Parametric Analysis is the new black!

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Iterative Process: Design - Evaluation - Optimization
What is [the History of] Parametric Design?

Go read this link: http://www.danieldavis.com/a-history-of-parametric/

two centuries of developments. A fairly convoluted path that missed potholes of theory and architecture in order to idle past idolised technology. Ultimately this history wasn’t scholarly enough and wasn’t needed for the argument of my thesis. I deleted it.
What is Grasshopper?
Why does it matter?
Visual Scripting

Pt = Rhino.Geometry.Point3D(X, Y, Z)
Visual Scripting

evenNum = []
oddNum = []
for i in range(10):
    if i%2 == 0: even.append(i)
    else: odd.append(i)
Make your own components!
Let’s Get Back to the Circle: Design - Evaluation - Optimization
Design <> Evaluation <> Optimization Workflow - Idea
Design Parameters
Design ↔ Evaluation ↔ Optimization Workflow - Reality!
Design <> Evaluation <> Optimization Workflow - Result

http://www.youtube.com/watch?v=fYw7KexxThM
Postpartum Depression

- Was it worth it?
- How long does it take to set up a similar workflow for the next project?
- Can I show to someone else how to do it?
- ...
Few Months later...

http://www.youtube.com/watch?v=qdbo0uM9mj4
Turning Point

Keep It Simple, but not Stupid!
Ladybug: Parametric [Weather Data] Analysis

http://www.youtube.com/watch?v=OEjwAyC2I_0
Ladybug: Sun Path (Radiance)
Ladybug: Sun Path (Radiance) + Hourly Weather Data
Ladybug: Tregenza Sky Dome (GenCumulativeSky)
Ladybug: Radiation Rose (GenCumulativeSky)
Ladybug: Interactive Radiation Rose (GenCumulativeSky)
Ladybug: Weather Data Verification
Ladybug: ~Realtime Radiation Studies
(GenCumulativeSky + Parallel Raytracing)
Honeybee: Grasshopper <> Radiance/Daysim/EnergyPlus

http://www.youtube.com/watch?v=qoqu4jaU2rM
Honeybee: WorkFlow

1. Split mass to zones
2. Add glazing based on orientation
3. Export to EnergyPlus and RADIANCE
4. Read the simulation result
Honeybee: All in 2 Minutes!

Watch the full length video here: http://www.youtube.com/watch?v=aoMy4O3vN6g
Honeybee: Make it faster and More Parametric Friendly!
Honeybee: Make it faster and More Parametric Friendly!
Honeybee: Make it faster and More Parametric Friendly!
Honeybee: Does it look right?

Honeybee: Multiple Sky Methods
Honeybee: Multiple Material Components

- **Glass Material**
  - `glass_0.23`
  - Properties: `RTransmittance`, `GTransmittance`, `BTransmittance`, `RefractiveIndex`
  - Values: `0.0`, `0.0`, `0.0`, `1.520`

- **Opaque Material**
  - `plastic_0.23`
  - Properties: `RReflectance`, `GReflectance`, `BReflectance`, `Roughness`, `Specularity`
  - Values: `0.0`, `0.0`, `0.0`, `0.0`, `0.0`, `0.230`, `0.230`, `0.230`, `0.000`, `0.000`
Honeybee: OCT + View + Rendering/Simulation Options
Honeybee: Result Modification
What’s happening inside the zoo after Ladybug?
Multi-objective optimization study (Ladybug + Octopus)

Check the video here:
(http://www.youtube.com/watch?v=6c32kZN19FU)

WIP by Francesco De Luca
(http://www.youtube.com/watch?v=6c32kZN19FU)

(Ladybug + Galapagos)
Tangible Design Interface (... + gHowl + Ladybug + Honeybee)

In collaboration with Anthony Viola (http://www.youtube.com/watch?v=cUqxE3rk8_M)
Butterfly: Grasshopper + Radiance + OpenFoam (web-based)

In collaboration with EFRI-SEED project (http://www.buildsci.us/efri-pulse.html)
Grasshopper <> OpenStudio

Thanks Daniel Macumber!

No luck to compile the python version yet! - Danie 🤔
Other developments...

- Grasshopper/Rhino <-> Ladybug/Honeybee <-> GIS
- Web-based Applications for Parametric Environmental Analysis
- New components on top of the Ladybug
- There will be a new release pretty soon!
Thank you!

Questions? Suggestions? Comments? ...

http://thorntontomasetti.com/blog/acm

Advanced Computational Modeling
Thornton Tomasetti