Volker Mueller

Assoc. AIA, LEED AP BD+C

Research & Development Director

Portfolio from 20+ years of PPTs & PDFs

Selective Topics, Slides, Thoughts

Mission & Believe

Design and develop solutions for the emerging challenges of forward-looking, ever-evolving design and engineering practices facing resource limitations and anthropogenic climate change

because design and construction is a
deliberate intervention in the environment with
ecological, social, urban, aesthetic, and economic dimensions.

Architectural Projects

@ NBBJ, 1998 to 2008

Architectural Projects

1999 - 2001	Public Employees Retirement System, Columbus, OH - BIM, visualization, physical modeling, 3D printing
2001 - 2003	Medical University of South Carolina Hospital, Charleston, SC - BIM and visualization
2001 - 2008	**Cleveland Clinic Foundation Heart Center, Cleveland, OH - BIM and consultant coordination**
2003	**Hamad Medical Center and Pan Asian Olympic Village, Qatar - distributed team coordination**
2003 - 2004	Moscow Medical Center, Moscow, Russia - BIM, visualization, laser cutting, 3D printing
2004 - 2008	Providence Park Hospital, Novi, MI - BIM, visualization, laser cutting, 3D printing
2005	**Al Babtain, Kuwait - computational design strategy and implementation**
2005	Abu Dhabi Mixed Use Development - computational design strategy and implementation
2005 - 2008	**Cleveland Clinic Foundation Glickman Tower, Cleveland, OH - BIM and consultant coordination**
2005 - 2006	i21 - Intervention Suite for the 21st Century - general digital strategy and CFD
2005 - 2008	Palo Alto Medical Facility, Palo Alto, CA - BIM and Integrated Project Delivery facilitator
2006	Constellation XXL, Los Angeles, CA - general digital strategy, laser scanning research
2006 - 2008	Massachusetts General Hospital, Boston, MA - BIM and visualization
2007	Dostyk, Almaty, Kazakhstan - computational design strategy and implementation
2007	**Al Farabi, Almaty, Kazakhstan - computational design strategy and implementation**

Cleveland Clinic, Cleveland, OH, 2001 - 2008

Sydell & Arnold Miller Family Pavilion, 2001 - 2008

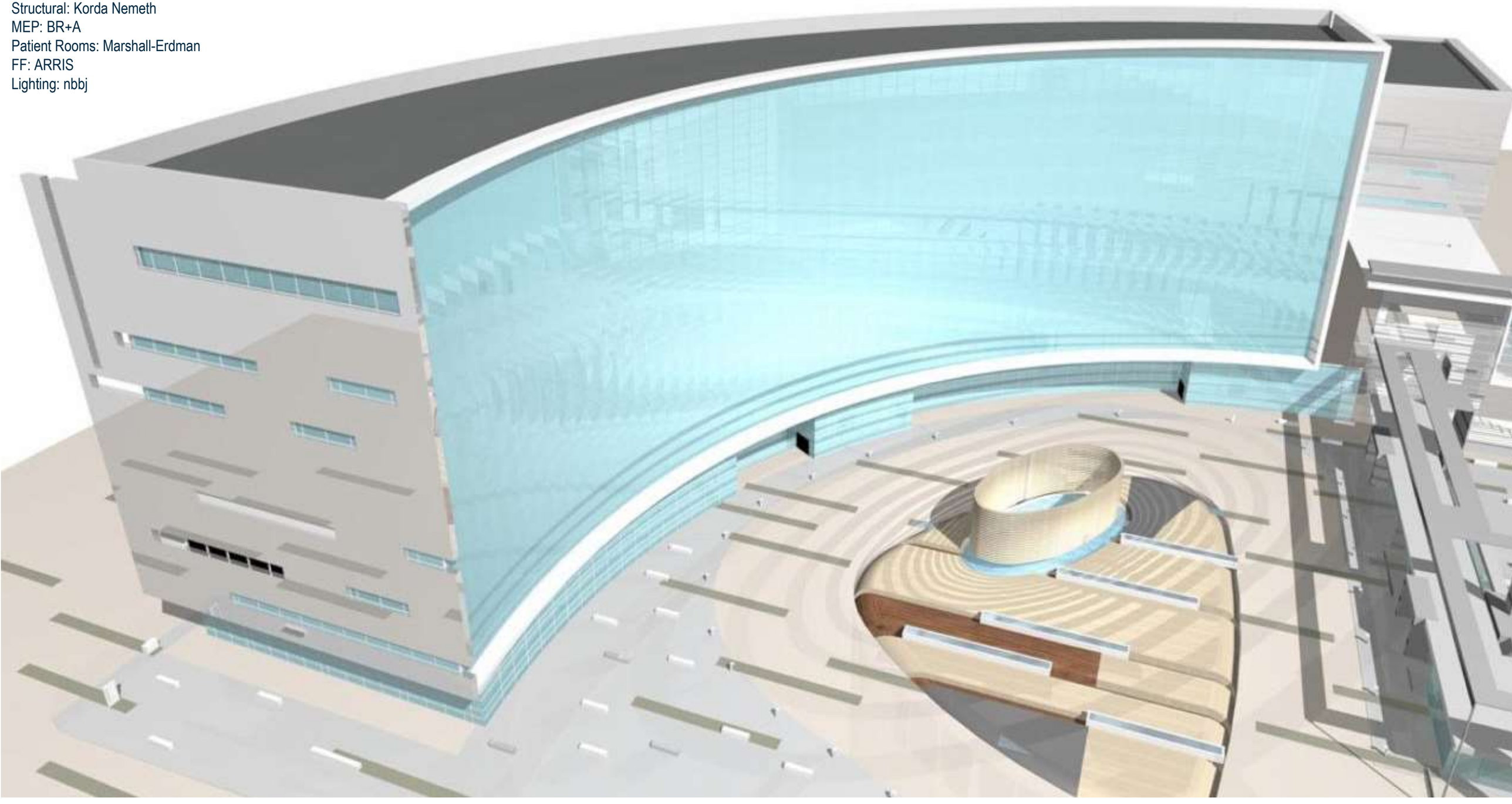
- Almost 1,000,000 sf of clinics, surgery suites, and patient tower
- Started in 2001 with projected delivery in 2008
- First large hospital project in integrated design mode at NBBJ
- Consultants largely in 2d-mode without dimensionally accurate drawings
- Architectural team modeled structural items based on engineering drawings

Glickman Tower, 2004 - 2008

- About 400,000 sf of clinics, lab, and shell space for future use
- Started in 2004 with delivery coinciding with Sydell & Arnold Miller Pavilion
- Structural and MEP consultants in 3d-mode for full 3d systems coordination

Cleveland Clinic Foundation Heart Hospital 2001 - 2008

Design: nbbj
Structural: Korda Nemeth
MEP: BR+A
Patient Rooms: Marshall-Erdman
FF: ARRIS
Lighting: nbbj



Cleveland Clinic Foundation Heart Hospital 2001 - 2008

Design: nbbj
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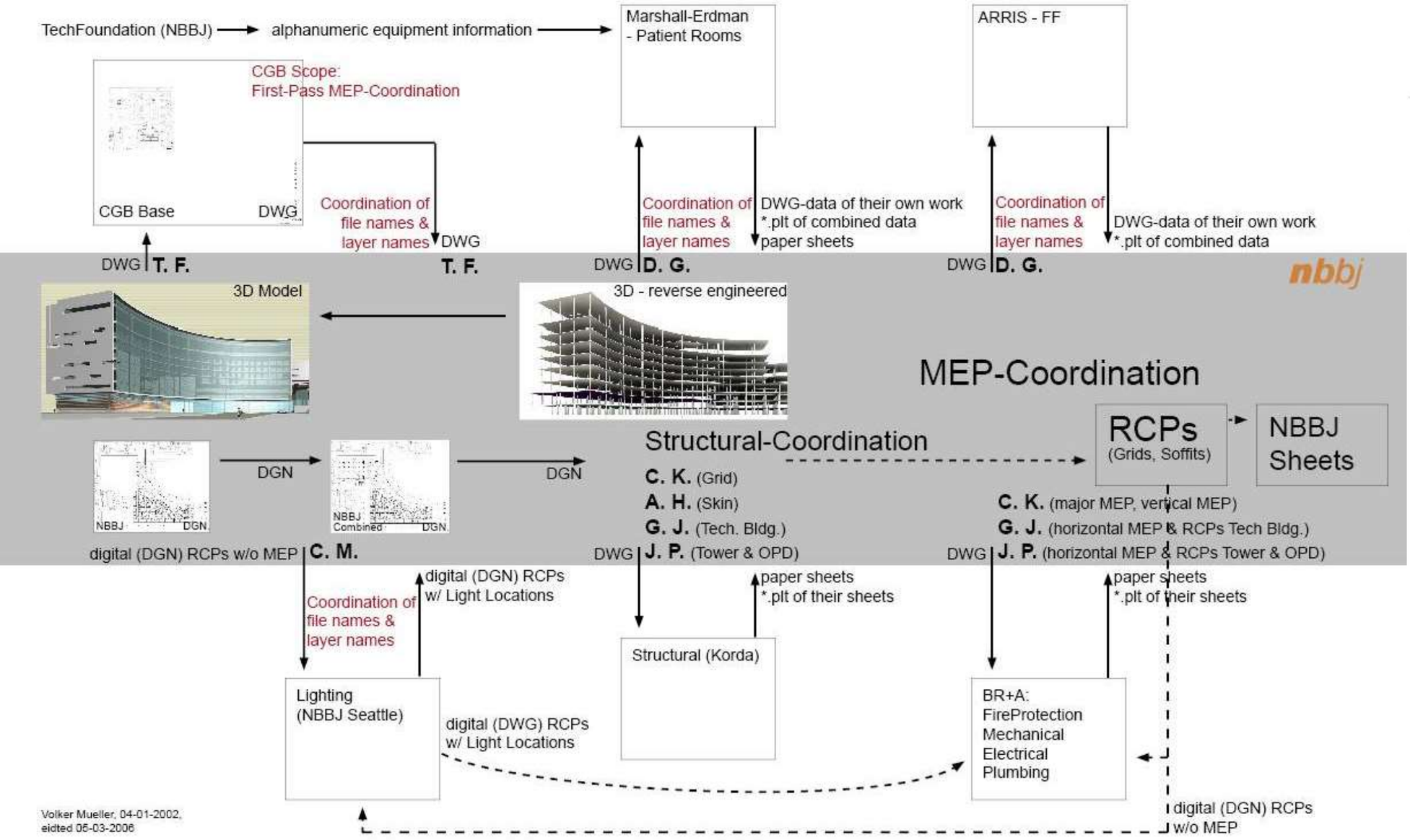
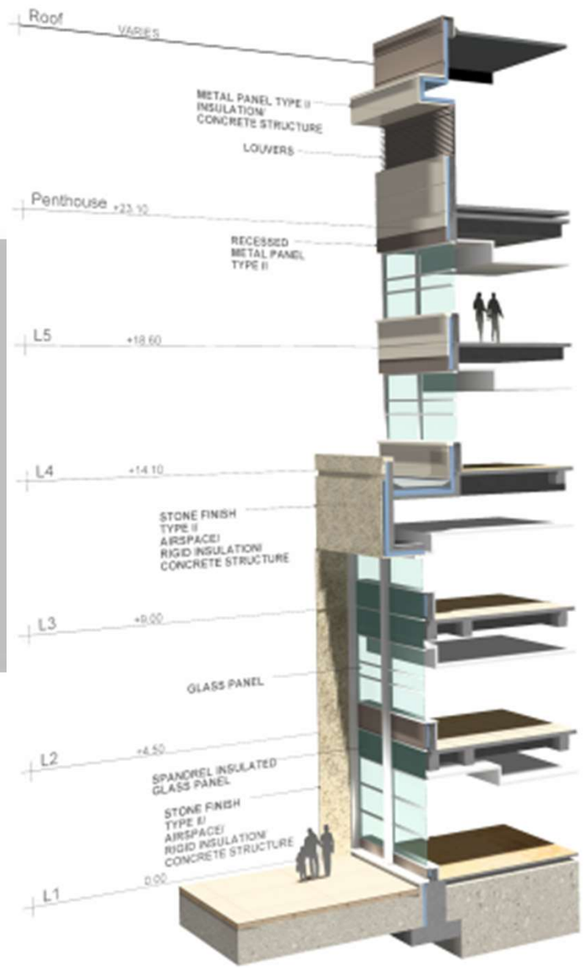




Cleveland Clinic Foundation Glickman Tower 2004 - 2008
Design: nbbj
Structural: Korda Nemeth
MEP: BR+A

Cleveland Clinic Foundation Glickman Tower 2004 - 2008

Design: nbbj
Structural: Korda Nemeth
MEP: BR+A

Hamad Medical Center and Pan Asian Olympic Village, Qatar, 2003

Hamad Medical Center

Architectural concept and design, NBBJ Studio 56, Columbus, OH

Medical planning and interiors, NBBJ Seattle, WA

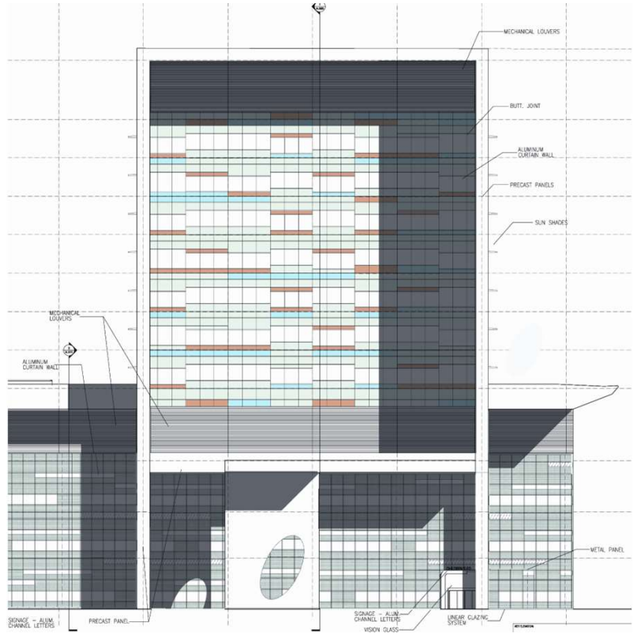
Pan Asian Olympic Village

NBBJ London, UK

Project data coordination for all involved NBBJ offices

Hamad Medical Center and
Pan Asian Olympic Village, Qatar, 2003

Design: nbbj Columbus, Seattle, and London offices
Distributed team data exchange concept and consulting
3D Modeling, Visualization, Documentation



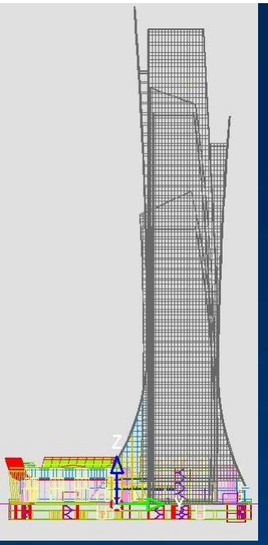
Al Babtain, Kuwait, 2005
Al Farabi, Almaty, Kazakhstan, 2007

Al Babtain

- Computational design concept for curved façade's horizontal elements to align with floor plates
- Rapid prototyping of façade model parts

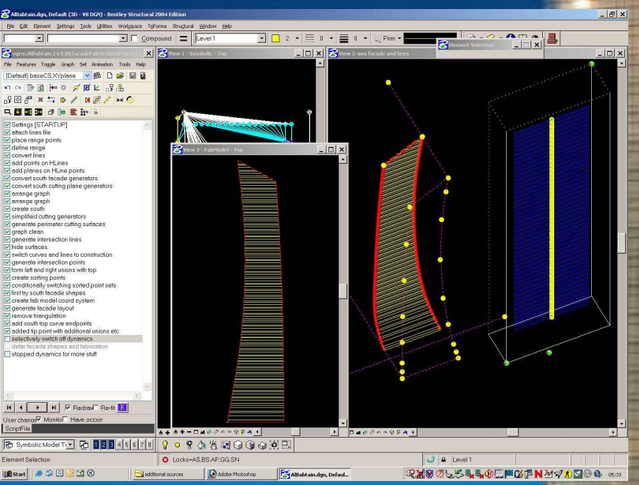
Al Farabi

- Computational design concept and script development for constructability of facades enforcing planarity of façade elements with computationally generated fins on long facades and control geometry adjustment on short facades



Al Babtain, Kuwait, 2005

Computational design and rapid prototyping



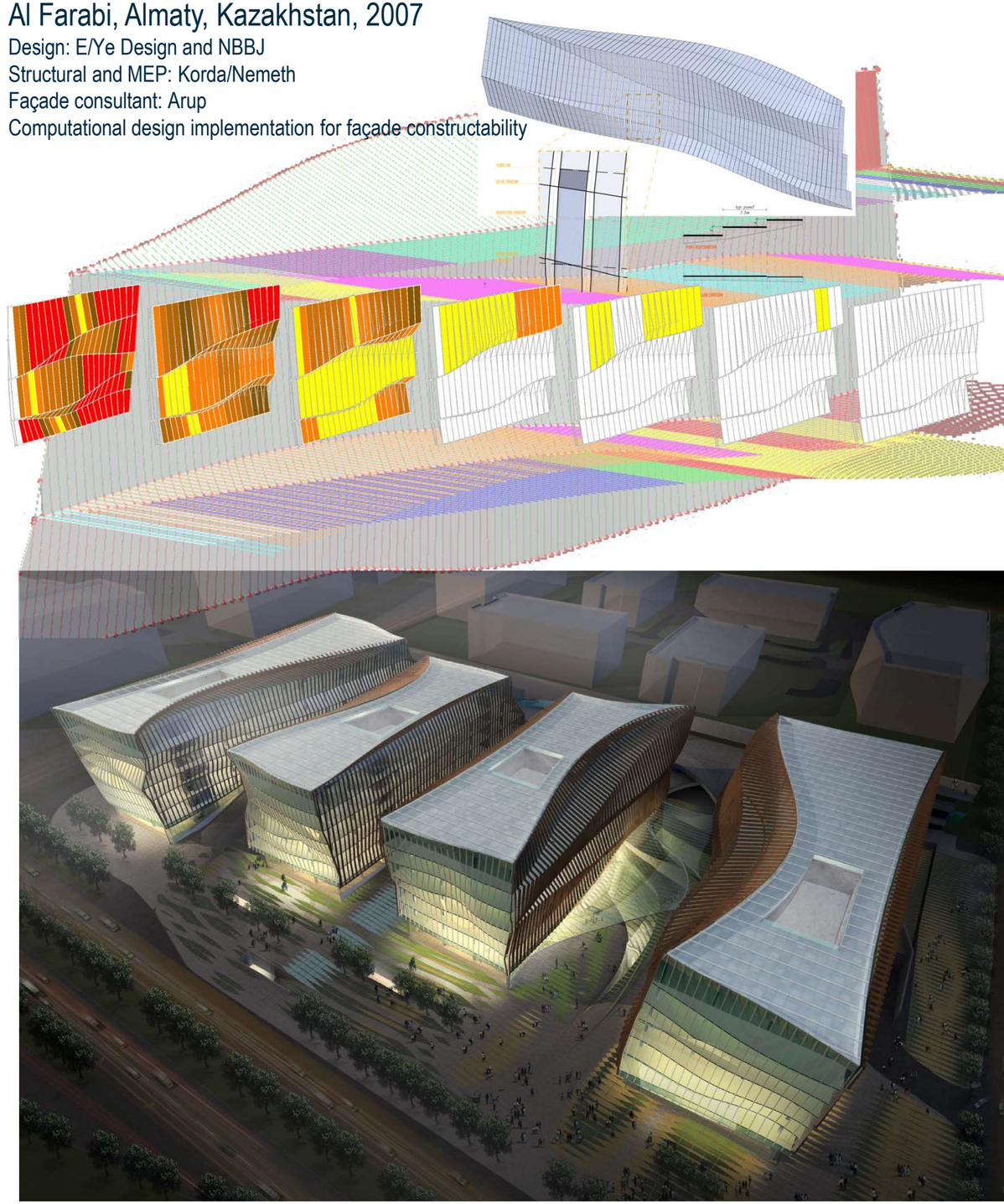
Al Farabi, Almaty, Kazakhstan, 2007

Design: E/Ye Design and NBBJ

Structural and MEP: Korda/Nemeth

Façade consultant: Arup

Computational design implementation for façade constructability



Selected Publications & Presentation Slides & Thoughts

My research and development is driven by the desire to realize the promise of computer aided design: current computer systems force designers to adjust to how computing works, whereas what designers want to do must guide how computer systems work.

Selected Publications

1993 “Introducing CAD to a Big Corporation”, in CAAD Futures ‘93: Proceedings of the Fifth International Conference on Computer-Aided Architectural Design Futures, 1993; Ulrich Flemming and Skip Van Wyk, eds. Elsevier Science Publishers B.V., Amsterdam 1993, pp. 497-512

2006 “Integrating Digital and Non-digital Design Work”, in Blurring the Lines: Computer-Aided Design and Manufacturing in Contemporary Architecture; André Chaszar, ed. John Wiley & Sons Ltd. London, UK 2006, pp. 38-45

2009 “Conceptual Design Tools: Establishing a framework for specification of concept design tools”, in Digitizing Architecture: Formalization and Content, 4th International Conference Proceedings of the Arab Society for Computer Aided Architectural Design, Manama, Kingdom of Bahrain, 11-12 May 2009, pp. 103-120

2013 "GenerativeComponents and Smartgeometry: Situated Software Development" with Makai Smith, in Inside Smartgeometry: Expanding the Architectural Possibilities of Computational Design; Brady Peters and Terry Peters, eds.; Wiley, Chichester, Sussex, UK, 2013, pp. 142-153

2013 "Cloud-Based Design Analysis and Optimization Framework" with Tiemen Strobbe, in Computation and Performance, 31st eCAADe Conference Proceedings; Stouffs, Rudi and Sariyildiz, Sevil, eds.; September 18-20, 2013, Delft, The Netherlands, pp. 185-194

2014 "Second Generation Prototype of a Design Performance Optimization Framework", in Digital Crafting – Virtualizing architecture and delivering real built environment, Proceedings of the 7th ASCAAD Conference; Sidawi, Bhzad and Mallasi, Zaki, eds.; March 31-April 3, The Arab Society for Computer Aided Architectural Design, Jeddah, Kingdom of Saudi Arabia, 2014, pp. 199-209

2015 "Learning about Parametric Model Behavior through Multi-Objective Optimization", in Project Information for Interaction, SIGraDi 2015 Proceedings, November 23-27, 2015, Florianópolis, Santa Catarina, Brazil, pp. 405-413

Introducing CAD to a Big Corporation

Author Müller, Volker

Year 1993

Title Introducing CAD to a Big Corporation

Source CAAD Futures ‘93 [Conference Proceedings / ISBN 0-444-89922-7] (Pittsburgh / USA), 1993, pp. 497-512

Summary The report presents the ongoing activity of introducing CAD to the entire range of facilities planning and management of the Frankfurt Airport Corporation. It addresses issues of organizing the shift from conventional to computer supported planning and facilities management, the problems of training professionals with various background in the use of new tools; aspects of data validity; regulation of data exchange; and customization of software to the needs of special tasks within the corporation. The report is based on about four years of project runtime. The preparation of the project started in fall 1988. The project proper started in June 1989. It is entering its last year. Up to now about 120 persons have been trained to use CAD.

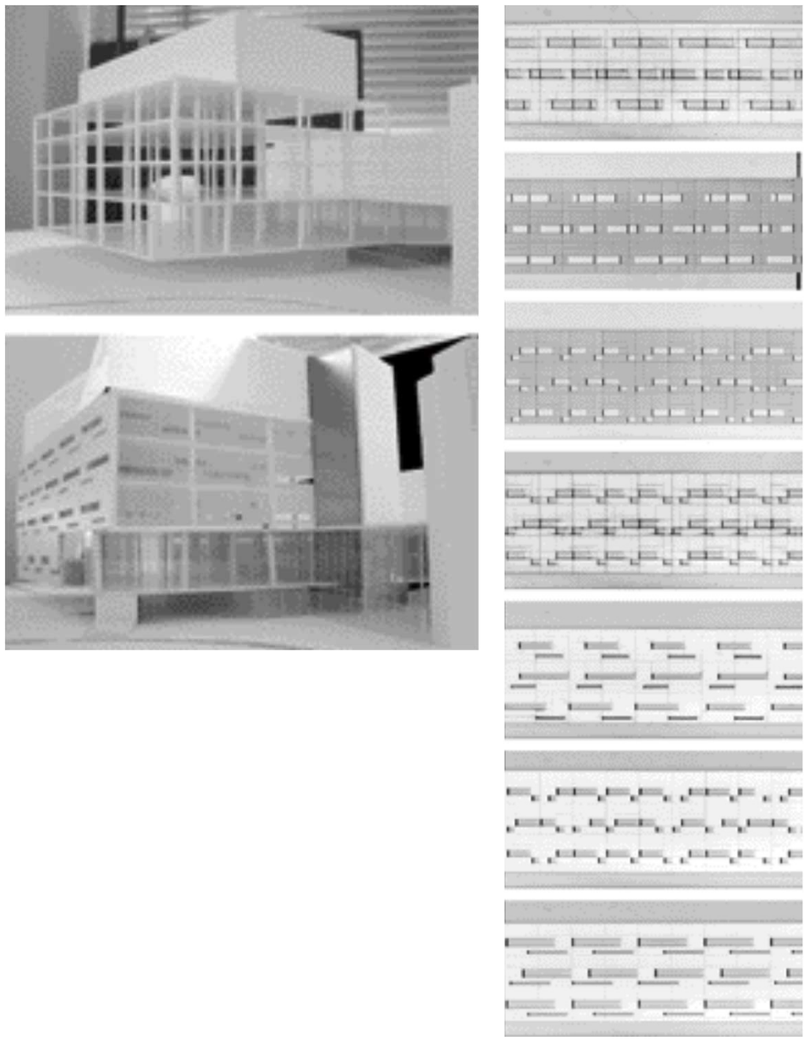
Integrating Digital and Non-digital Design Work

Author Mueller, Volker

Year 2006

Title Integrating Digital and Non-digital Design Work

Source Blurring the Lines: Computer-Aided Design and Manufacturing in Contemporary Architecture; André Chaszar, ed. John Wiley & Sons Ltd. London, UK 2006, pp. 38-45



Abstract. This contribution seeks to enrich the discussion about the changed expectations towards computers as design tools by presenting two case studies describing how a commercially available computer-aided design (CAD) system is used in a design setting. Both case studies show how designers in an architectural firm have evolved distinctly different ways of augmenting their creative thinking using the CAD system. The cases demonstrate how designers adopt standard tools and adapt their individual design processes to utilise digital media creatively. This contribution is based on and elaborates part of a paper presented at the eCAADe Conference in 2003 (Mueller and Talbott, 2003).

Conceptual Design Tools:
Establishing a framework for specification of concept design tools

Author Mueller, Volker

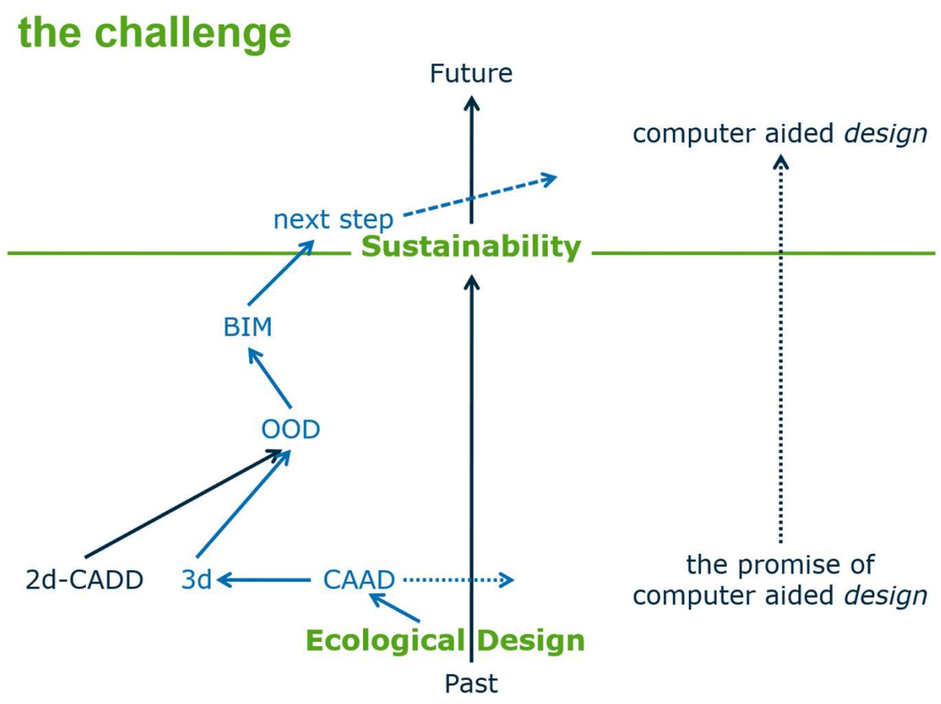
Year 2009

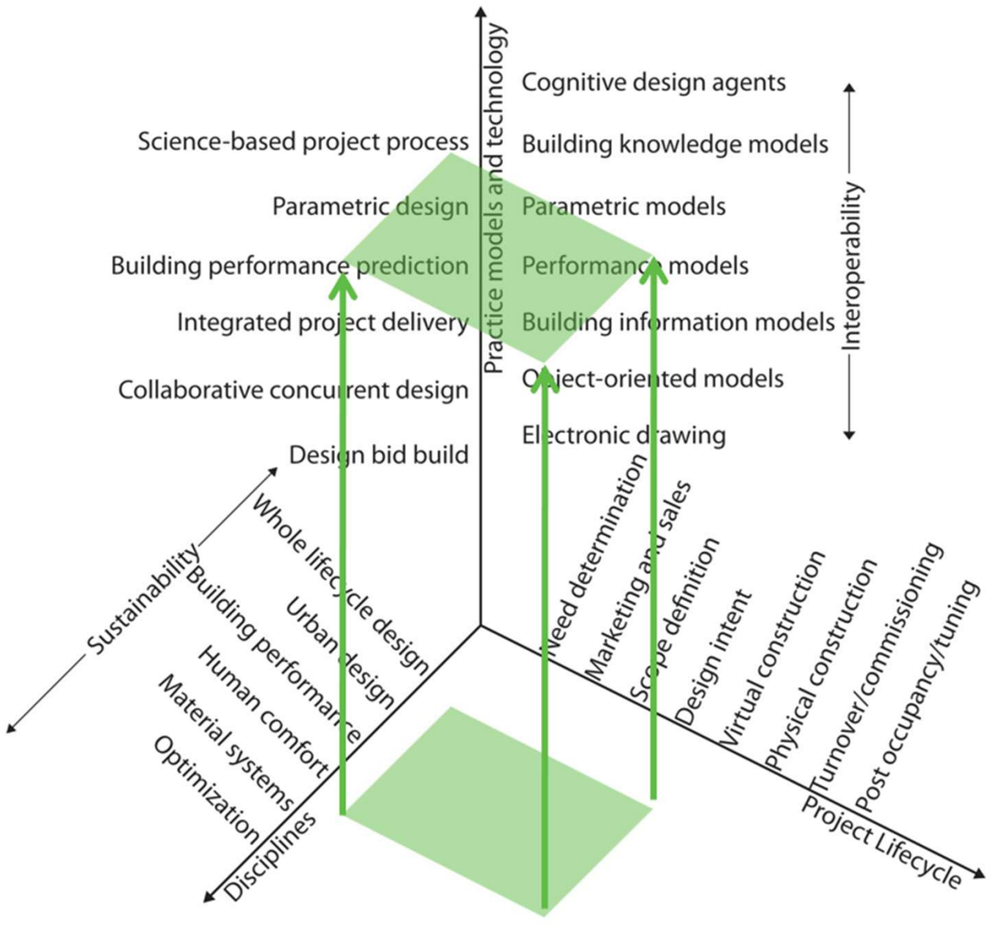
Title Conceptual Design Tools: Establishing a framework for specification of concept design tools

Source Digitizing Architecture: Formalization and Content [4th International Conference Proceedings of the Arab Society for Computer Aided Architectural Design (ASCAAD2009) / ISBN 978-99901-06-77-0], Manama (Kingdom of Bahrain), 11-12 May 2009,pp. 103-120

Summary For considerable time research has been conducted into architectural design activities and the digital tools that support these design activities. Previous research endeavors have focused on specific aspects of digital tools and design processes and have yielded correspondingly focused insights. This effort attempts to build a framework that allows assembling insights from research across the domain of digitally supported facilities design in order to develop a cohesive set of design tool specifications. This design tool specification framework in combination with a review of existing research will allow identification of areas for future investigation to rethink concept tool design.

Presentation Sketches of Digital Design Tool Research Space

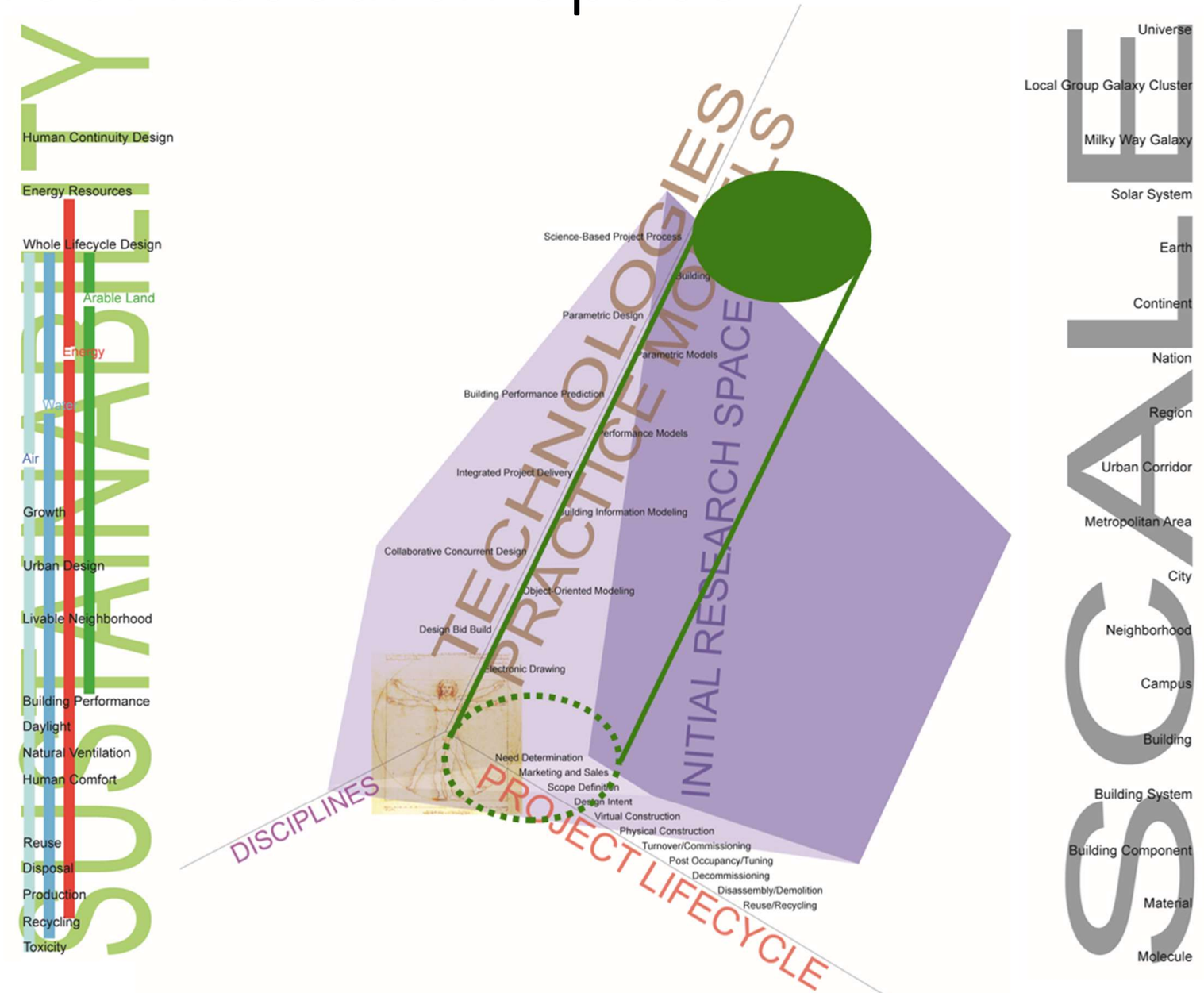




Research at Bentley
Presentation at ASTUDIO, London
23rd February 2010

Digital Design Tool Research Space

Computational Design Research (diagram used 2008 to 2010):
Early design phases,
intermediate scale centered around building scale,
expanding to components and materials on one side,
and to urban scale on the other,
high level of technology, and innovative practice models like Integrated Practice.



Generative Components and Smartgeometry

Situated Software Development

Authors Volker Mueller and Makai Smith

Year 2013

Title GenerativeComponents and Smartgeometry: Situated Software Development

Source Inside Smartgeometry: Expanding the Architectural Possibilities of Computational Design; Brady Peters and Terry Peters, eds.; Wiley, Chichester, Sussex, UK, 2013, pp. 142-153

Summary Software developers Bentley Systems have been a key part of the Smartgeometry (SG) community since the first workshop in 2003, providing financial and organisational support, expertise and software. Yearly SG events provide a unique setting of dedicated high-level users for sharing cutting-edge intellectual and technical ideas in architecture and engineering. GenerativeComponents™ (GC) is among the programs used by leading academics and practitioners who explore their designs through developing creative parametric tools. Here, Volker Mueller (Research Director for Computational Design) and Makai Smith (Product Manager of GenerativeComponents) explain how Bentley Systems engages with advanced users at SG, pushing continued developments in GC software.

Prototype Implementation
of a Loosely Coupled Design Performance Optimisation Framework

Authors Mueller, Volker; Drury B. Crawley and Xun Zhou

Year 2013

Title Prototype Implementation of a Loosely Coupled Design Performance Optimisation Framework

Source Open Systems: Proceedings of the 18th International Conference on Computer-Aided Architectural Design Research in Asia (CAADRIA 2013) / Singapore 15-18 May 2013, pp.675-684

Summary Integration of analyses into early design phases poses several challenges. An experimental implementation of an analysis framework in conjunction with an optimization framework ties authoring and analysis tools together under one umbrella. As a prototype it served intensive use-testing in the context of the SmartGeometry 2012 workshop in Troy, NY. In this prototype the data flow uses a mix of proprietary and publicised file formats, exchanged through publicly accessible interfaces. The analysis framework brokers between the parametric authoring tool and the analysis tools. The optimization framework controls the processes between the authoring tool and parametric engine on one side and the optimization algorithm on the other. In addition to some user-implemented analyses inside the parametric design model the prototype makes energy analysis and structural analysis available. The prototype allows testing assumptions about work flow, implementation, usability and general feasibility of the pursued approach.

Cloud-Based Design Analysis and Optimization Framework

Authors Mueller, Volker and Strobbe, Tiemen

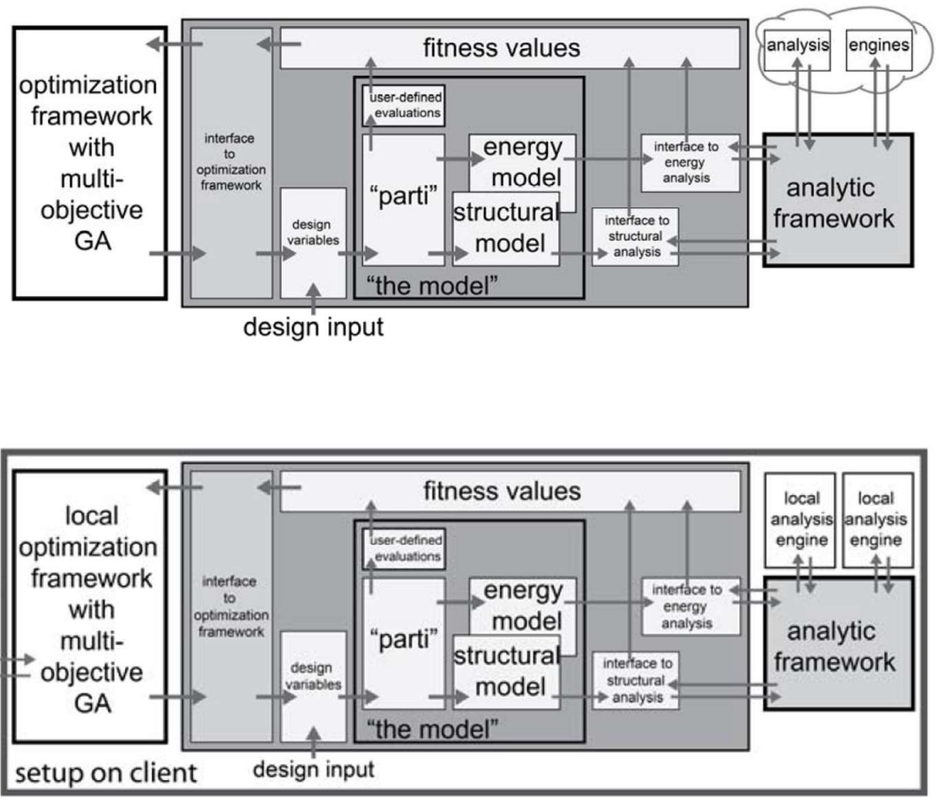
Year 2013

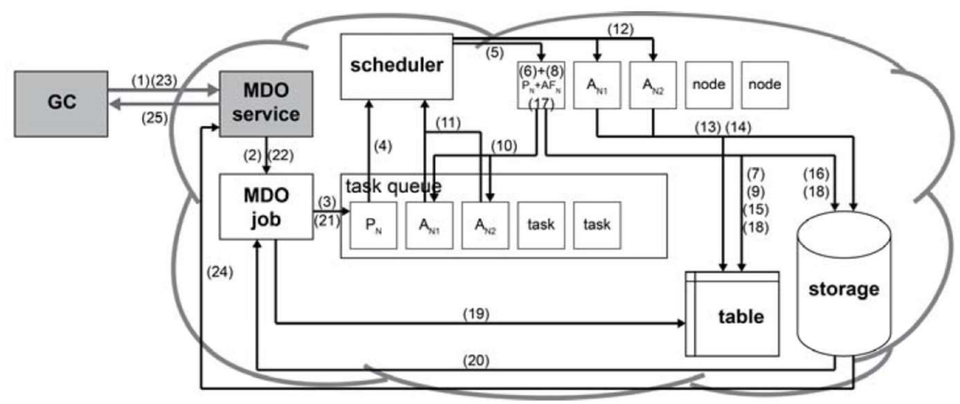
Title Cloud-Based Design Analysis and Optimization Framework

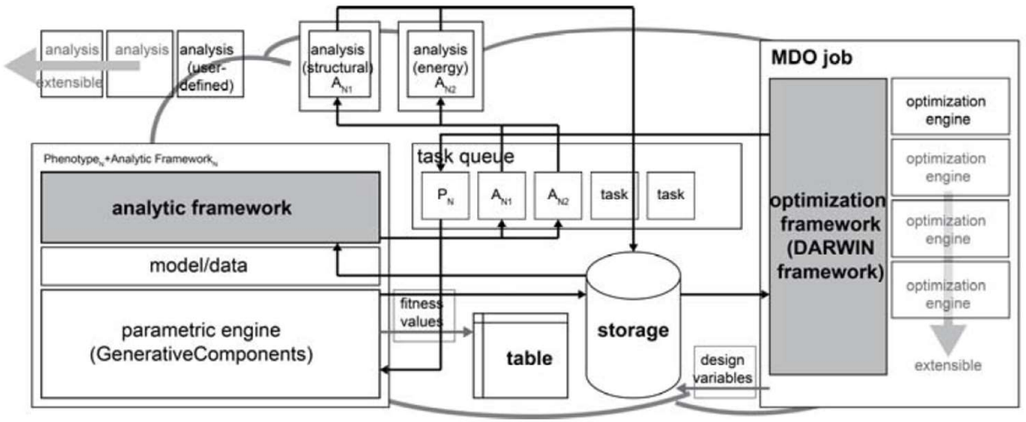
Source Stouffs, Rudi and Sariyildiz, Sevil (eds.), Computation and Performance – Proceedings of the 31st eCAADe Conference – Volume 2, Faculty of Architecture, Delft University of Technology, Delft, The Netherlands, 18-20 September 2013, pp. 185-194

Summary Integration of analysis into early design phases in support of improved building performance has become increasingly important. It is considered a required response to demands on contemporary building design to meet environmental concerns. The goal is to assist designers in their decision making throughout the design of a building but with growing focus on the earlier phases in design during which design changes consume less effort than similar changes would in later design phases or during construction and occupation. Multi-disciplinary optimization has the potential of providing design teams with information about the potential trade-offs between various goals, some of which may be in conflict with each other. A commonly used class of optimization algorithms is the class of genetic algorithms which mimic the evolutionary process. For effective parallelization of the cascading processes occurring in the application of genetic algorithms in multi-disciplinary optimization we propose a cloud implementation and describe its architecture designed to handle the cascading tasks as efficiently as possible.

Cloud-Based Design Analysis and Optimization Framework







Various figures from the paper showing the system schema for the client-server (cloud) architecture

Second Generation Prototype of a Design Performance Optimization Framework

Authors Mueller, Volker

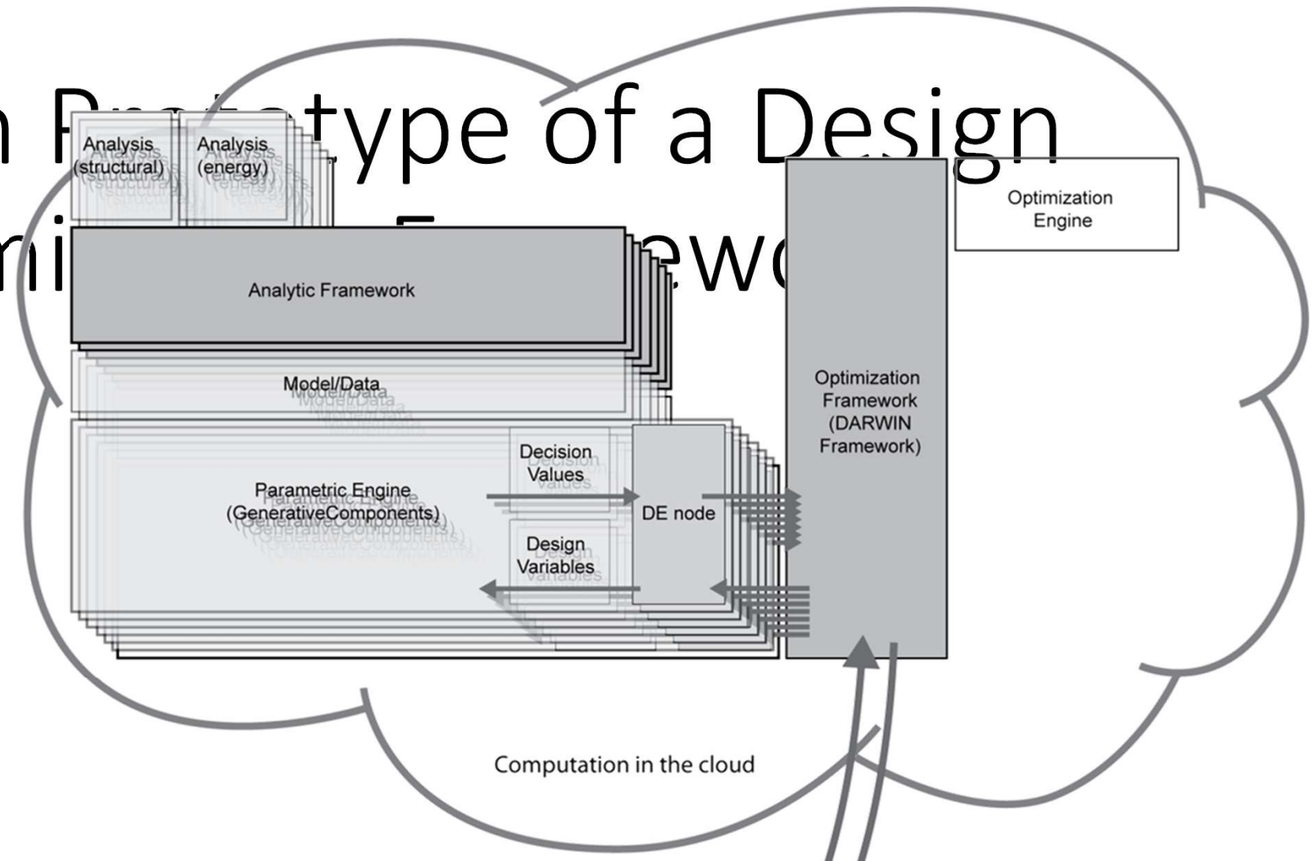
Year 2014

Title Second Generation Prototype of a Design Performance Optimization Framework

Source Digital Crafting [7th International Conference Proceedings of the Arab Society forComputer Aided Architectural Design (ASCAAD 2014 / ISBN 978-603-90142-5-6],Jeddah (Kingdom of Saudi Arabia), 31 March - 3 April 2014, pp. 199-209

Summary The integration of performance evaluation into the building design process becomes increasingly important in order to respond to demands on contemporary design with respect to the future of our built and natural environments. This paper presents work on the second iteration of an implementation of a design performance optimization framework that attempts to respond to the challenges of integrating analysis and optimization into the design process. Main challenges addressed are speed of feedback through implementation on the cloud, utilizing parallelization of computations and availability of results in the computational context of the model through leveraging the parametric nature of the application. The goal is to enable designers in their decision-making throughout the design process with focus on earlier phases of the design process during which changes can be implemented faster and at much lower costs than in later phases of design or even during construction and occupation.

Second Generation Prototype of a Design Performance Optimi… Framew…



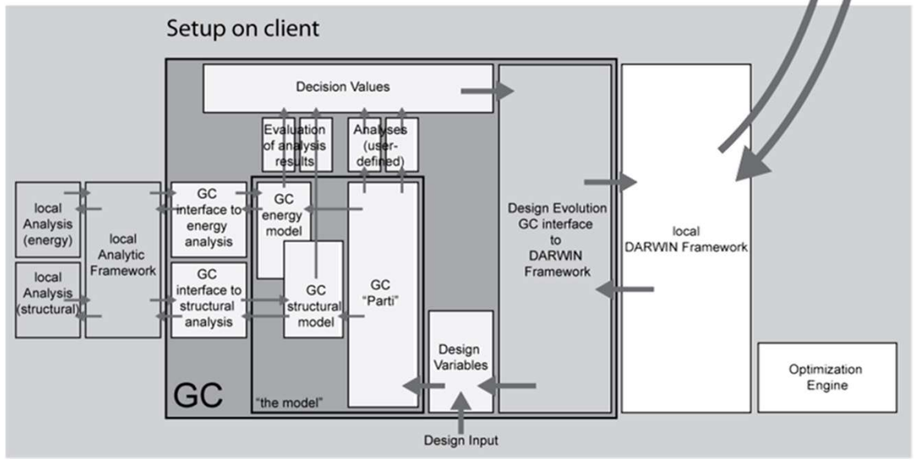


Figure from the paper showing implementation as a single-client and cloud architecture for the multi-disciplinary optimization use case.

Second Generation Prototype of a Design Performance Optimization Framework

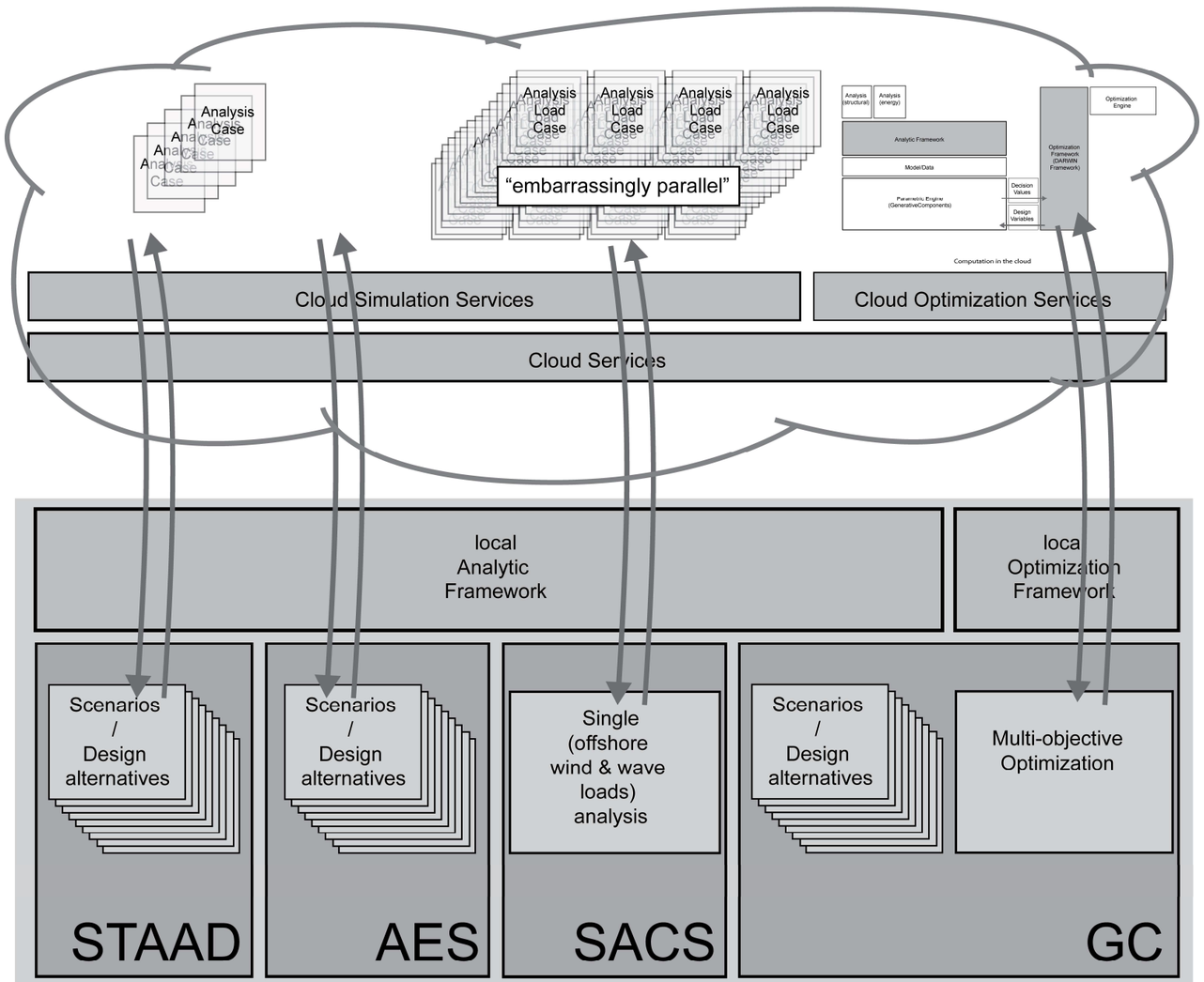
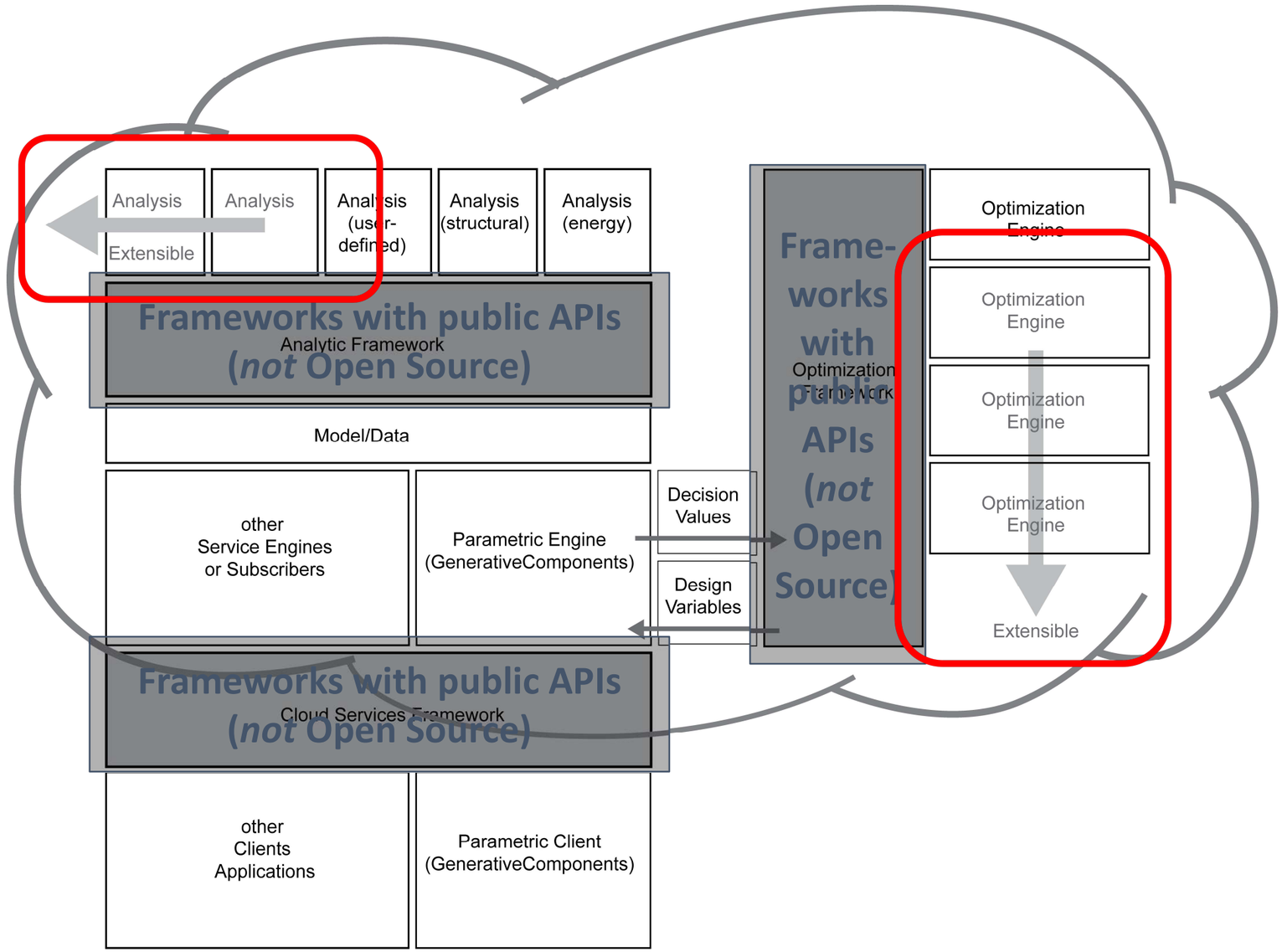


Figure from the paper showing implementation as a multi-client and cloud architecture with three distinct use cases.

eCAADe 2014 Computational Design



Concept diagram from a presentation at the eCAADe 2014 Conference showing the extensibility concept of the parametric multi-disciplinary optimization system enabled by public APIs.

Learning about Parametric Model Behavior through Multi-Objective Optimization

Authors Mueller, Volker

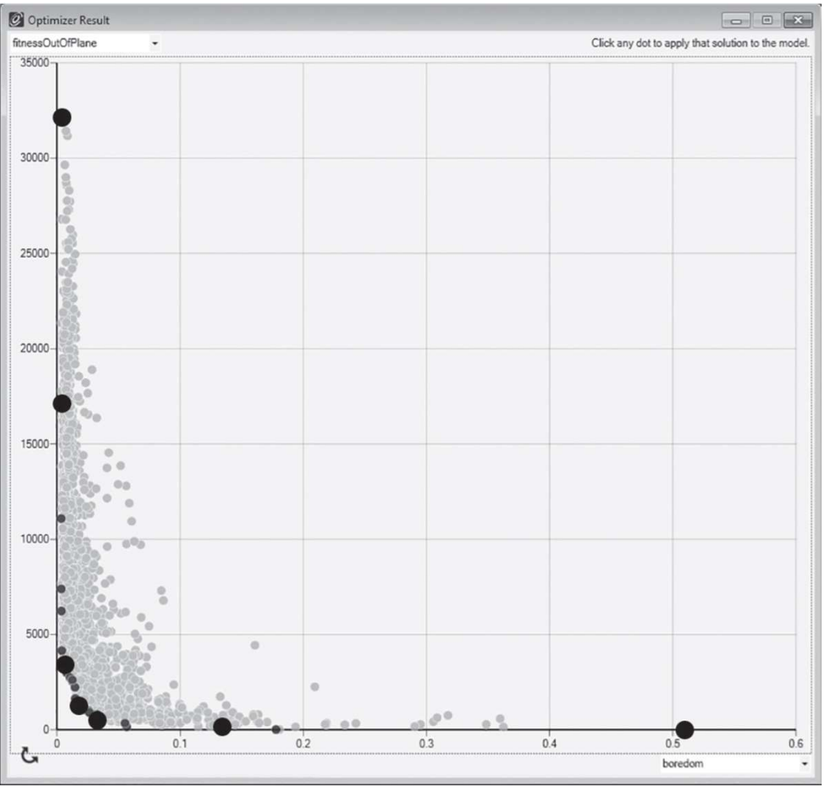
Year 2015

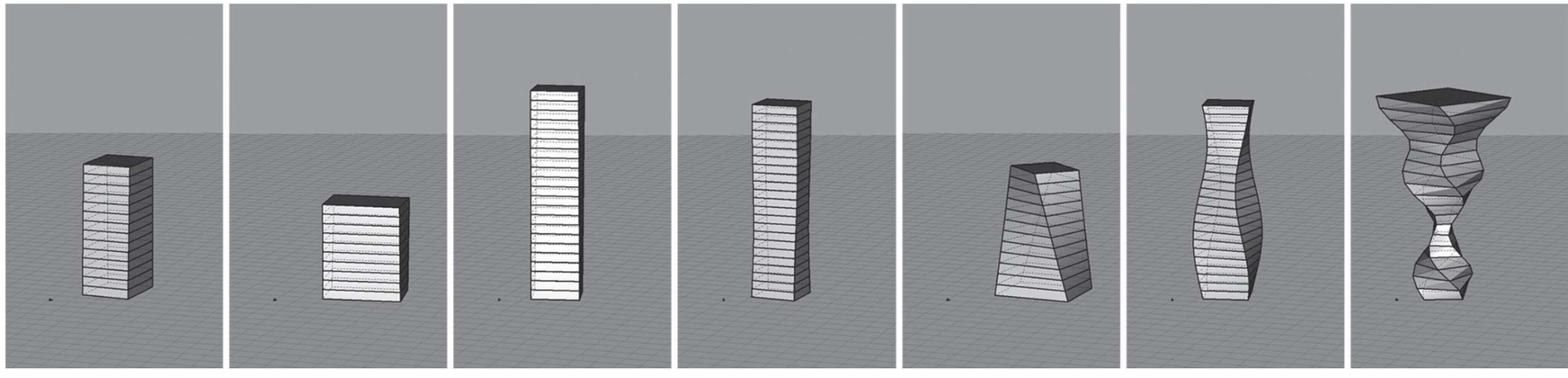
Title Learning about Parametric Model Behavior through Multi-Objective Optimization

Source SIGRADI 2015 [Proceedings of the 19th Conference of the Iberoamerican Society ofDigital Graphics - vol. 1 - ISBN: 978-85-8039-135-0] Florianópolis, SC, Brasil 23-27November 2015, pp. 405-413.

Summary This paper reports about a design process as a case study illustrating different levels of learning that seem required for successful computational design. The learning process occurred during a two-day workshop about parametric design with integrated analysis and multi-objective optimization. First, the design team needs to understand the behavior of the model in order to validate that the model behaves in a way that actually conforms with the project goals; second, the design team needs to learn about potential trade-offs between different project goals, and thus understand the decisions that need to be made, or the additional problems that need to be solved in order to arrive at a better design solution.

Learning about Parametric Model Behavior through Multi-Objective Optimization





Scatter plot of construction cost proxy and visual interest proxy.
The marked solutions are shown as well.

Presentation Slides and Thoughts

Whole systems thinking, ecology, energy, design process, design decision support through computational systems

INVASIVE SPECIES

Sustainability = Longevity

1000 years from now: 3014
ca. 35 generations after ours…
what will “the human condition” be like?
how will our buildings have fared?

100 years from now: 2114
ca. 3.5 generations after ours…
how will our buildings perform?
how much has the sea level risen?

1,000 years ago (in 1014):
Feb 14th - Pope Benedict VIII crowns Henry II Roman German Emperor
Apr 23rd - King Brian Boru of Ireland beats Danes at Battle of Clontarf
Jul 29th - Battle of Strumitsa-valley: Byzantine destroys Bulgarian armies

1010

St. Michael in Hildesheim

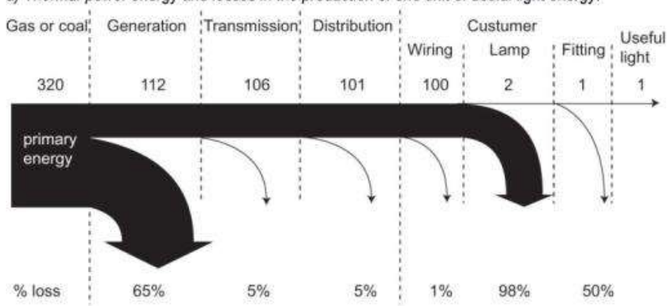
BIG BANG

13,000,000,000 to
14,000,000,000 years ago

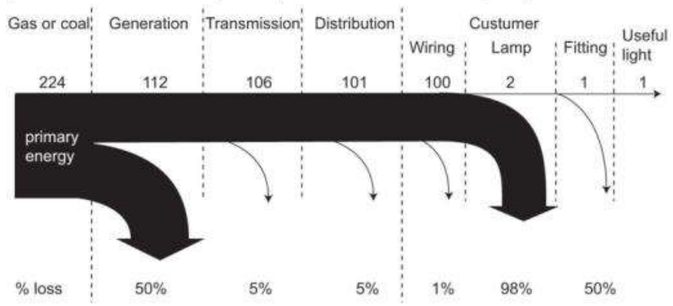
4,600,000,000 years ago

200,000 years ago

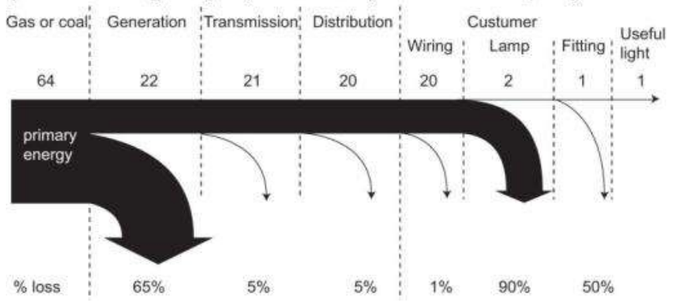
a) Thermal-power energy and losses in the production of one unit of useful light energy.



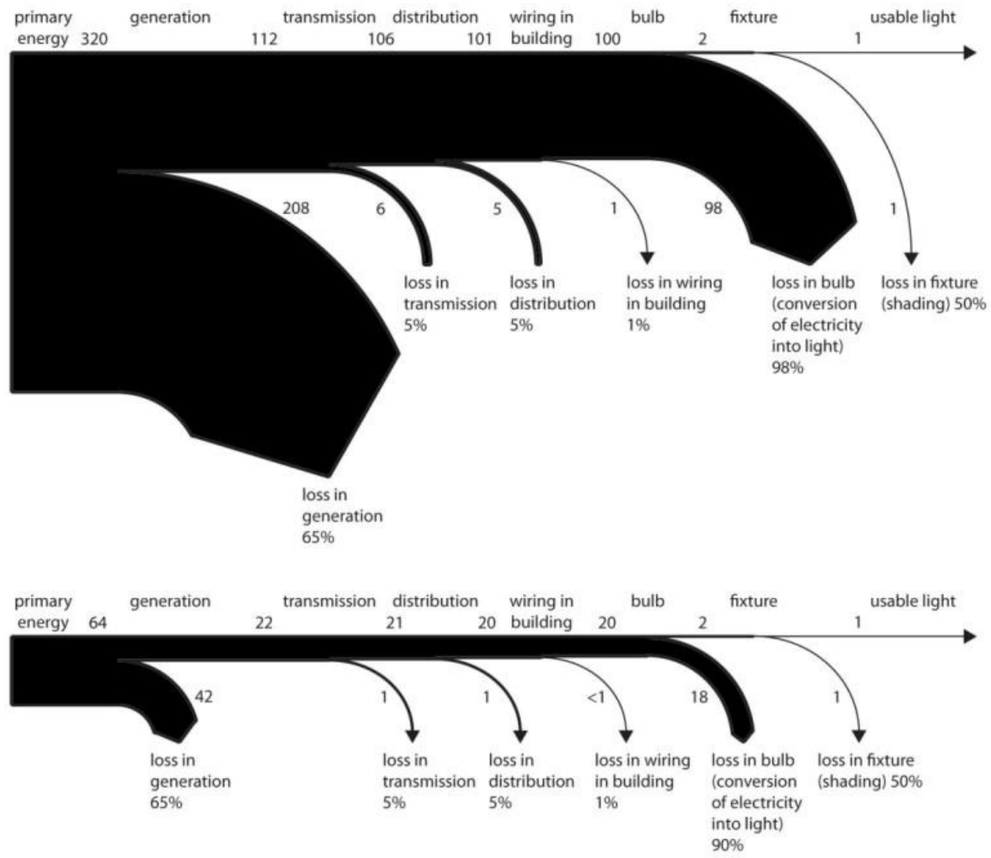
b) Investment in more efficient gas-fired power stations reduces fuel inputs by around 30%.



c) Investment in energy-saving compact fluorescent lightbulbs reduces fuel inputs by around 80%.



Source: IPCC 2007 Workgroup 3 Chapter 4 [corrected numbers]



Redrawn to scale, reflecting actual savings

Used in various presentations in 2008 ff: Scale matters: the 2007 IPCC comparison does not illustrate the energy savings properly when switching to more efficient power generation and fluorescent light bulbs.

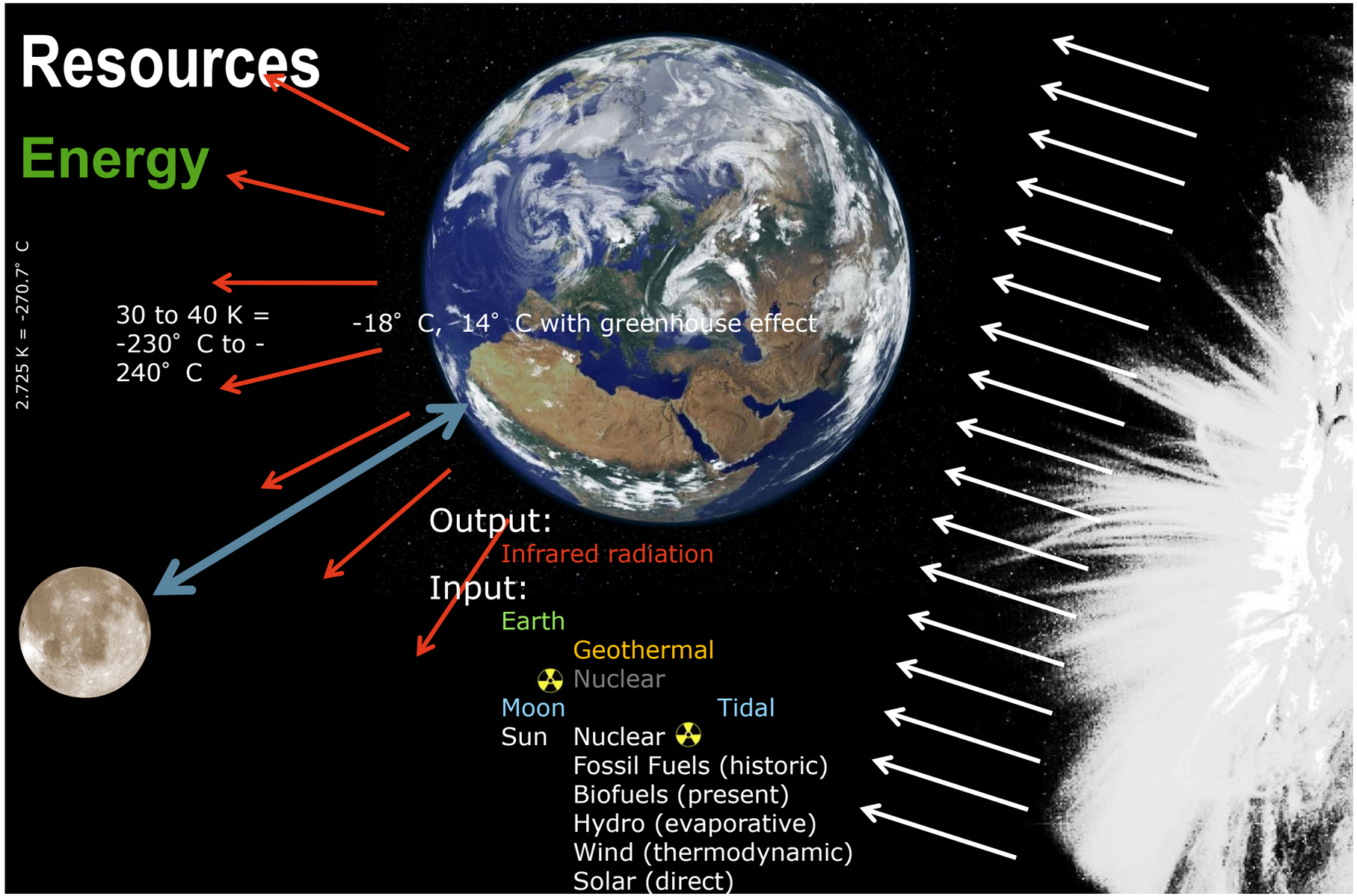
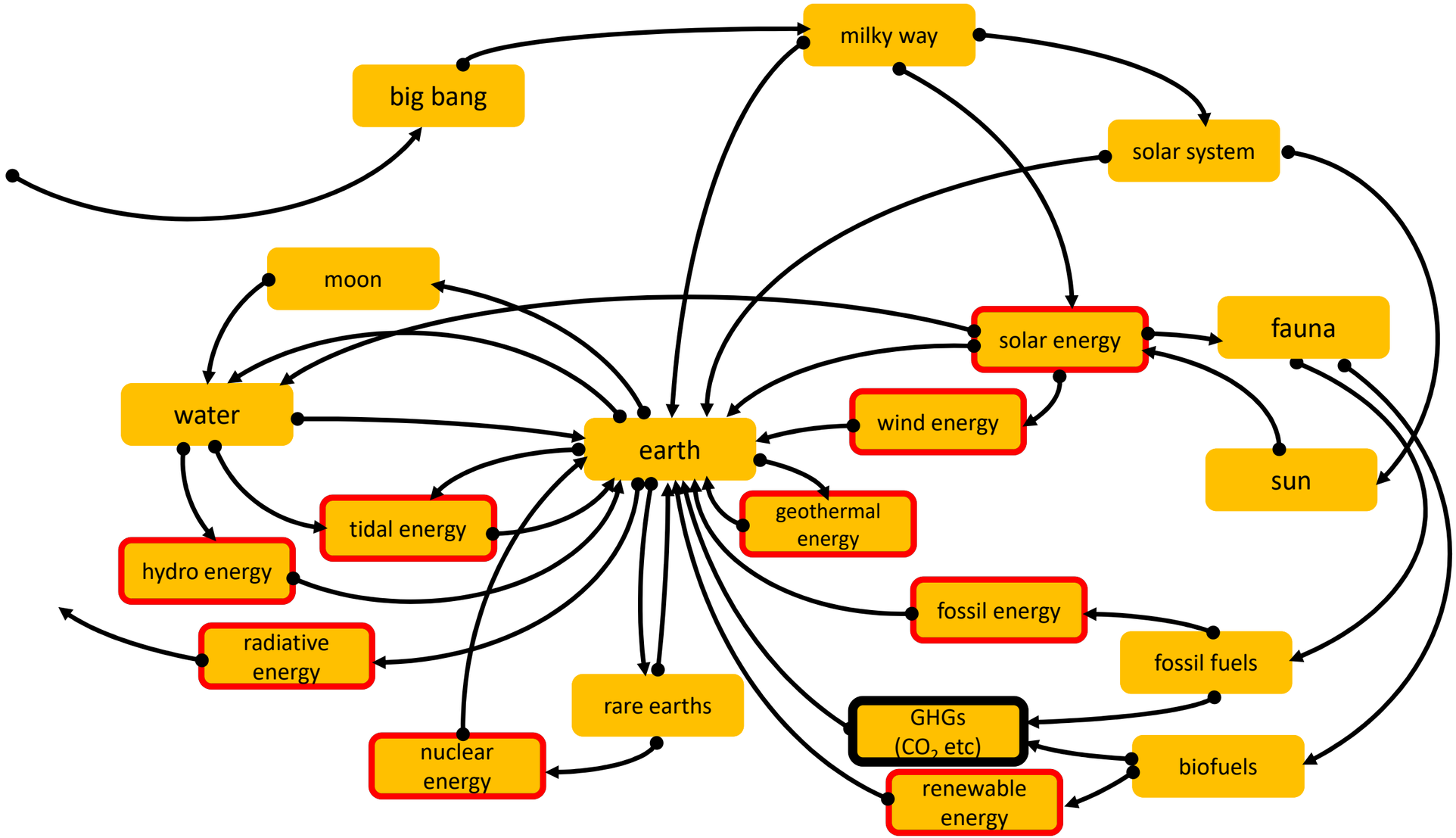


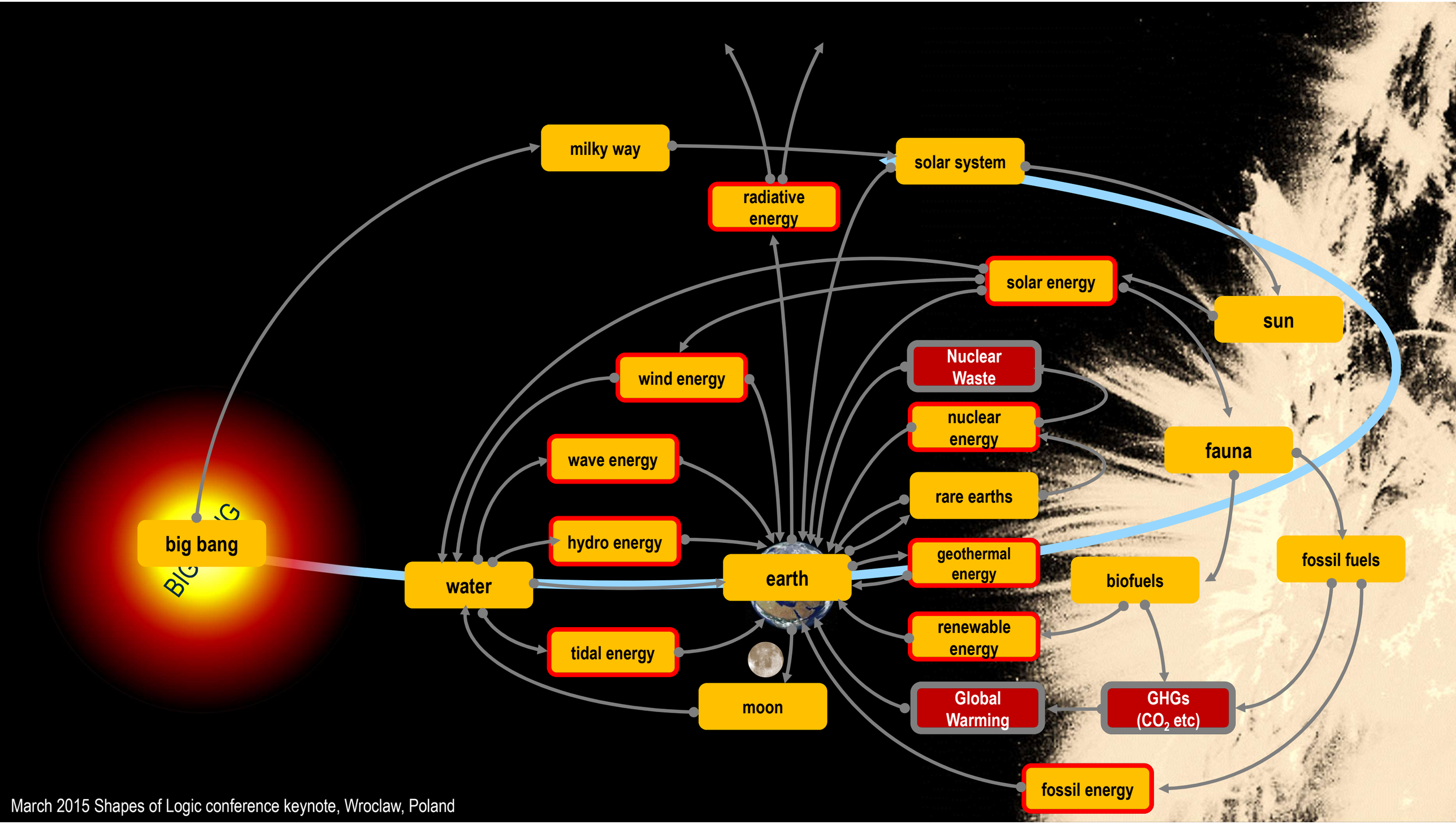
Image Source: NASA

Nov 2012 parametric design presentation at Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

System: Universe → Earth

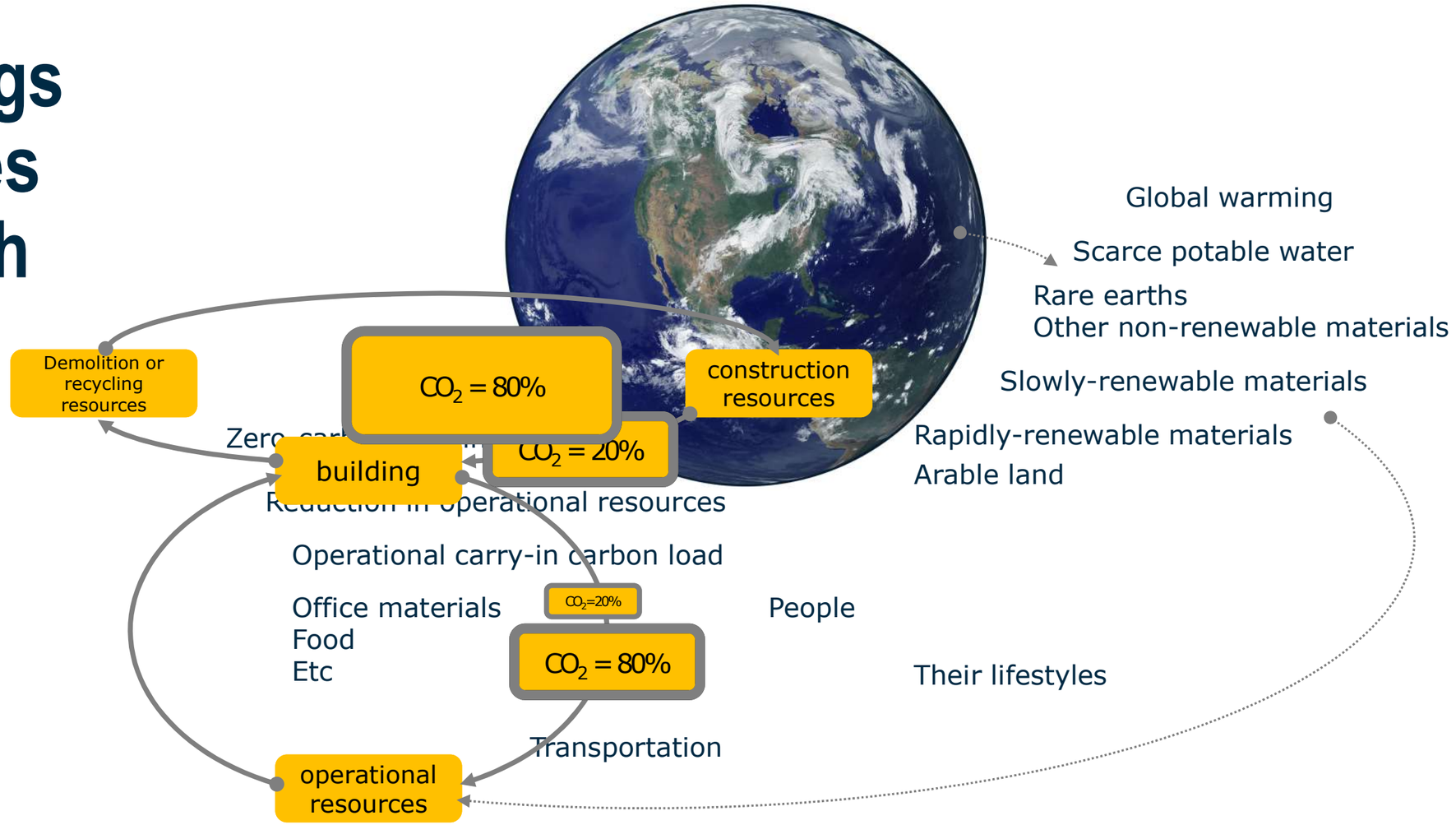


November 2009 Smarter Geometry presentation at SmartGeometry conference, University College London



March 2015 Shapes of Logic conference keynote, Wroclaw, Poland

Buildings
→ Cities
→ Earth



As we decrease operational energy the relative embedded energy increases

November 2009 Smarter Geometry presentation at SmartGeometry conference, University College London

(Conceptual) Design and Computing

Shifting understanding from interaction of various design and analysis teams and tools to semi-automated design iterations with analysis feedback where each of the (computational) systems is developed by teams or team members.

From an AI perspective, all involved entities are agents in the system.

Design Feedback Loop

Tuners

Location

Weather/climate data

etc

GIS data – (urban) context data

Architectural program data

Materials information

Cost data

Solar performance analysis

Program performance analysis

Visual/Aesthetic performance analysis

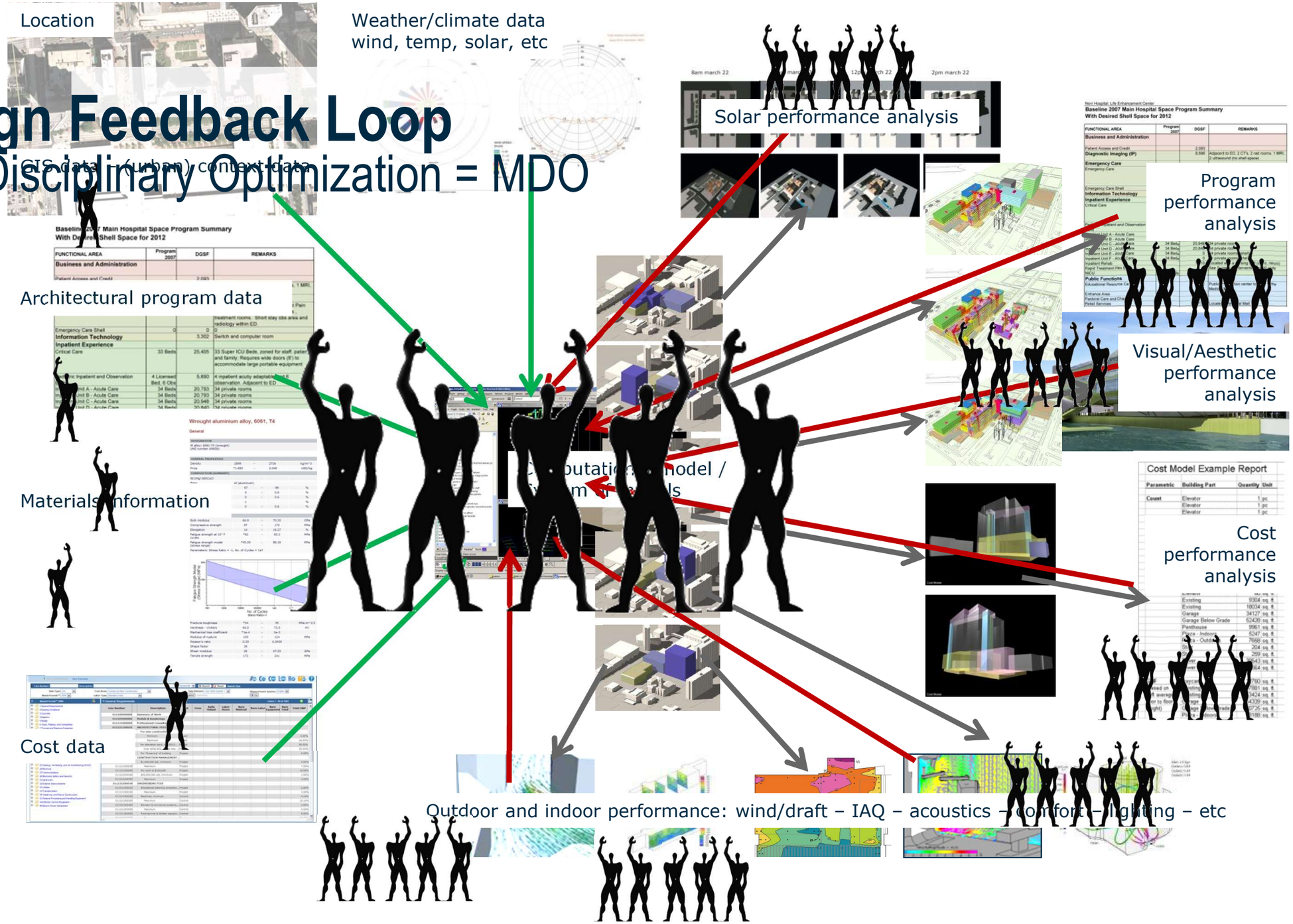
Cost performance analysis

Outdoor and indoor performance: wind/draft – IAQ – acoustics – comfort – lighting – etc

November 2009 Smarter Geometry presentation at SmartGeometry conference, University College London

Design Feedback Loop

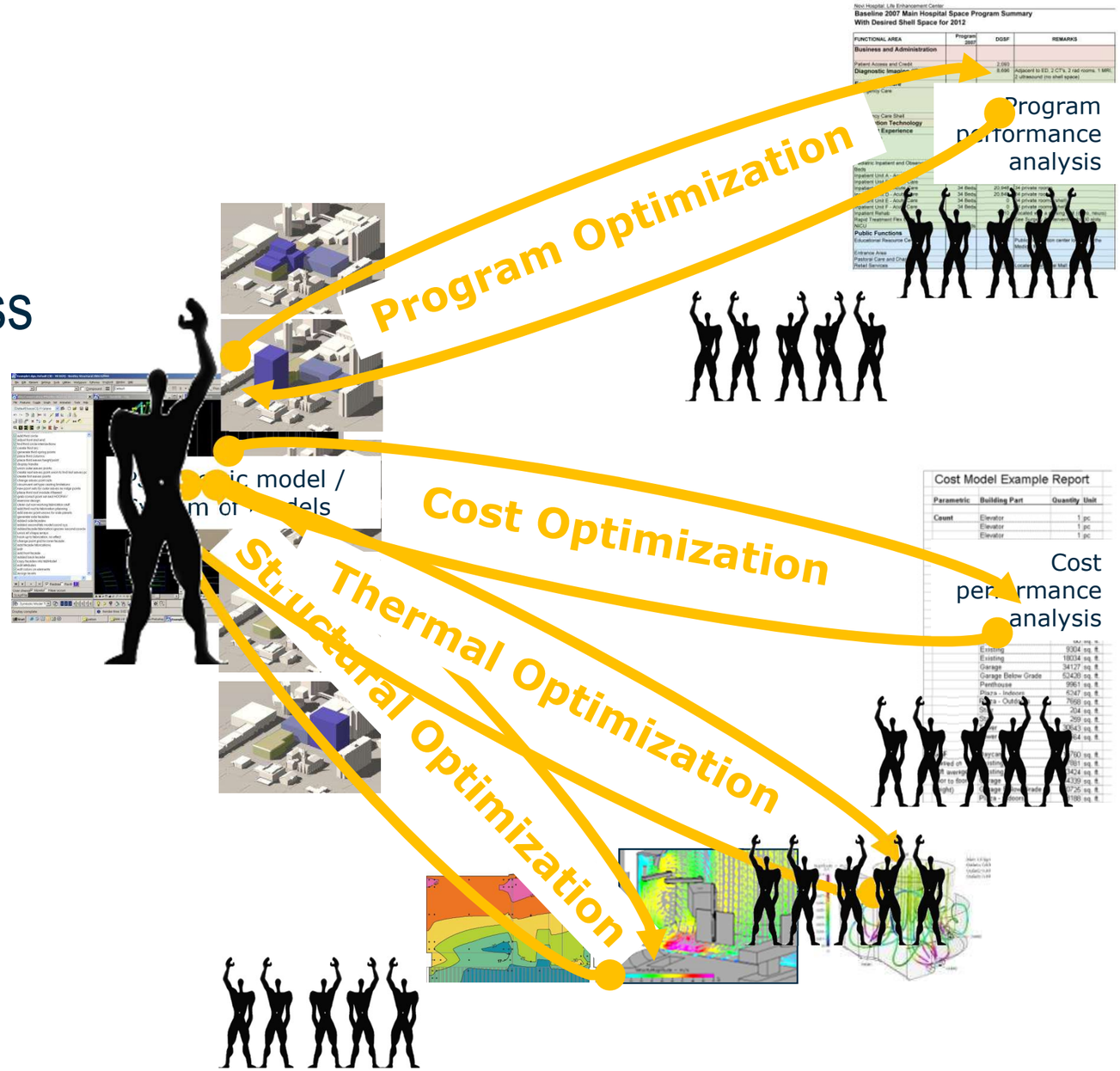
Multi-Disciplinary Optimization = MDO



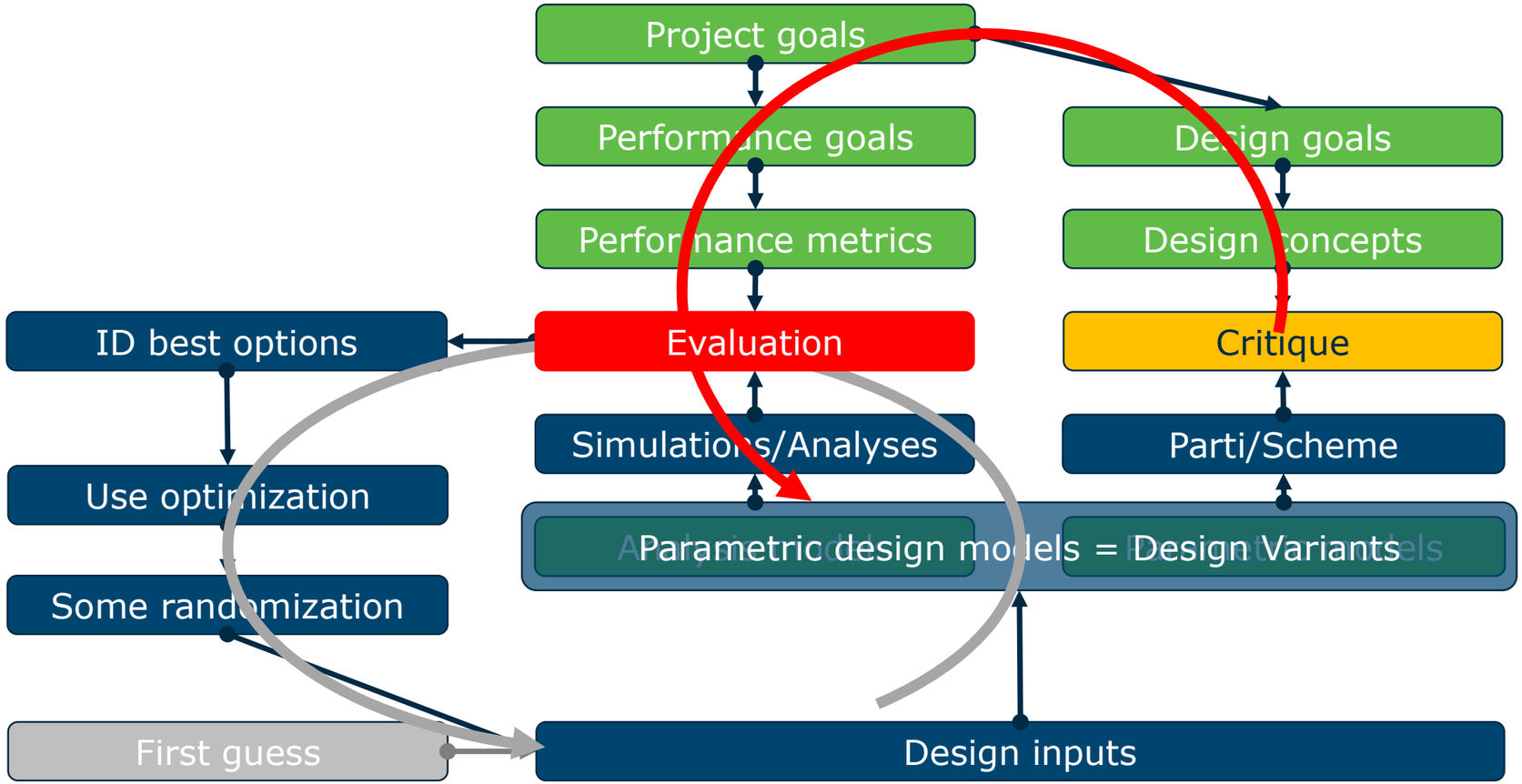
Nov 2012 parametric design presentation at Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

Refinement

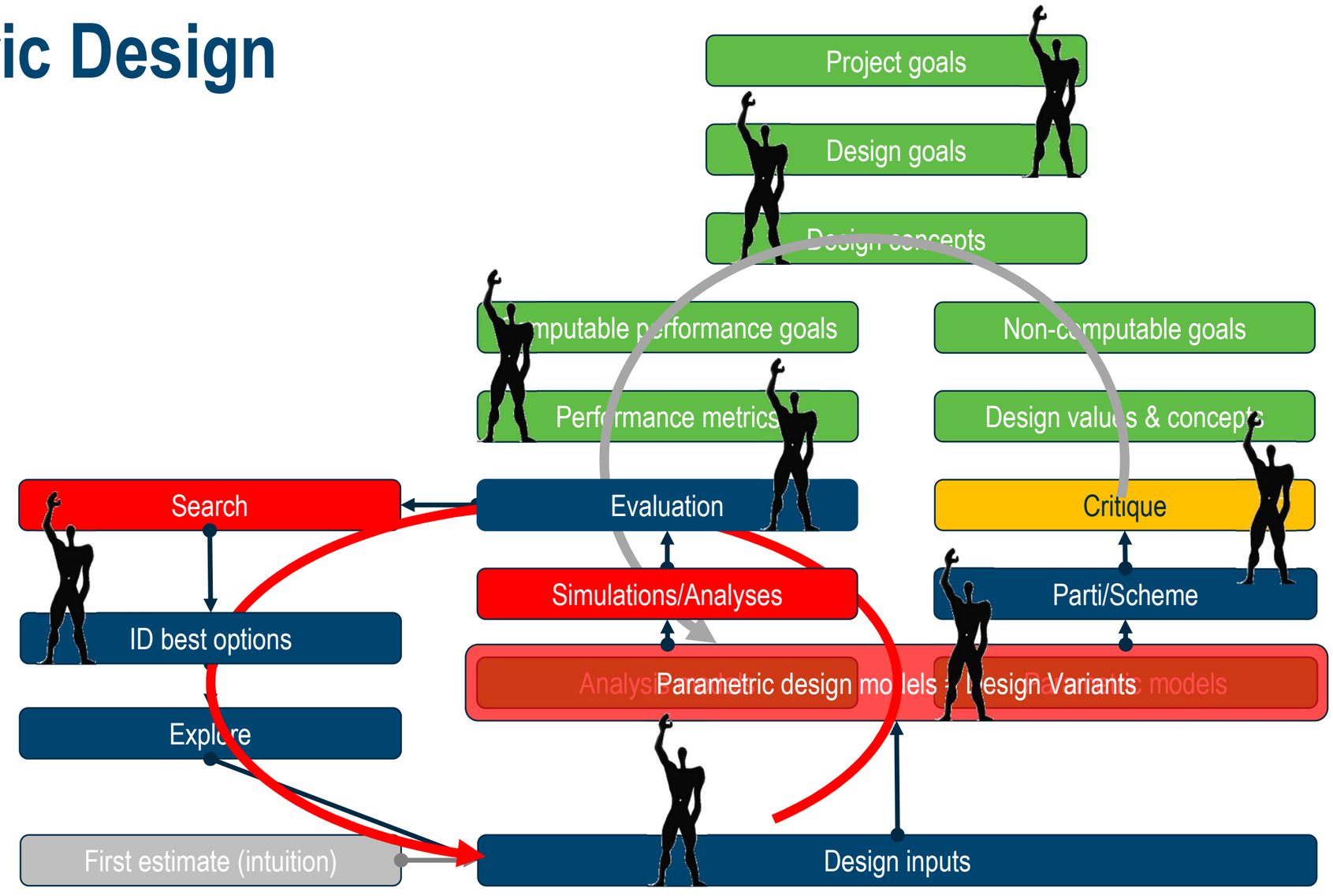
Social/cultural process



Iterative Design Refinement Strategy



Parametric Design



A wholistic design systems must integrate
non-computable design goals (value-based)

October 2013 ACADIA Design Analysis and Optimization workshop, University of Waterloo, Cambridge, ON, Canada

An Observation

The design process is a complex dynamic, coupled system of people, artifacts, and socio-cultural practices.

Nancy Nersessian, SIGraDi 2013 keynote

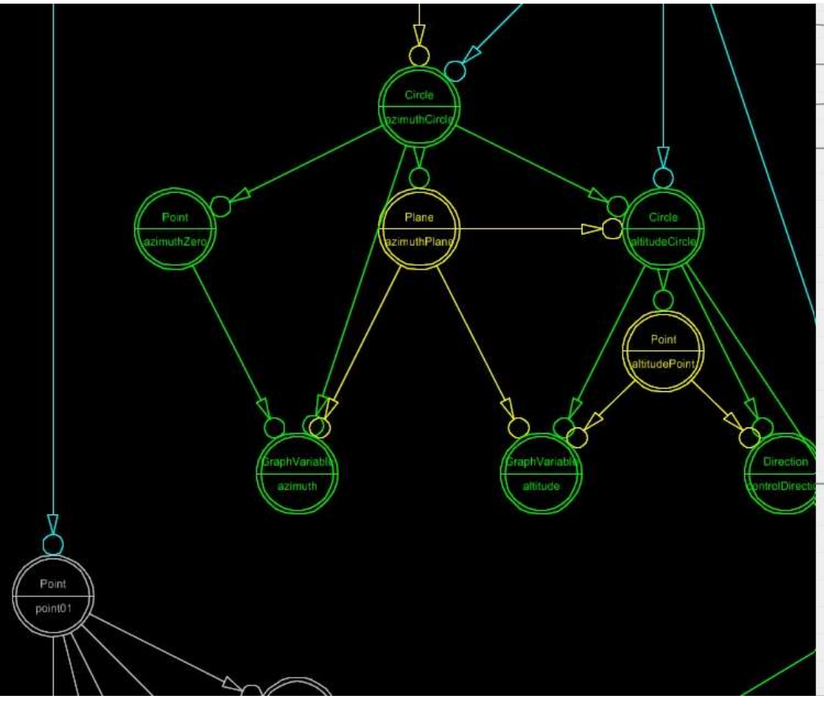
Product Management

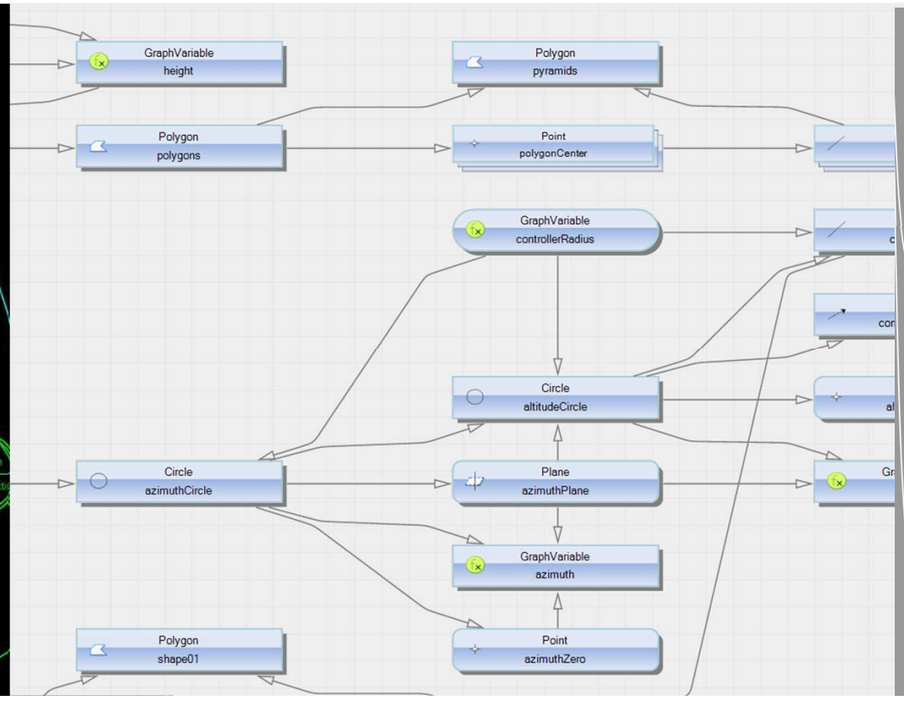
OpenBuildings™ GenerativeComponents®

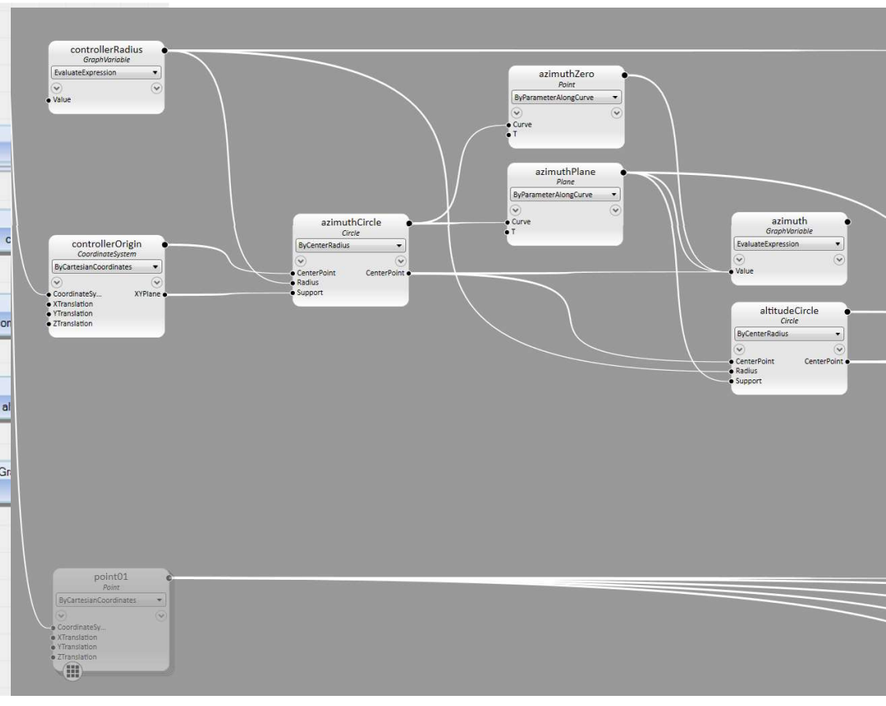
OpenBuildings™ Station Designer

GenerativeComponents UX

Based on collaborative research with Simon Fraser University Professor Rob Woodbury, revolutionized GenerativeComponents' User Experience paradigm from a node-edge graph reporting the algorithmic structure to an interactive algorithm editing tool.







GenerativeComponents Optimization Node

Successfully advocated cross-departmental effort to use industry-proven genetic algorithm (GA).

Convinced the owner of the GA to extend it from single-objective to true multi-objective GA.

Achieved with my team user experience improvements in visualization of results, retrieving parameter sets for interesting solution, and persisting optimization results for later reference.

CAAD Futures 2015 Parametric Design And MOO Workshop.gct [GenerativeComponents Transaction File (GCT)] - GenerativeComponents V8i (SELECTseries 6)

File Edit Settings Tools Utilities Workspace Window Help

Default

Control Panel

depth	30.0
f2f	5.0
height	100
rotation	0
slider01	10
slider02	0
slider03	1.0
taperRatio	0.5
width	15.0

Tasks | Control Panel

Transactions

	Transaction
1	Add baseCS
2	Change baseCS
3	Add coordinateSystem01, depth, f2f, height, point01, rotation,...
4	Add note01, point02, point03, point04; change point01
5	Add coordinateSystem01, coordinateSystem02,...
6	Add floorSeries; change f2f, height
7	Add point05
8	Function changes; add curvePointX, point06, point07,...
9	Function changes; add slider03, taper2, taperRatio; change...
10	Function changes
11	Change curvePointX
12	Change slider01, slider02, taperRatio
13	Add floorplates
14	Add polygon01
15	Change slider01, slider02, slider03, taperRatio
16	Add expression01, fitnessArea
17	Function changes; add functionCall01; change polygon01
18	Function changes
19	Rename fitnessOutOfPlane; add curvePointY; change...
20	Change point06, point08
21	Rename fitnessFacadeArea; change fitnessFacadeArea
22	Add buildingSolid, facadeSurface, fitnessVolume2Surface;...
23	Add fitnessInverseArea, note02; change fitnessOutOfPlane,...
24	Function changes; add daylightGuess, fitnessDayLighting;...
25	Add optimizer01
26	Change optimizer01
27	Add expression01
28	Add expression02
29	Change slider01, slider02, taperRatio
30	Change expression01, expression02, fitnessArea,...
31	Delete expression01, expression02
32	RUN OPTIMIZATION HERE

Transactions | Node Types

Graph

note02
fitness values adjusted for minimization (lacking the capability to switch to maximization)

fitnessArea
rplates.TotalArea - floorpl
366.56684480646

fitnessInverseArea
1.0/fitnessArea
0.000157070
Value

area:
economic potential

optimizer01
Local
Parameters
Objectives

fitnessFacadeArea
gon01.TotalArea
467.79851102124

fitnessVolume2Surfac
fitnessFacade
0.2387718
Value

envelope/Volume:
energetic performance

fitnessOutOfPlane
outOfPlaneRatio
2375.4981
Function
facadePanels

non-planarity:
construction cost

daylightGuess
daylightAssessment
0.476190476190476
Function
floorplateList
Value

fitnessDayLighting
daylightGuess
0.4761904
Value

day lighting:
IEQ/energetic perf.

facadeSurface
BSplineSurface

buildingSolid
Solid
BySurfaceCapping
SurfaceToCap
Volume

Element Selection

Element Selection > Identify element to add to set

GCCOMMAND loaded.

Default

baseCS.XYPlane

Google Earth Pro

Axon

1 2 3 4 5 6 7 8

X 39.7323 Y 36.5098 Z 43.4778

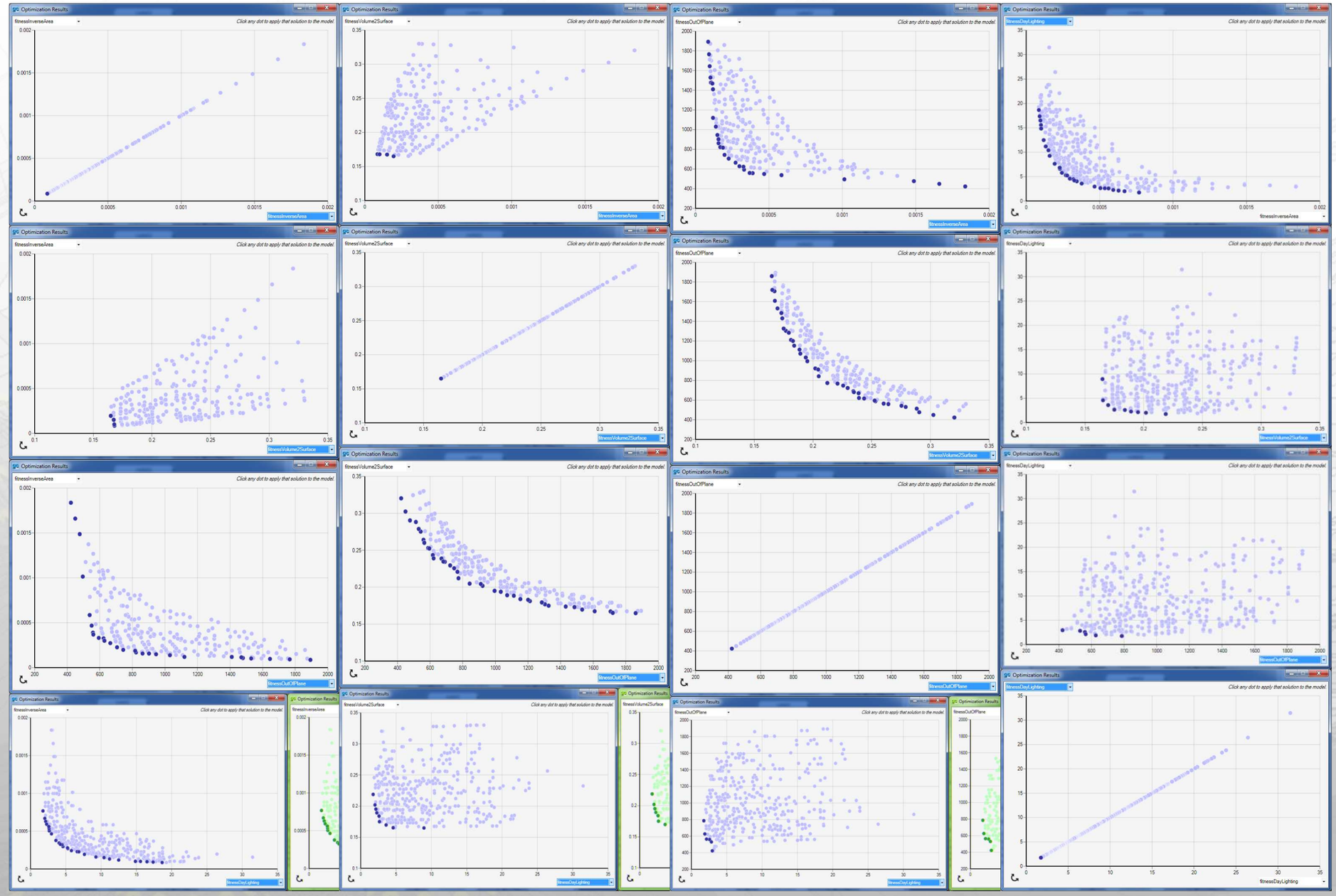
13:02

fitnessInverseArea

fitnessVolume2Surface

fitness outOfPlane

fitnessDayLighting



GenerativeComponents Special Interest Group

2017-09 GC SIG - Working With the Graph
2017-10 GC SIG - (Nested) Lists, Arrays, and Replication
2017-11 GC SIG - Simple Scripting
2017-12 GC SIG - GNTs
2018-01 GC SIG - CompoundCells
2018-02 GC SIG - Teamwork
2018-03 GC SIG - Facades
2018-04 GC SIG - Query Expressions Recursion Curves
2018-05 GC SIG - CONNECT Edition Update 3
2018-06 GC SIG - Curved and Spiral Stairs
2018-07 GC SIG - Zero to Simple Scripting
2018-08 GC SIG - One Year GC SIGs
2018-08 GC SIG - Recursion (2018-08 Encore)
2018-09 GC SIG - CONNECT Edition Update 4
2018-10 GC SIG - Zero to Simple Scripting 2
2018-11 GC SIG - The GC SDK
2018-12 GC SIG - Lists, List.Methods, Juggling Lists
2019-01 GC SIG - Alignment-Based Modeling
2019-02 GC SIG - The GC SDK - Digging Deeper
2019-03 GC SIG - DoubleTangentController Demystified
2019-04 GC SIG - Arcs, Cones, Toroids
2019-05 GC SIG - Transactions
2019-06 GC SIG - Collected User Topics

Developed an algorithm generating curved stairs between two non-intersecting curves.

Developed a recursive algorithm for subdivision of polygonal quad meshes.

OpenBuildings Station Designer

Developed linear asset generation through GenerativeComponents, for example to generate tunneling systems like they are used for the London subway system and for London’s CrossRail tunnels.

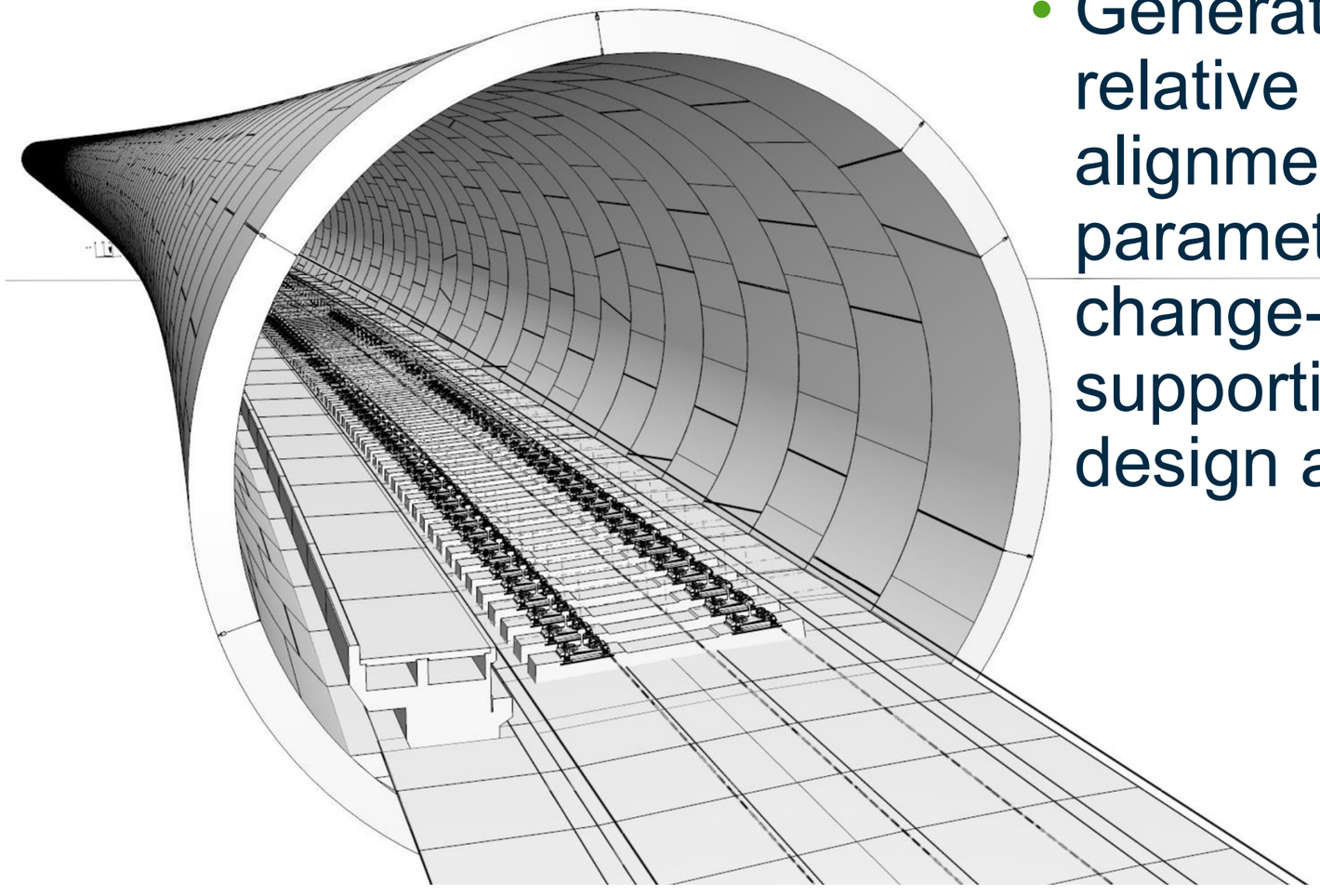
Developed coordination of assets like platform edges with tactile tiles aligned to linear assets like rail lines.

Developed cross-passage scripts connecting between two tunnels for services and safety, with corresponding structural concrete volumes needed to stabilize the tunnel linings.

Capability #4

OpenBuildings Station Designer

Computational Design Templates



- Generate station assets relative to linear alignments utilizing parametric design and change-propagation supporting exploration of design alternatives.

Computational Design — ABD-GC CE U4.tunnel.28.dgn [3D - V8 DGN] - AECOsim Building Designer

File | Home | View | Model | Help

Search Ribbon (F4)

Selection | Move | Copy | Delete | References | Models | Levels — Common Tools

None | Default ((none)) — Attributes

Assign to Node | Replication Style — GC Attributes

Update Model | Generate Node Type — Primary

Element Selection | Construction Plane — Selection

Point | Promote Element — Place Geometry

Move | Copy | Mirror — Manipulate

Edit Node | Delete Submodel — Modify

Compound | Part Level | Part Color | Part Style | Part Weight | X -63.2 | Y -38.5 | Z 19.0

Transactions

101	T2 Change TopConcreteProfiles, TopProfile2SegLast
102	Add LastProfileForTopConc
103	Add TopConcProfilesAll
104	Add TopConcSurface
105	Add TopConcrete
106	Add WalkwayEdgeDatum
107	Add WalkwayProfOriginPnt
108	Add WalkwayProfCS
109	Add WalkwayAlignmentDists
110	Add WalkwayXPoints, WalkwayYPoints; change WalkwayProfCS
111	Add WalkwayProfilesForSurface; change WalkwayProfCS
112	Add WalkwayNegativeXDir; change WalkwayProfCS
113	Add WalkwayLastProfile; change refAttachRailSections
114	Add WalkwayAllProfiles
115	Change WalkwayXPoints
116	Add WalkwayTopAllProfiles, WalkwayTopLastProfiles, WalkwayTopPr
117	Add WalkwaySurface
118	Add WalkwayTopSurface
119	Add WalkwayAsSolid
120	Add WalkwayTopAsSolid
121	Add color03
122	Add RailCantLines
123	Add RailCenterLine
124	Add sleeperDistances, sleeperDistancesWatch; change ringRadius, sl
125	Add sleeperOrientationDist
126	Add sleeperAlignmentOrigins
127	Add sleeperAlignmentPoints
128	Add sleeperAlignmentDirection
129	Add sleeperAlignmentPlanes
130	Add sleeperTrackPoints
131	Add sleeperPlacementCS
132	Add Sleepers
133	Change nu
134	Add Export
135	Add Export
136	Add Export
137	S Change r

Node Types | Node Pro

Graph

View 1, Design Model

Algorithm placing keyed segmented tunnel liners with programmed rotations as used in bored tunnels and other tunnel and rail assets.

Change View Perspective > Settings Saved | File [C:\ProgramData\Bentley\AECOsim CONNECT Edition\Configuration\WorkSpaces\AECOsimExamples\worksets\TIM\Designs\ABD-GC CE U4.tunnel.28.dgn] saved | Default ((none))

orginCS.XYPlane | Design Model | 1 2 3 4 5 6 7 8 | None | 0.00°

Algorithm placing platform edges parametrically aligned with rail alignments to generate tactile tile placements and other platform assets.

Computational Design — CrossPassage.dgn [3D - V8 DGN] - AECOsim Building Designer

File | Home | View | Model | Help

Search Ribbon (F4)

Selection | Move | Copy | Delete | References | Models | Levels — Common Tools

None | Default ((none)) — Attributes

Assign to Node | Replication Style — GC Attributes

Update Model | Generate Node Type — Primary

Element Selection | Construction Plane — Selection

Point | Promote Element — Place Geometry

Move | Copy | Mirror — Manipulate

Edit Node | Delete Submodel — Modify

Compound | Part Level | Part Color | Part Style | Part Weight | X 21.7 | Y 11.2 | Z 8.7

Transactions

79	Change CPSLength
80	Change TunnelSegmentLength
81	Change PrimaryTunnelCSs
82	Change InnerSurface1
83	Change OuterSurface1
84	Change CPPAxisInnerSurface, CPPAxisOuterSurface
85	Change CSAtCPPAxisEnd
86	Change CollarRadius, CollarRectangleHDim, CollarRectangleVDim
87	Change CollarInnerVolume1, Tunnelsegment1
88	Change watch1
89	Change CollarMinusInnerTunnel1, CollarOuterVolume1, CollarStub1,
90	Change Collar1
91	Change CPLong
92	Add TunnelSegment2Color
93	Add T2LengthSensors
94	Add T2SensorPlanes
95	Add point14
96	Change Tunnel2CSs
97	Change OuterSections2
98	Change OuterSurface2
99	Change InnerSections2
100	Change InnerSurface2
101	Add CSAtCPSAxisEnd
102	Add CollarCircle2
103	Add CollarMinusInnerTunnel2, CollarOuterVolume2, InnerTunnelVol
104	Add CollarRectangle2
105	Add CollarInnerVolume2, CollarStub2
106	Add Tunnelsegment2
107	Add TunnelToCollarRectangle2
108	Add TunnelToCollarDemo2, TunnelWithCollarOpening2
109	Add Collar2
110	Add watch2
111	Add CPSA:
112	Add Tunne
113	Add Tunne
114	Add Cross
115	Change Cu

Graph

View 1, Design Model

Algorithm placing cross-passages between two neighboring tunnel alignments with all required structural elements as volumes.

Node Types | Node Pro

Element Selection > Identify element to add to set

Default ((none))

baseCS.XYPlane | Design Model | 1 2 3 4 5 6 7 8 | None | 0.00°

Sample Generative UI Specification

UI - Task bar and toolboxes

Tuesday, August 12, 2014
19:28
Last changes 09-06-2014 18:41

Design proposal (see list of changes below)

Primary Tasks								
Toolboxes from Primary Tasks								
Graph Tasks								
Transactions Tasks								
Parameter Tasks								
Function Tasks								
GC Tasks								
Node Tasks								
Manipulate Node Tasks								

TJ/N

2014-08-13: removal of New DGN Model icon from GC tasks.

2014-09-05: included Jeff's suggestions renaming items (and need to double-check whether tools issue correct commands)
Commands only **open** dialogs/windows. Users can close them through the windows' respective close boxes.

HELP menu needs some work/clean up, too

	Used	Name in menu/toolbox	Name in Tasks	Definition Location	Key-in	Additional notes
	X		Select	Microstation		
	X	Show Graph	Show Graph	dgnlib	gc dialog graph show	
	X	Record Graph Locations	Record Graph Locations	GCCOMMAND /Transactions	gc graph applylocations	[currently: Record Graph Locations] Actually affects transactions
TBD	X	Remove Graph Locations	Remove Graph Locations	Missing		[currently: Remove All Assigned Symbol Locations] Actually affects transactions
	X	Show Transactions	Show Transactions	dgnlib	gc dialog transactions show	
	X	Record Model Changes	Record Model Changes	GCCOMMAND /Transactions	gc transactions commitchanges	Should be top-level command icon
	X	Indicate Affecting Transactions	Indicate Affecting Transactions	GCCOMMAND /Transactions	gc node showtransactions	[~~misnomer: indicates transactions affecting the node~~]
	X	Delete Suppressed Transactions	Delete Suppressed Transactions	GCCOMMAND /Transactions	gc transactions delete suppressed	
	X	Show Controls	Show Controls	dgnlib	gc dialog controlpanel show	
	X	Show Functions	Show Functions	dgnlib	gc dialog functions show	
	X	Show Node Dictionary	Show Node Dictionary	dgnlib	gc dialog dictionary show	
	X	Update Model	Update Model	GCCOMMAND /Model	gc model update all	
	X	Show Watches	Show Watches	dgnlib	gc dialog watches show	

Sample Sprint

Sprint 07 priorities (Oct 5 to Nov 1):

There are three high-priority categories:

1. **Finish up what's been started to "completion" (minus anything that can be considered Defects rather than finishing the Enhancement)**
2. **Start new "epics" that we want to be in version 1 of the ABD-GC integration project**
3. **High priority items that are not included in Epics but still are important to include in version 1**

1. **Finish up what's been started to "completion" (minus anything that can be considered Defects rather than finishing the Enhancement)**
   a. **Finish up started ABD-GC nodes (everybody their own node types)**
      Make them work consistently and robustly
      (Roman will finish Door/Windows)
      Placement Points for Doors/Windows (list of points depends on type of/specific item door/window/user defined contents) (Roman)
      Writing input to DataGroup properties and make them persist (Mykolas)
   b. **ATPs for ABD-GC nodes (Jonas coordinates)**
      (otherwise everybody should provide ATPs for their own node types)
   c. **Fully resolve workspace clean-up: (Mary)**
      assert continued functionality of stand-alone version.
      Remove from DGN folder or isolate example scripts into separate folder in GC
      Default project for standalone version.
      Assure availability of all required resources to GC extension in ABD and MicroStation, as well as for GC standalone.
      Configuration (substantially done)
      PW integration (file operations) (Michael >= 2 weeks left)
   d. **Integration proper:**
      Interface/task integration (ongoing) (Mary)
      DGNLIB clean up and Internationalization (ongoing) (Mary)
      GC loading/unloading from ABD (done, but cannot demo) (Mary)
      Flyover information (Mary)

2. **Start new "epics" that we want to be in version 1 of the ABD-GC integration project**
   a. **Feature Tracking (for us) (Michael, after finishing PW integration)**
   b. **Internationalization:**
      Additional rework of DGNLIBs (Mary)
      Strings from source files to resources
   c. **Compound Cell Factory (Jonas)**
      Quick parametric generation of cell families, e.g. windows
   d. **Dynamic Views**

Globally Distributed Team

Global Presentations and Workshops

Relevant Quote about Architecture

[…] today many people think of architecture only as
a discipline that produces shiny, spectacular objects.
Yet architecture is a discipline that requires a
deep cultural, sociological, economical,
political and ethical understanding of the world.

[…] in a state of crisis like we are today,
we have to rethink the world.

Odile Decq, Confluence Institute for Innovation and Creative Strategies

Comprehensive List of Publications, Presentations, Workshops, Civic Activities, etc. is separately available