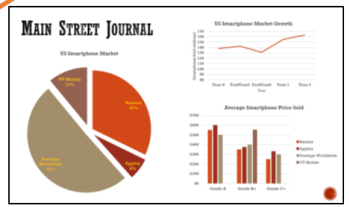
What can we **LEARN** from art, sports, food…?



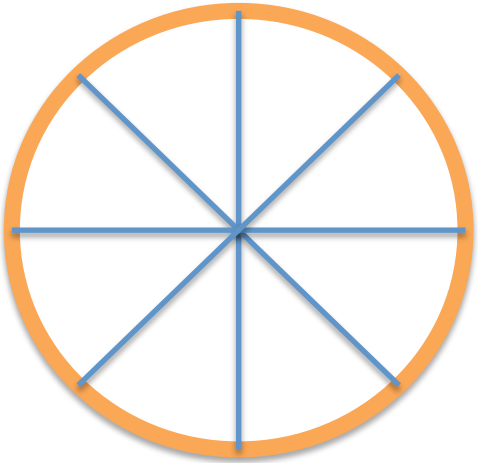
RIGOR

REALISM

SYNERGY



How do we embed **BEHAVIOR** in education?



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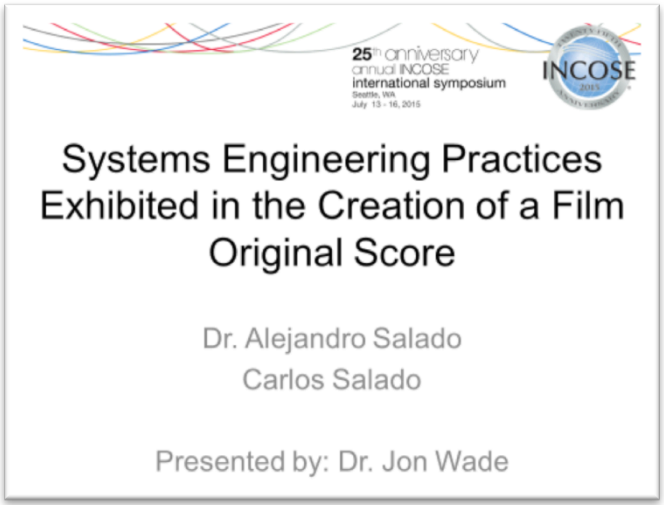
25th Annual INCOSE International Symposium (IS2015)
Seattle, July 13-16, 2015

Systems Engineering Practices Exhibited in the Creation of a Film Original Score

Alejandro Salado
Stevens Institute of Technology
asaladod@stevens.edu

Carlos Salado
Freelance Composer and Filmmaker
contacto@carlossalado.com

Abstract. Systems engineering has been successfully applied to a wide variety of industries, which include defense, space, energy, or transportation. All those systems have in common that they are engineered systems and/or socio-technical ones. Yet, systems engineering is considered both an art and a science. Therefore, could systems engineering be or have been applied in the domain of art, even if not done explicitly? Being one of the authors of this paper a systems engineer and the other one a music composer, this paper reports on the reflections of mutual discussions about how each of us of carried out our activities in our respective domain. Interestingly, it turns out that engineering a space system and creating a film original score abstractly follow the same set of principles and practices.



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10 APR 2015 CAMPUS & COMMUNITY

Stevens Students Draw Parallels Between Art and Complex Systems at MoMA

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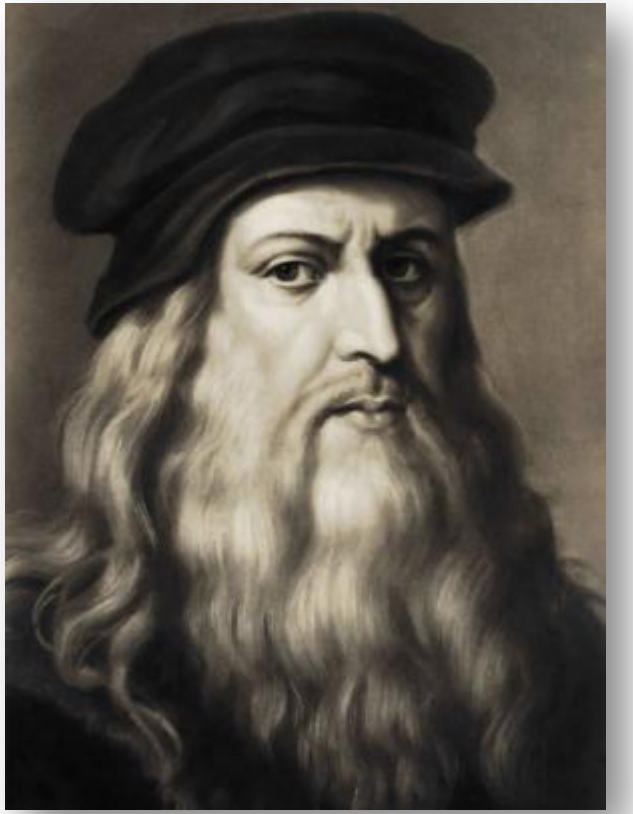
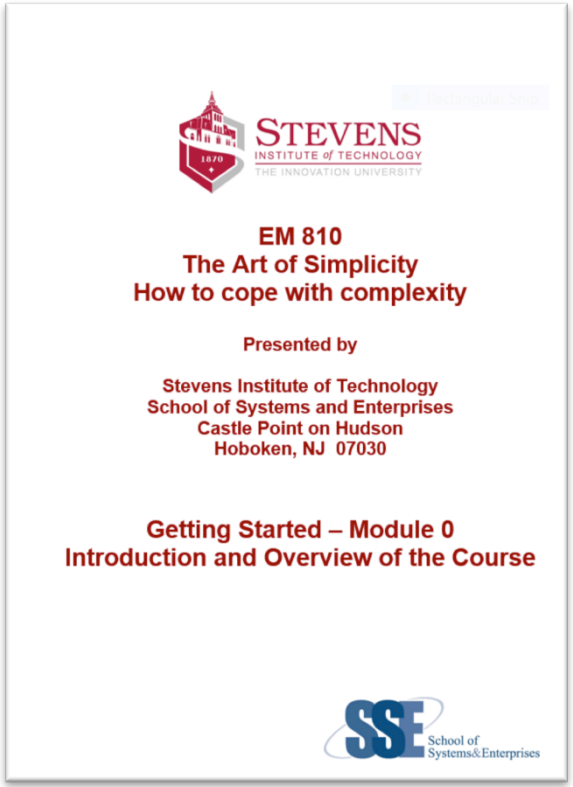
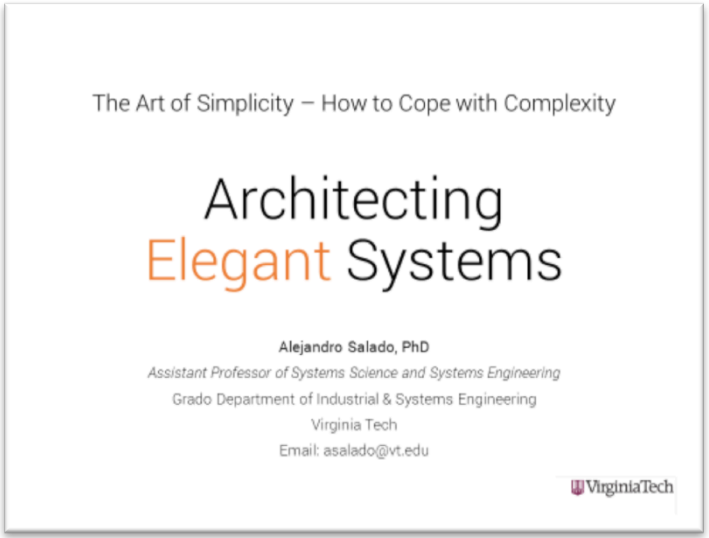
The Museum of Modern Art (MoMA) in New York City is not the usual venue for an engineering class. However, when the topic is complexity, whether it is in art, design, socio-technical systems or corporate organizations, a visit to MoMA can be quite illuminating.



Sources: http://www.customasapblog.com/wp-content/uploads/2011/11/da-vinci-alam_159842t.jpg


STEVENS
INSTITUTE of TECHNOLOGY
THE INNOVATION UNIVERSITY
EM 810
The Art of Simplicity
How to cope with complexity
Presented by
Stevens Institute of Technology
School of Systems and Enterprises
Castle Point on Hudson
Hoboken, NJ 07030
Getting Started – Module 0
Introduction and Overview of the Course
SSE
School of Systems&Enterprises


The Art of Simplicity – How to Cope with Complexity
Architecting
Elegant Systems
Alejandro Salado, PhD
Assistant Professor of Systems Science and Systems Engineering
Grado Department of Industrial & Systems Engineering
Virginia Tech
Email: asalado@vt.edu
VirginiaTech

An **ARCHITECTURE** is…

A technical strategy

Set of components and interrelations

Multidimensional

Beyond SysML or other

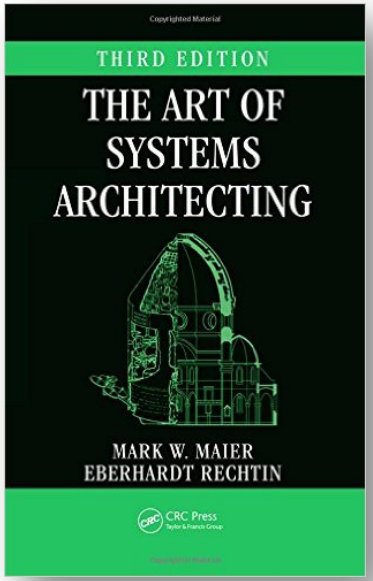
ARCHITECTING	A/E	ENGINEERING
Ill-structured	Constrained	Understood
Satisfaction	Compliance	Optimization
Heuristics	Both	Equations
Synthesis	Both	Analysis
Art & science	Art & science	Art & science

Source: Maier and Rechtin, 2009

Simplify. Simplify. Simplify.

Simplify, combine, and eliminate.

System structure should resemble functional structure.



The most reliable part … is the one that isn't there – because it isn't needed.

Complex systems will … evolve … if there stable intermediate forms.

Don't make an architecture too smart for its own good.

The eye is a fine architect. Believe it.

Never aggregate systems that have a conflict.

Aggregate around testable units; partition around logical subassemblies.

Choose low external complexity and high internal complexity.

A good solution somehow looks nice.

Build in and maintain options in the design.

Group elements that are strongly related; separate elements that are unrelated.

Poor aggregation results in gray boundaries and red performance.

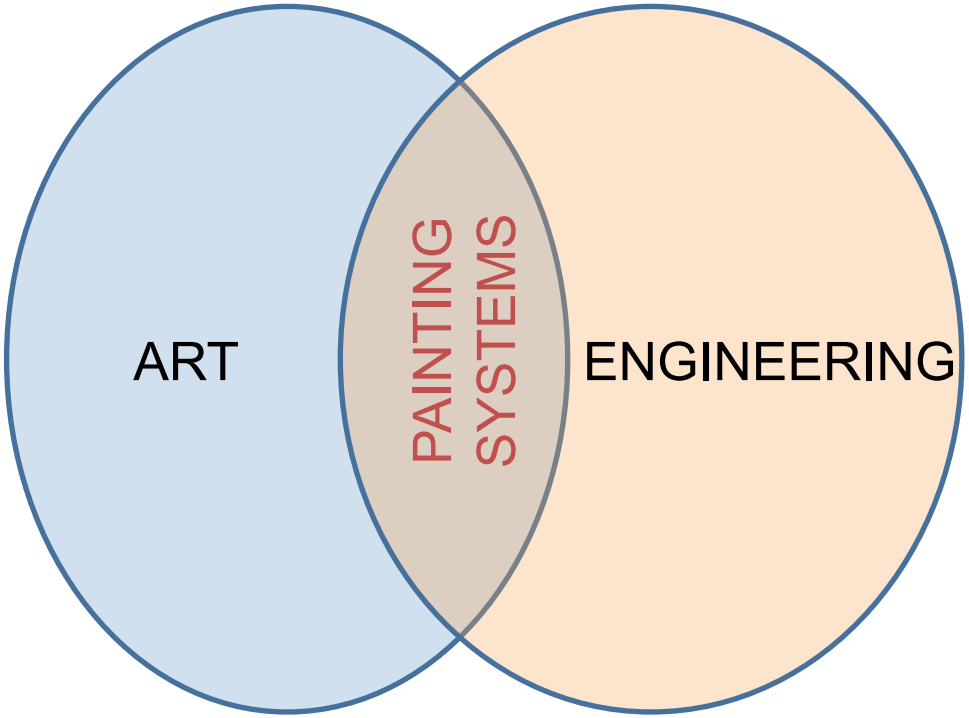
Don't slice through regions where high rates of information exchange are required.

Choose minimal communication between subsystems.

Design the structure with good bones.

?

Sources: http://4.bp.blogspot.com/_Osaxq-kFmqQ/TMkuBuUGoGI/AAAAAAAAADw/EAVVvz9c5mQ/s1600/Miguel+Angel+Buonarroti.jpg
And https://upload.wikimedia.org/wikipedia/commons/thumb/5/5e/Wernher_von_Braun_crop.jpg/250px-Wernher_von_Braun_crop.jpg



Make symmetries

Subtract

Group

Split

Contrast and balance

Focus

Reconnect

Emphasize

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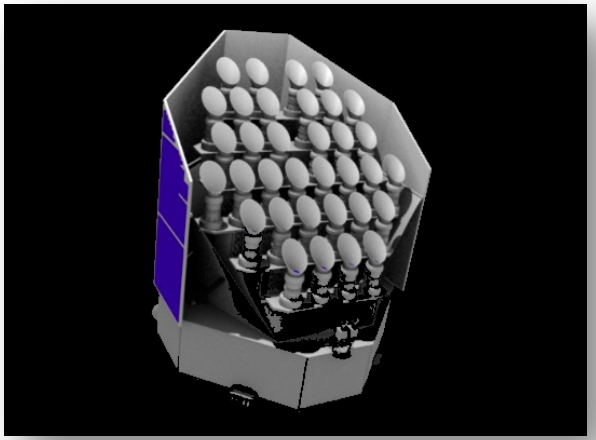
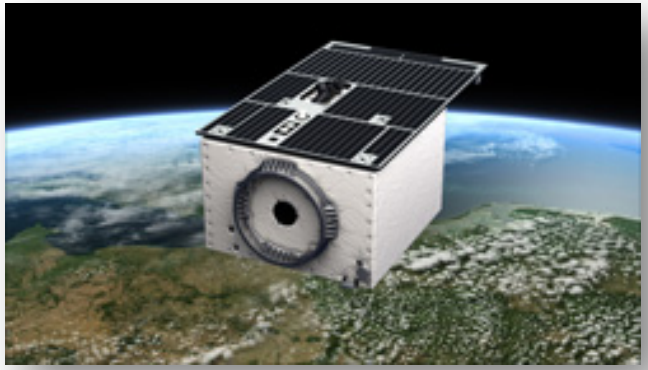
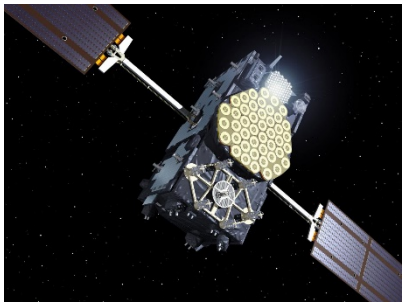
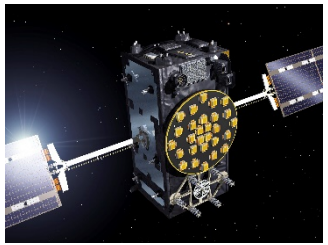


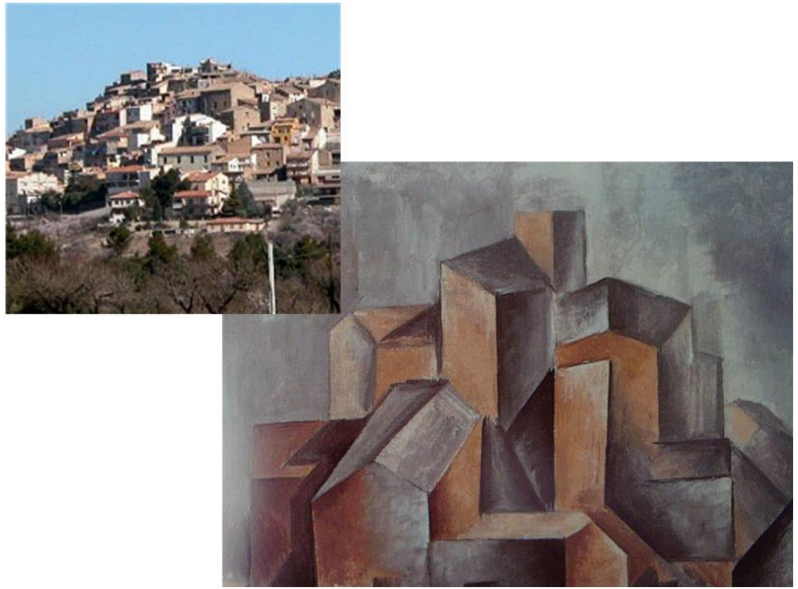


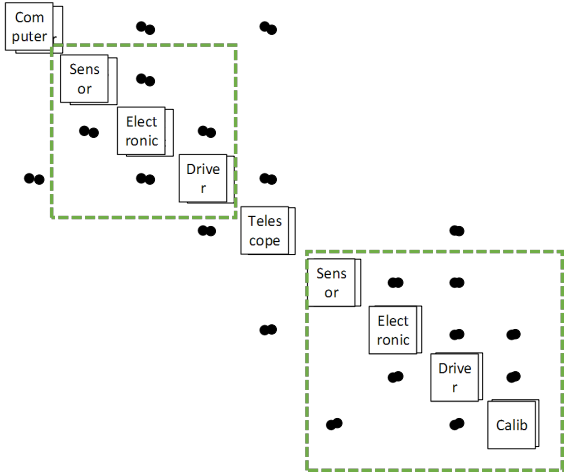


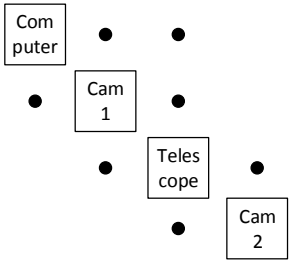


Sources: Official images of PLATO, EnMAP, Galileo IOV, and Galileo FOC

SUBTRACT

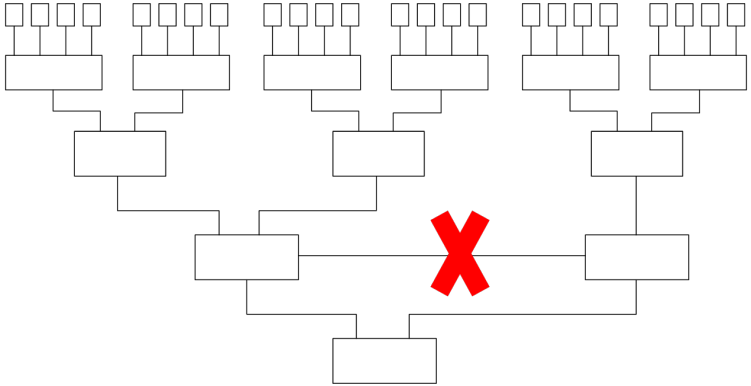


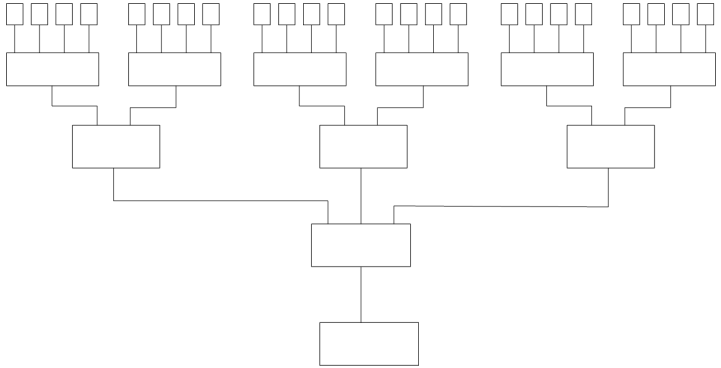




Source: In the paper

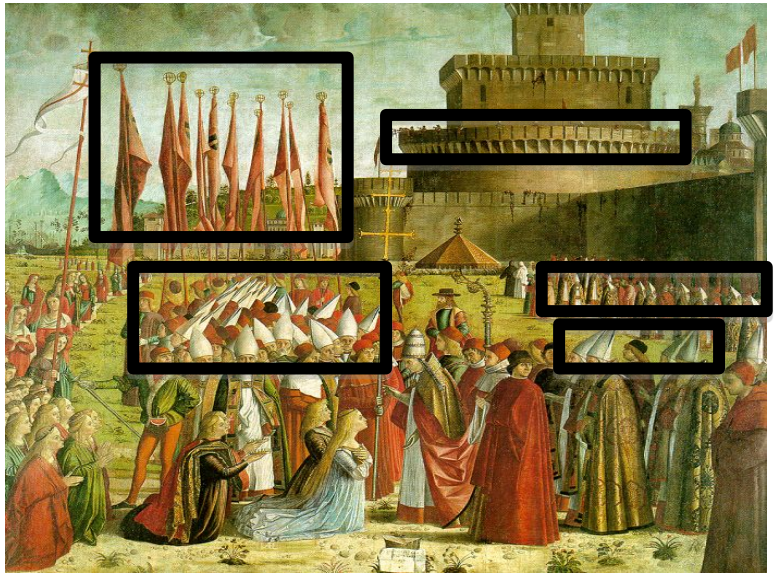
SYMMETRIES

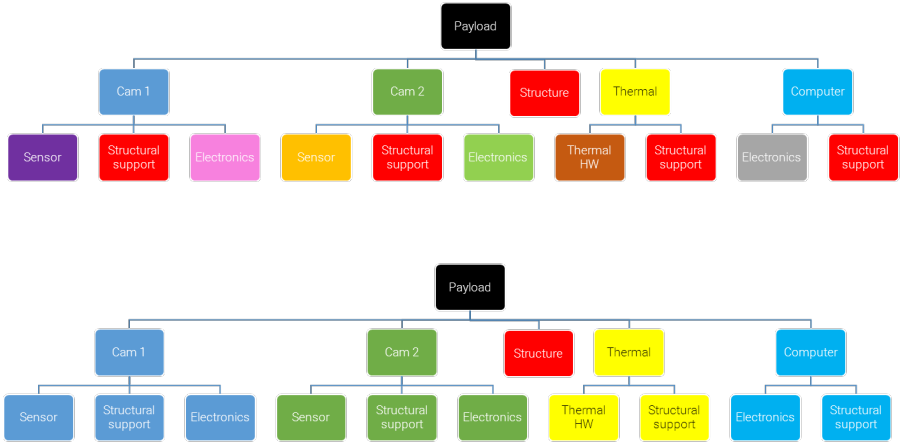




Source: In the paper

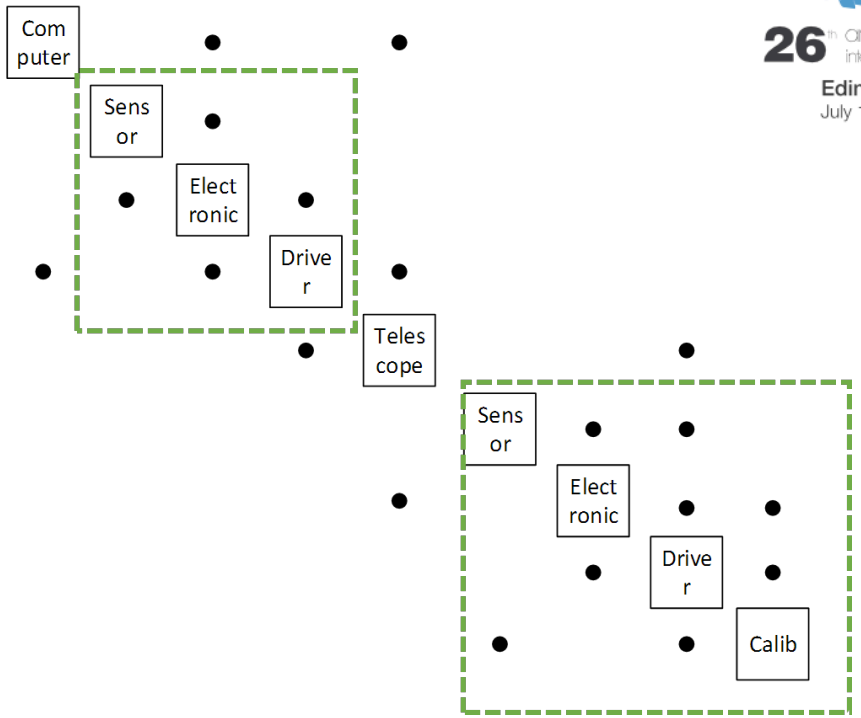
GROUPING





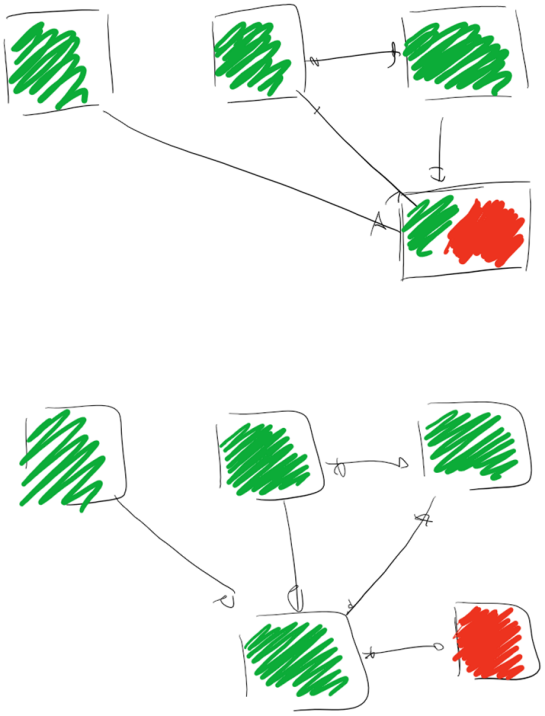
Source: In the paper

SPLITTING



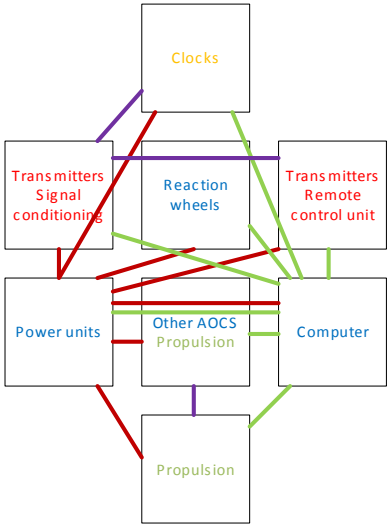
Source: In the paper

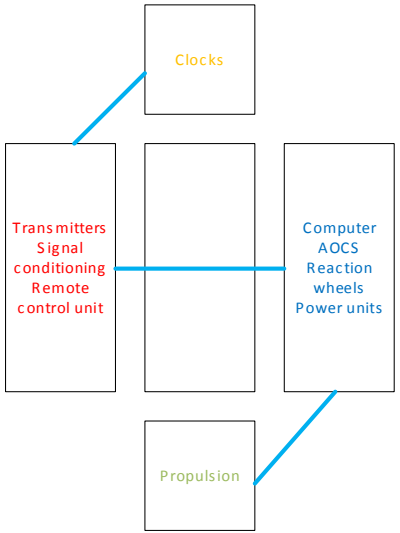
EMPHASIZE DIFFERENCES



Source: In the paper

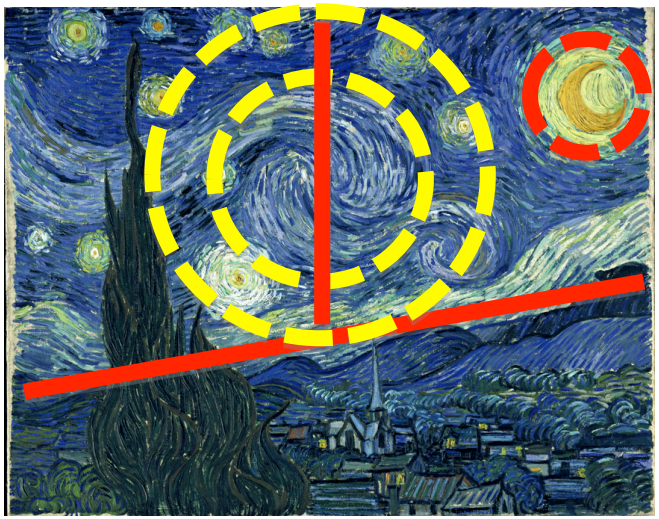
RECONNECT





Source: In the paper

FOCUS

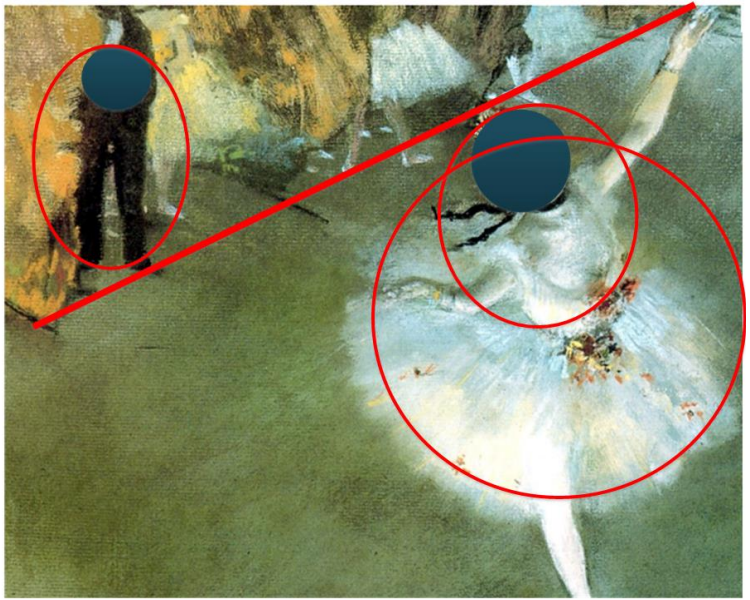


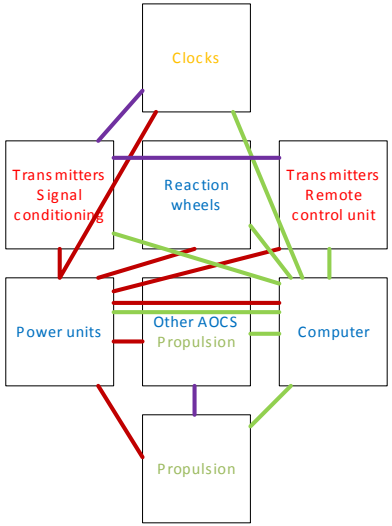
Asset 4	Asset 4 To Asset 2 Asset 4 To Asset 2 Asset 4 To Asset 2 Asset 4 To Asset 2 Asset 4 To Asset 2		Asset 4 To Asset 1 Asset 4 To Asset 1		
Asset 2 To Asset 4 Asset 2 To Asset 4 Asset 2 To Asset 4 Asset 2 To Asset 4	Asset 2	Asset 2 To Asset 5 Asset 2 To Asset 5 Asset 2 To Asset 5 Asset 2 To Asset 5		Asset 2 To Asset 3 Asset 2 To Asset 3 Asset 2 To Asset 3	
	Asset 5 To Asset 2 Asset 5 To Asset 2 Asset 5 To Asset 2 Asset 5 To Asset 2	Asset 5	Asset 5 To Asset 1 Asset 5 To Asset 1		
Asset 1 To Asset 4 Asset 1 To Asset 4	Asset 1 To Asset 2 Asset 1 To Asset 2 Asset 1 To Asset 2 Asset 1 To Asset 2		Asset 1	Asset 1 To Asset 3 Asset 1 To Asset 3	
	Asset 3 To Asset 2 Asset 3 To Asset 2	Asset 3 To Asset 5 Asset 3 To Asset 5		Asset 3	

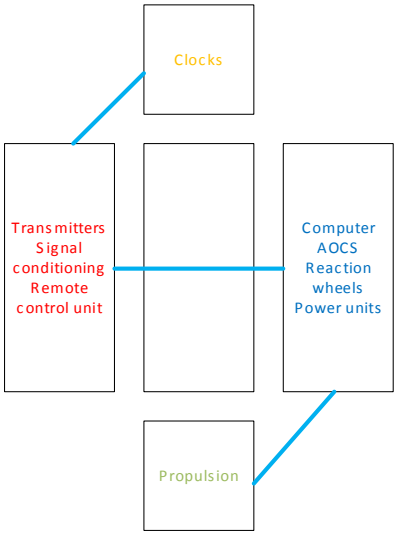
Asset 4	Asset 4 To Asset 2 Asset 4 To Asset 2 Asset 4 To Asset 2 Asset 4 To Asset 2 Asset 4 To Asset 2				
Asset 2 To Asset 4 Asset 2 To Asset 4 Asset 2 To Asset 4 Asset 2 To Asset 4	Asset 2	Asset 2 To Asset 5 Asset 2 To Asset 5 Asset 2 To Asset 5	Asset 2 To Asset 1 Asset 2 To Asset 1 Asset 2 To Asset 1	Asset 2 To Asset 3 Asset 2 To Asset 3 Asset 2 To Asset 3	
	Asset 5 To Asset 2 Asset 5 To Asset 2 Asset 5 To Asset 2 Asset 5 To Asset 2	Asset 5			
	Asset 1 To Asset 2 Asset 1 To Asset 2 Asset 1 To Asset 2 Asset 1 To Asset 2		Asset 1		
	Asset 3 To Asset 2 Asset 3 To Asset 2 Asset 3 To Asset 2 Asset 3 To Asset 2			Asset 3	

Source: In the paper

CONTRAST & BALANCE



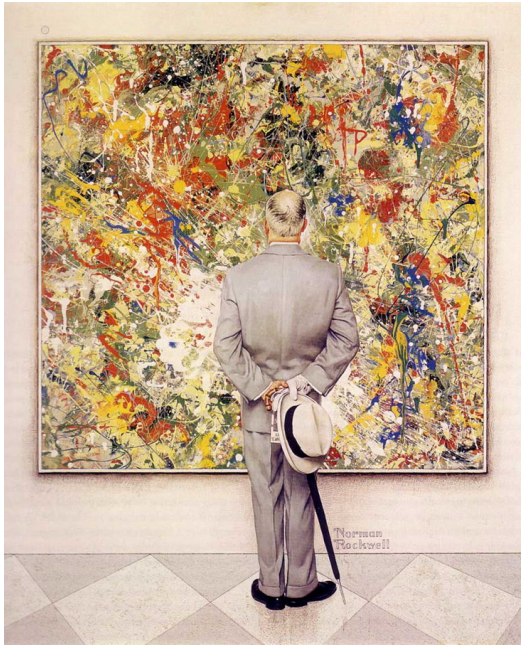


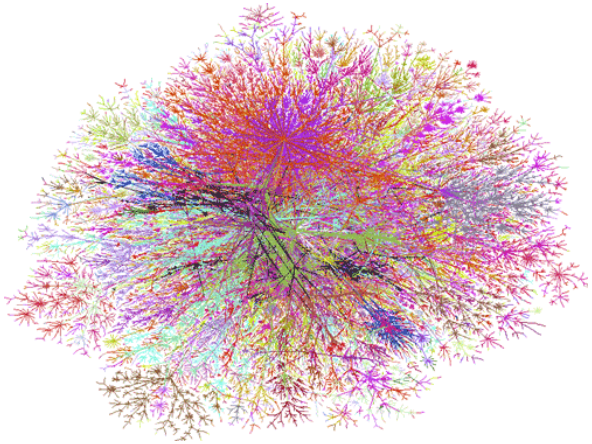


Source: In the paper

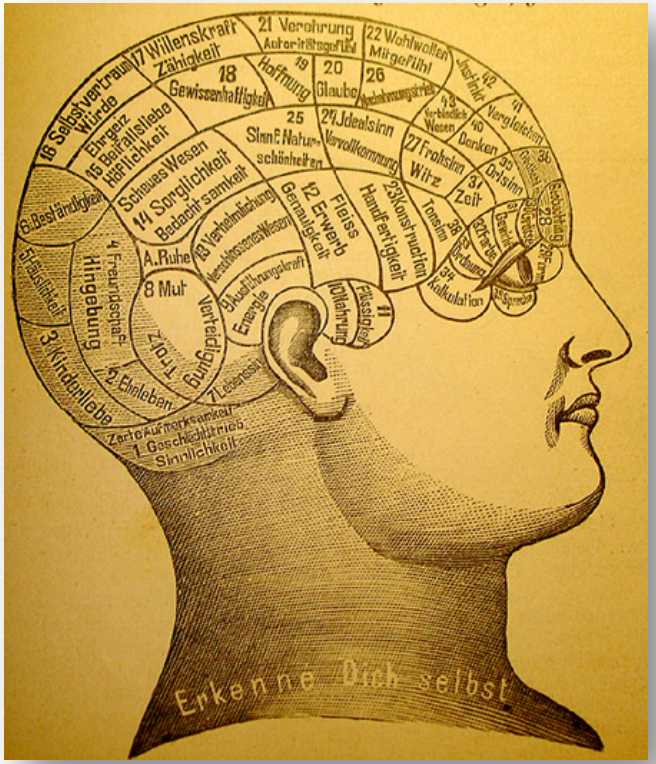
JUST GUIDELINES!

FUTURE…





Sources: In the paper



Source: https://en.wikipedia.org/wiki/Mind#/media/File:Phrenology1.jpg

THANK YOU!

asalado@vt.edu