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A Set of Heuristics to Support Early Identification of Conflicting Requirements

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Presented by: Dr. Rob Cloutier

Apologies



Unfortunately I have not been able to be with you today...

...but I am joining Virginia Tech in August as a junior faculty after 10+ years in the space industry...

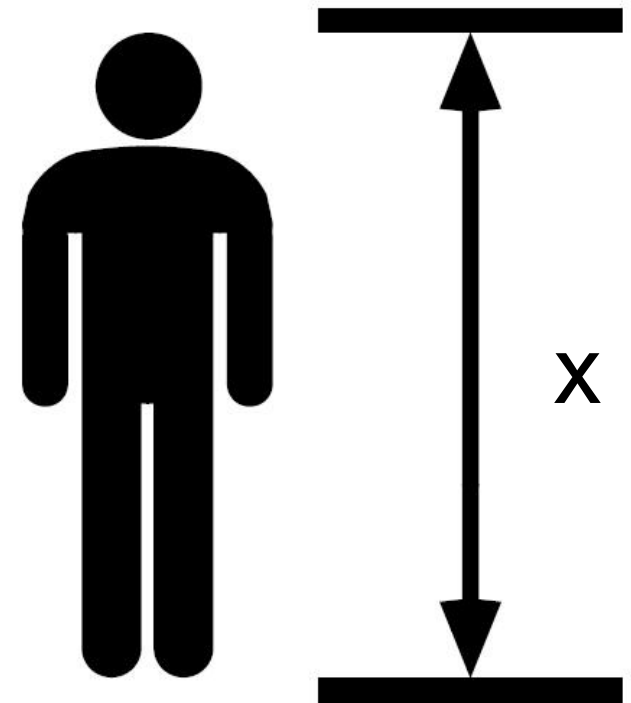
...and have not been able to secure funding.

I hope to meet you in next IW and IS!

Defining a problem

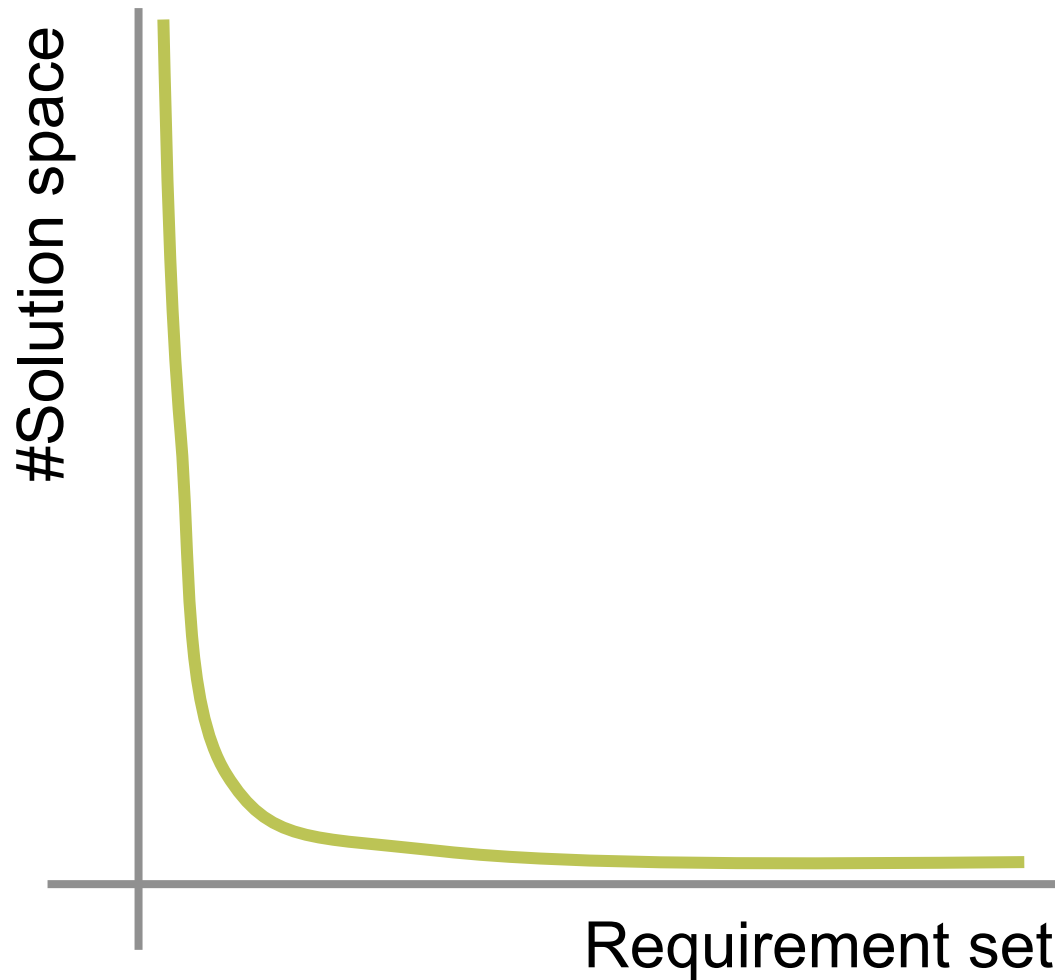


The audience shall
congratulate
the presenter.

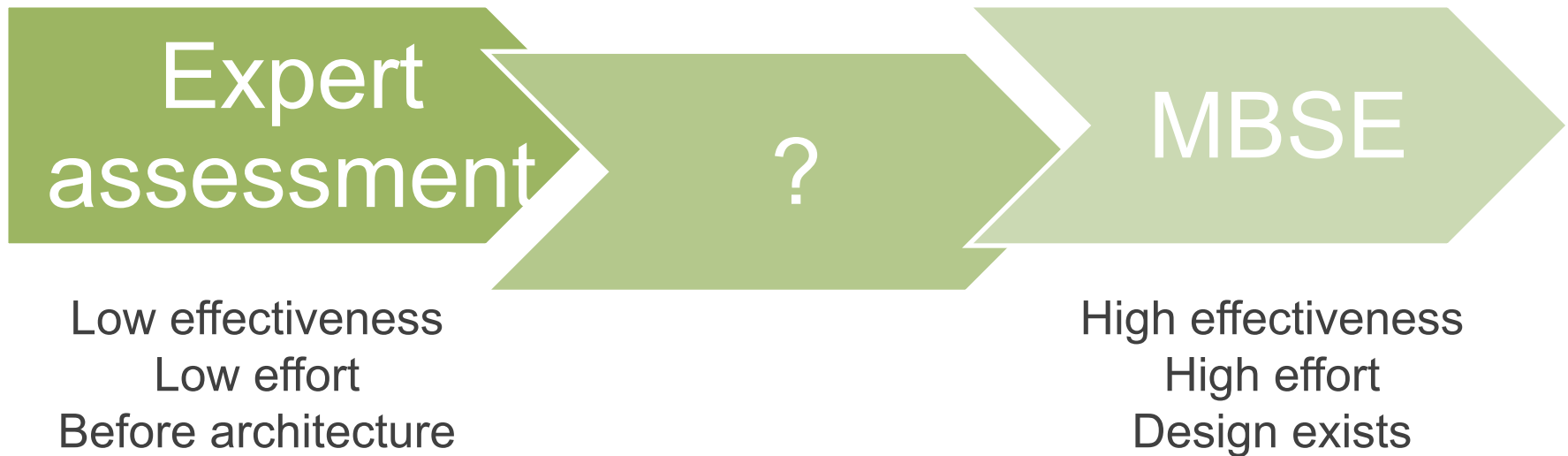


Output = 2 x Input A + Input B

Reqs or objectives conflict



How to identify them?

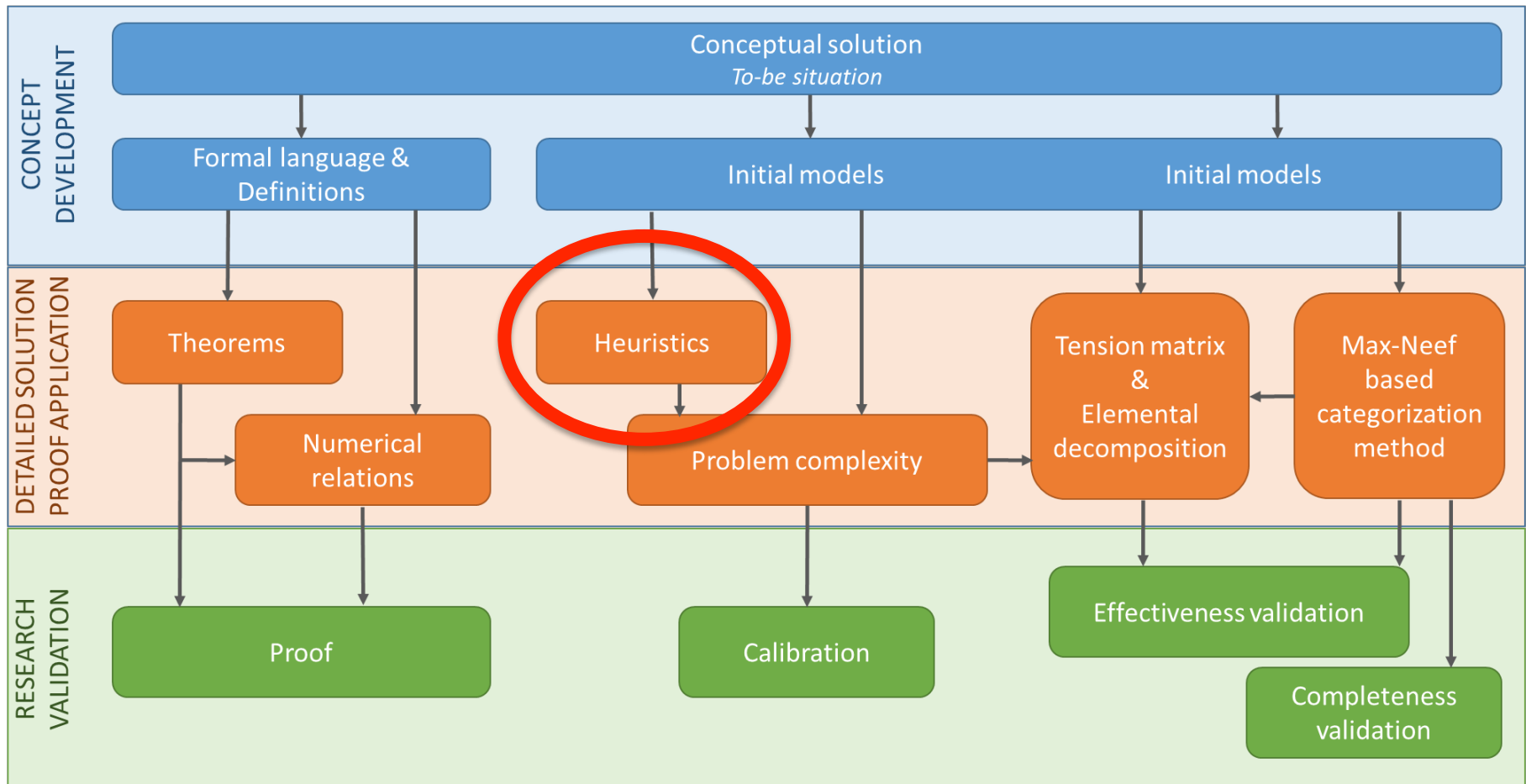


A solution

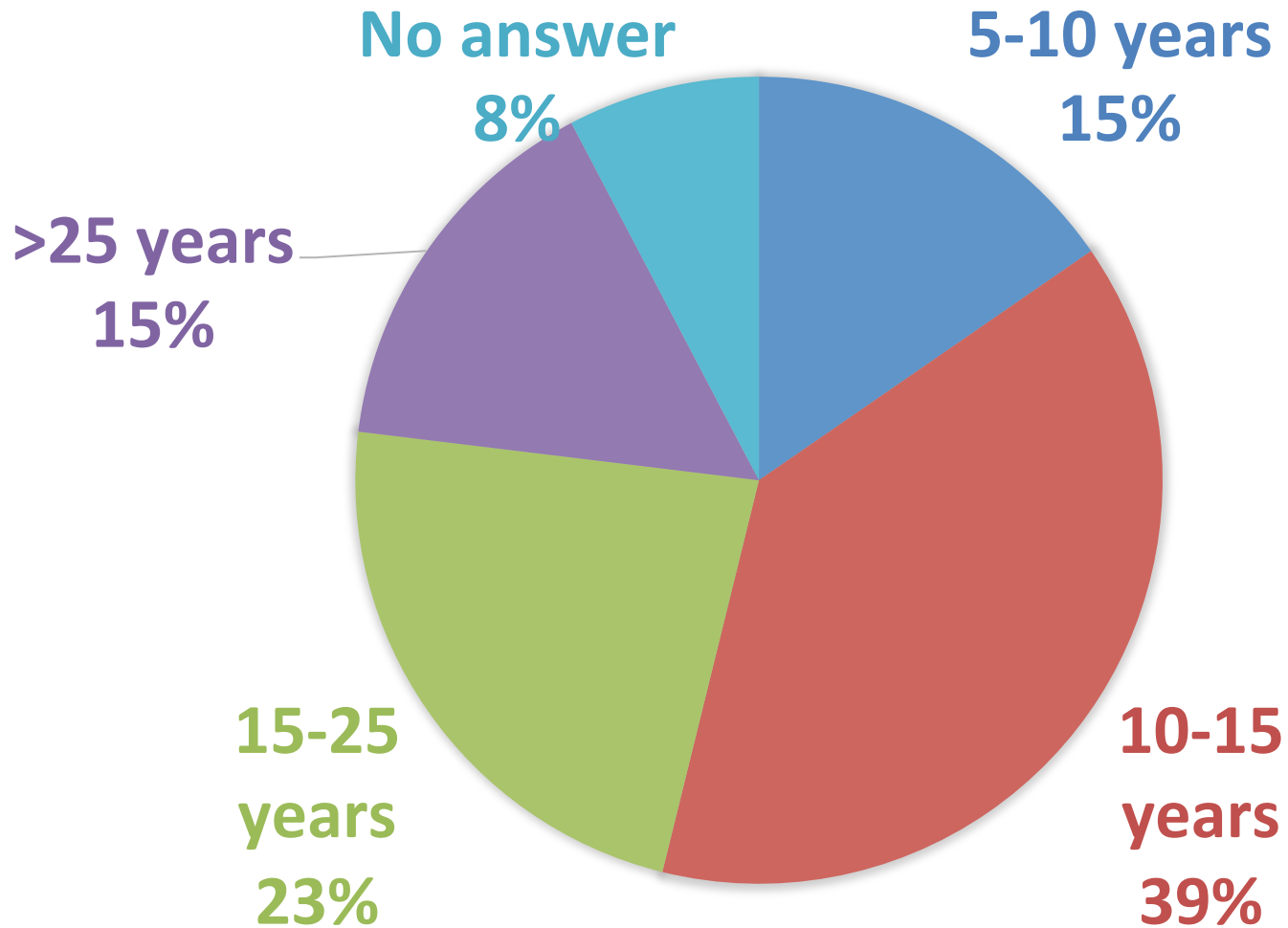
SYSTEMS THEORY

COMPLEXITY SCIENCE

SYSTEMS ENGINEERING METHODS



Who



13 experts... Until convergence criteria achieved

How



Questionnaire:

- Positive and negative range
- Narrative discussion
- 0% to 100% agreement
- After pilot tests to ensure reliability
- Based on requirement partition

Conflict type	Functional reqs	Performance reqs	Resource reqs	Interaction reqs
Functional reqs	C1	C2	C3	C4
Performance reqs		C5	C6	C7
Resource reqs			C8	C9
Interaction reqs				C10

Results: program failure

Conflict type	FUNCTIONAL REQ	PERFORMANCE REQ	RESOURCE REQ	INTERACTION REQ
FUNCTIONAL REQ	1.00	0.53	0.39	0.53
PERFORMANCE REQ		0.75	0.65	1.00
RESOURCE REQ			0.82	0.43
INTERACTION REQ				1.00

Results: program success



LACK of conflict type	FUNCTIONAL REQ	PERFORMANCE REQ	RESOURCE REQ	INTERACTION REQ
FUNCTIONAL REQ	0.82			0.92
PERFORMANCE REQ		0.83		1.00
RESOURCE REQ			0.35	
INTERACTION REQ				0.35

Heuristics



A conflict may exist when two or more requirements oblige the system to...

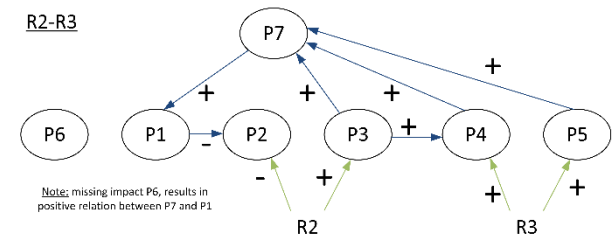
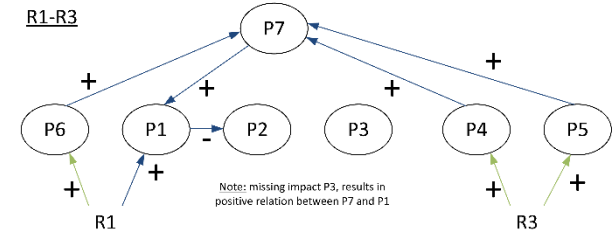
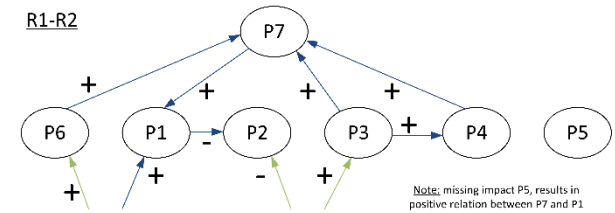
- Operate in two or more phases of matter.
- Compete for the same resource.
- Satisfy opposing directions in laws of physics.
- Satisfy logical contradictions.
- Satisfy opposing directions in laws of society.

A few examples



Seeding a method

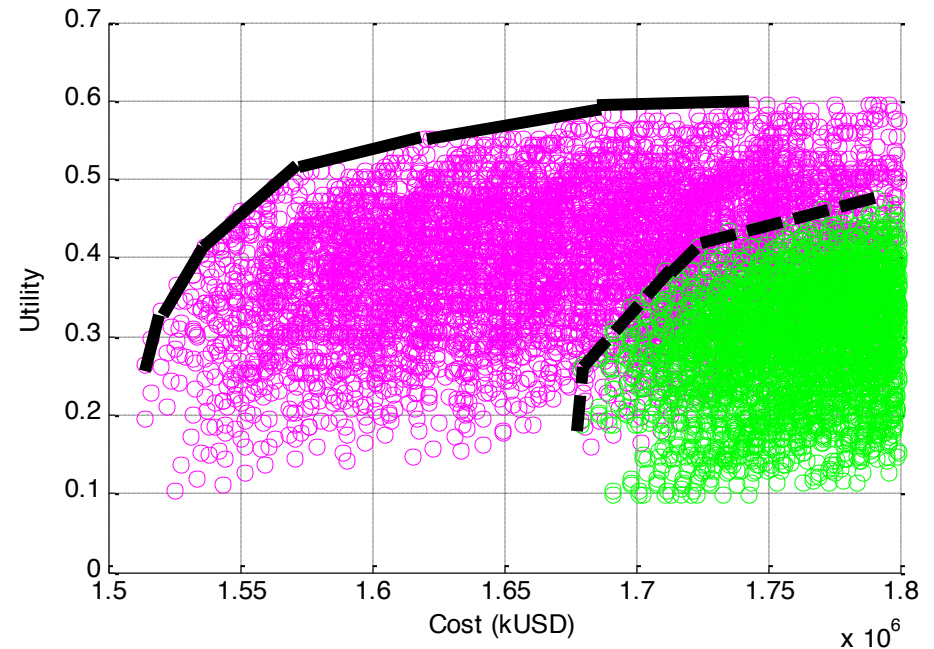
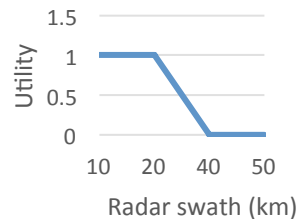
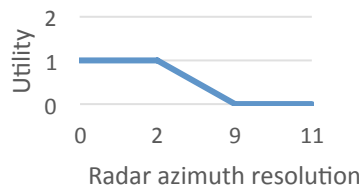
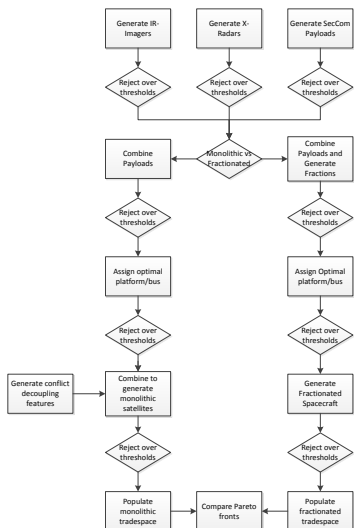
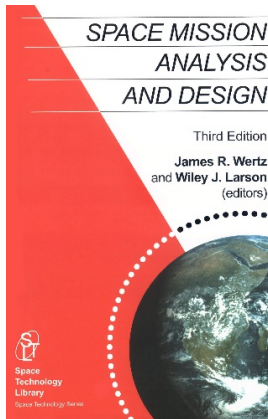
Reqs.		Resources			Phases of matter				Elemental decomposition						
									Laws of physics			Laws of society			Logical
		r7	r8	r9	S	L	G	V	T	P	v	L1	L2	L3	
F	r1	X												↑	Methods in chapter 2
	r2		X						↑			↓			
	r3		X												
P	r4								↓						
	r5	X							↑		↓	↑			
	r6			X							↑				
R	r7														
	r8								↓						
	r9														
I	r10				X										
	r11						X		↓					↓	
	r12					X									



Objective assessment of independent requirements!

From A. Salado and R. Nilchiani "The Tension Matrix and The Concept of Elemental Decomposition: Improving Identification of Conflicting Requirements," IEEE Systems Journal, 2015.

Method effectiveness



Finale



In order to be fair with the presenter, please feel encouraged to send your questions to:

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Or

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