AS500585

How Generative Design Can Help Optimize New Neighborhoods

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Learning Objectives

- Learn step by step how to build your own Generative Design script for dwelling layout optimization.
- Learn about the value and positioning of Dynamo, Spacemaker, and Generative Design for Revit.
- Learn why, how, and when to use Spacemaker for residential planning optimization.
- Discover how Generative Design in Revit can effectively be used for neighborhood planning.

Description

The need for affordable housing has never been so high worldwide. One possible solution is to optimize the development of new neighborhoods. But how can you get a maximum number of residential buildings on your plot in a sustainable way while still providing comfort?
In this class, we'll teach you step by step how you can use Generative Design in Revit and Dynamo to optimize the planning of neighborhoods of single-family residential buildings, including plot subdivision, land-use assignment, and placement and shape of structures. We'll then review how Spacemaker brings even more value into this complex exercise for the optimization of single family residential buildings.

Speaker

Dieter Vermeulen

Working as a Technical Sales Specialist AEC for the Northern European region at Autodesk, Dieter is specialized in the products of the Computational Design and Engineering portfolio. Within that domain he helps their customers to learn more about new and innovative workflows and solution strategies. He is an evangelist and big influencer of the power of generative and computational design in the AEC industry. He has been given numerous presentations about these topics at conferences worldwide.

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YouTube Channel	www.youtube.com/user/RevitbeyondBIM

Jacob Small

Jacob is an experienced design technologist with a demonstrated history of finding solutions in the AEC industry. He has ample experience leveraging BIM, computational design, generative design, Revit, Dynamo, and other associated software suites to find the 'best way forward' and ensure the customers he works with are successful in their endeavors..

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Introduction

However, today, our built environment – including some of its newest assets - is responsible for 40% of global energy consumption, 25% of global water consumption, and 30% of GHG emissions. So there's no doubt we need to re-evaluate how we design and deliver our buildings.

There are now twice as many people on the planet today as there was 50 years ago Urbanization will result in 9.7B people living on this planet by 2050, with 6.4B expected to live in cities – 68% of our total population. According to the WEF the population of the world's urban areas are increasing by 200K people per day. To accommodate this growth in population, we are going to need to build an additional 3,600 city-swelling buildings every day from now till then. Each accommodating at least 250 people.

The challenge we face is building these buildings quickly enough and upskilling our workforce to deliver them.

By 2060 two thirds of the expected population of 10 billion will live in cities. To accommodate this tremendous growth, we expect to add 2.48 trillion square feet (230 billion m2) of new floor area to the global building stock, doubling it by 2060. This is the equivalent of adding an entire New York City every month for 40 years. This new building stock must be designed to meet zero-net-carbon standards.

At Autodesk we believe that a better world can be designed and made for all. The future is a design challenge. The AEC industry owns much of the responsibility for building out the commercial, residential, social and economic spaces for the rapidly expanding global population. This is actually really good news for all of us. We're going to have a lot of work to do. Workflow automation, generative design and automated design exploration can revolutionize the way we design by using goals and measurable outcomes to help guide us and get all of this work done!

Imagine you are planning the interior for an office building. In one scenario, your first step is to define the design parameters by describing the amount of light you want for desks depending on the season, the desired views for conference rooms, and the maximum amount you want to spend for construction. After you define the criteria, your design tools generate all the best possible outcomes with a single analysis and evaluate the alternatives. This all takes place in a fraction of the time that it normally takes you to manually arrive at one or two best guess approximations. In the other scenario, you sit down and manually calculate how your design parameters impact other aspects of the office building like energy loads and construction costs. You tediously go through the hundreds of location variables - kitchens, bathrooms, desks, or communal space placements - produced by your choices as the design develops.
This entire process takes days or weeks as you review the options.
How might it change the way you design if, like in the first scenario, your software could help discover the implications of the goals you define instead?

Now think about a typical construction project and shifting your approach to the actual procedure of building - and not just what you're building, but how it is built. Cost overruns and waste are always the enemies of construction. What if you could mitigate these potential risk factors with better recommendations on materials or by scheduling and sequencing job site work?
What is the right strategy for placing precast concrete panels?

Or the optimum placement of a crane? A software algorithm can test numerous scenarios for potential solutions to find the best one.

These are the objectives of generative design; a technique that uses computation to augment the designer's ability to define, explore, and choose alternatives through automation. Generative design is more than a methodology; it embodies many applications and techniques. It will continue to grow more potent and useful with technology advancements such as artificial intelligence and machine learning.

But, at its heart, generative design is about providing practitioners with the ability to quickly explore, optimize, and make informed decisions to complex design problems.

The Triple Bottom Line

The triple bottom line is a business concept that posits firms should commit to measuring their social and environmental impact—in addition to their financial performance—rather than solely focusing on generating profit, or the standard "bottom line." It can be broken down into "three Ps": profit, people, and the planet.

Profit

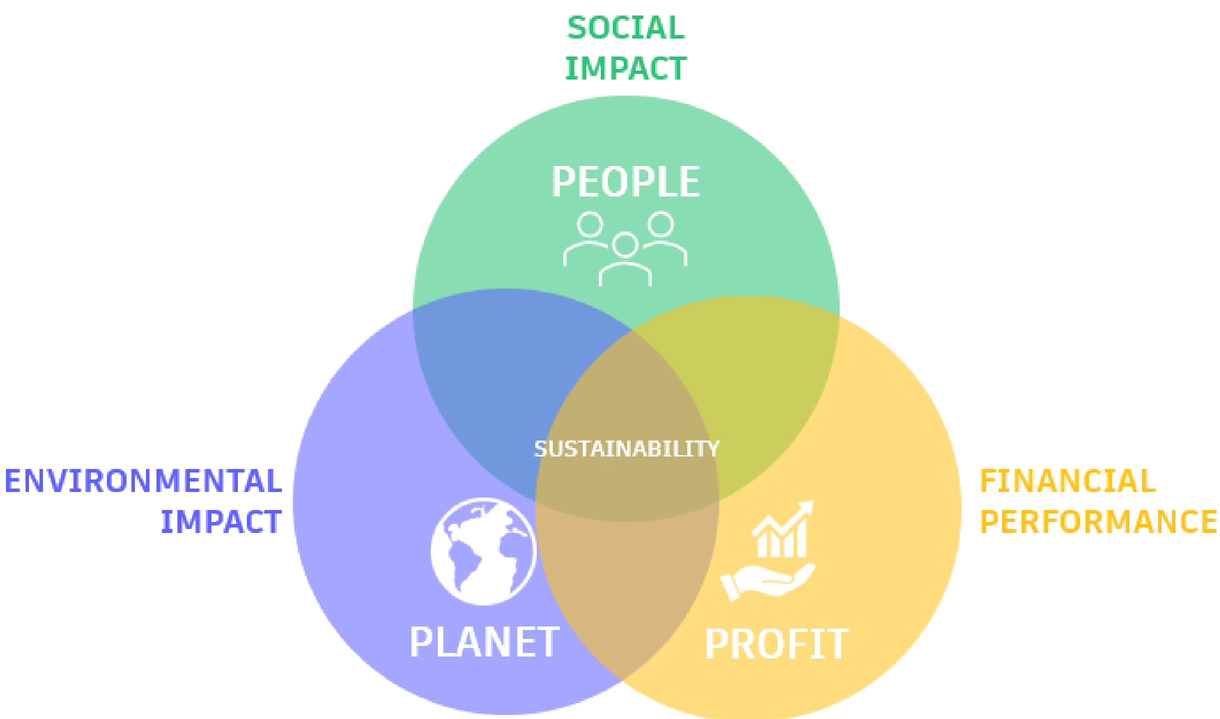
In a capitalist economy, a firm's success most heavily depends on its financial performance, or the profit it generates for shareholders.

People

The second component of the triple bottom line highlights a business's societal impact, or its commitment to people.

The Planet

The final component of the triple bottom line is concerned with making a positive impact on the planet.



Neighborhood Planning

Neighborhood planning is a form of urban planning through which professional urban planners and communities seek to shape new and existing neighborhoods.

The following six steps are typical of a general neighborhood planning process:

Defining neighborhood boundaries

Neighborhoods can be difficult to define geographically, although neighborhood planning can work with all scales of area, from urban neighborhoods to rural areas. The process of defining boundaries can sometimes be problematic, for example if some areas do not want certain streets or houses to be included within a neighborhood boundary. Less problematic neighborhood boundary definitions are sometimes based on existing natural boundaries such as rivers, existing administrative boundaries, …

Public engagement & consultation

After the boundaries of the plan are established, those leading the plan should decide how to get the wider neighborhood involved with the planning process. Many strategies may be used to involve neighborhood residents in the planning process and outreach methods may be used to generate interest. Planners can involve neighbors by collecting data and information about the area and how the residents use it. Community development practitioners are often asked to assist with consultation as they can act as an independent facilitator to engagement.

Evidence Collection

Planners can then combine the information they have gathered from residents with other evidence at their disposal. This might include retail or employment surveys, demographic data or housing needs assessments.

Plan-Writing

Successful neighbourhood plans typically seek to deliver community wishes in ways that are supported by the underpinning evidence. This may be achieved by generating policy alternatives before consulting again with the wider community to decide among them.

Implementation

The next step is to figure out how to implement the plan the committee has created. This requires the planning committee to decide what actions need to take place effectively implement the plan. The committee must decide what resources are available, and how to create more available resources.

Evaluation & monitoring

The final step of neighborhood planning is generally considered to be evaluating and monitoring. Planning and sustaining a functional neighborhood involves iterations of work and decision-making, and so plans may also be revised or replaced by a new plan.

Challenges to urban design & development

- Urban sprawl & inefficient use of land causes housing affordability problems, transport problems, and uses up a finite resource.
- Public Transport: In most cases roads dominate, and the development does not support public transport, and is unfriendly for walking and cycling.
- Single use vs mixed use developments: since the rise of the car, recent decades have favoured single use; mixed use may enable more needs to be met locally.
- Affordability: the cost of housing has a big impact on our wellbeing
- Sustainability : we need a healthy and sustainable environment to life in
- Social aspect: the effect on people and communities that happen as a result of neighbourhood plan
- Accessibility : how to connect a new neighbourhood to the existing environment and communities
- Environmental Site: developable land is scarce and the topographic elements and boundaries such as waterways, hills, soil types, ...

Sustainable Neighborhood Planning

Adequate space for streets and an efficient street network
The street network should encompass at least 30 per cent of the land with at least 18 km of street length per square kilometer.

High density
At least 15,000 people per km^2; that is, 150 people/ha or 61 people/acre.

Mixed land-use
At least 40 per cent of the floor space is allocated for economic use in any neighbourhood.

Social Mix
The availability of houses in different price ranges and tenure types in any given neighbourhood to accommodate different incomes; 20 to 50 per cent of the residential floor area is distributed to low cost housing, and each tenure type should be no more than 50 per cent of the total.

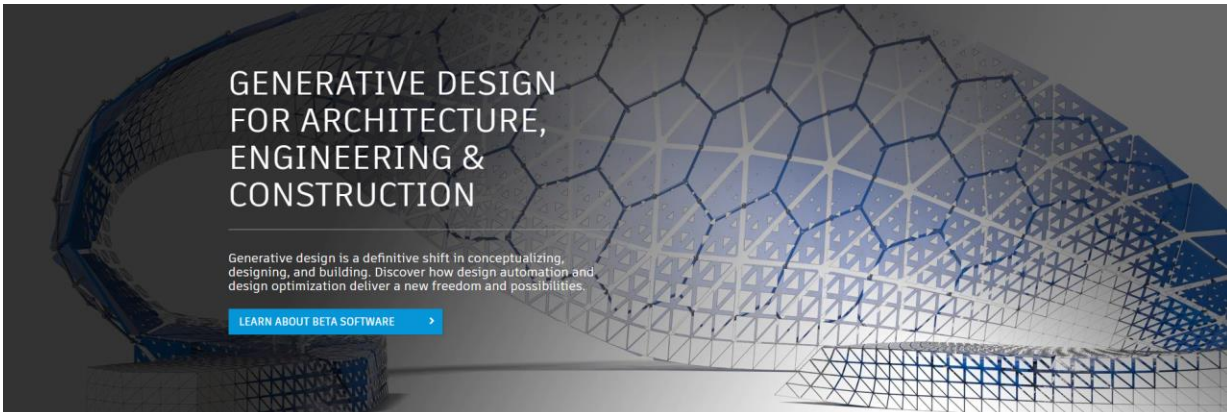
Limited land-use specialization
To limit single function blocks or neighbourhoods; single function blocks should cover less than 10 per cent of any neighbourhood.

SOURCE: HTTPS://UNHABITAT.ORG/SITES/DEFAULT/FILES/DOCUMENTS/2019-05/FIVE_PRINCIPLES_OF_SUSTAINABLE_NEIGHBORHOOD_PLANNING.PDF

Definition of 'Generative Design'

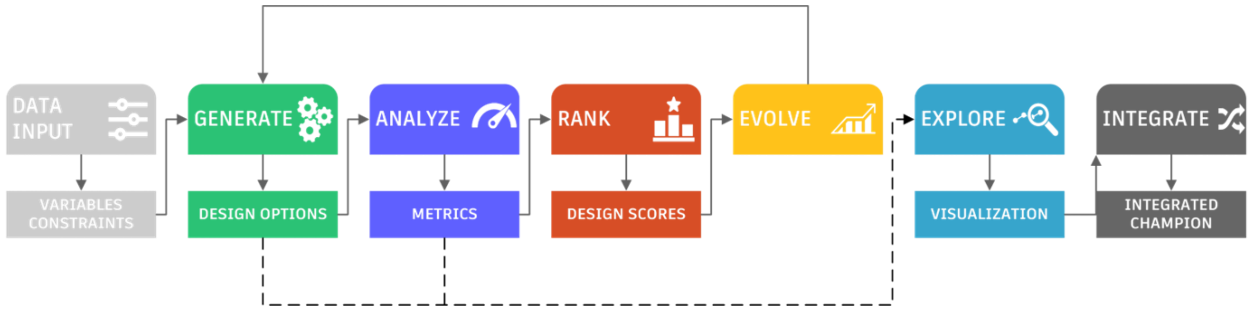
A goal-driven approach to design that uses automation to give designers and engineers better insight so they can make faster, more informed design decisions. Your specific design parameters are defined to generate many—even thousands —of potential solutions. You tell the software the results you want. With your guidance it arrives at the optimal design along with the data to prove which design performs best.

Learn more on how Autodesk looks at Generative Design in the AEC Industry here: https://www.autodesk.com/solutions/generative-design/architecture-engineering-construction



Learn more how to use Generative Design in the Generative Design Primer !

Generative Design Process



Generative design allows for a more integrated workflow between human and computer, and as a result both are required to undertake a series of steps that allow the process to take place. These steps can be categorized into the following stages: generate, analyze, rank, evolve, explore, integrate.

Generate
This is the stage when design options are created or generated by the system, using algorithms and parameters specified by the designer.

Analyze
The designs generated in the previous step are now measured or analyzed on how well they achieve goals defined by the designer.

Rank
Based on the results of the analysis, design options are ordered or ranked.

Evolve
The process will use the ranking of the design options to figure out in which direction designs should be further developed or evolved.

Explore
Generated designs are compared or explored by the designer, inspecting both the geometry and evaluation results.

Integrate
After choosing a favorite design option, the designer uses or integrates this design into the wider project or design work.

Downloadable Class Materials

The presentation contains videos that can't be disclosed before the actual session.

Therefore all materials for this class will be made available through the link below on the day of the session.

Through the download link (click the image), you will have access to the **full dataset**, the **presentation in PPTX** format including videos and the **handout**.