

Scenario Developing for life cycle design and analyses

Waldo Galle

Transform research team, part of æ-lab
Department of architectural engineering

Supervised by Niels De Temmerman
Vrije Universiteit Brussel

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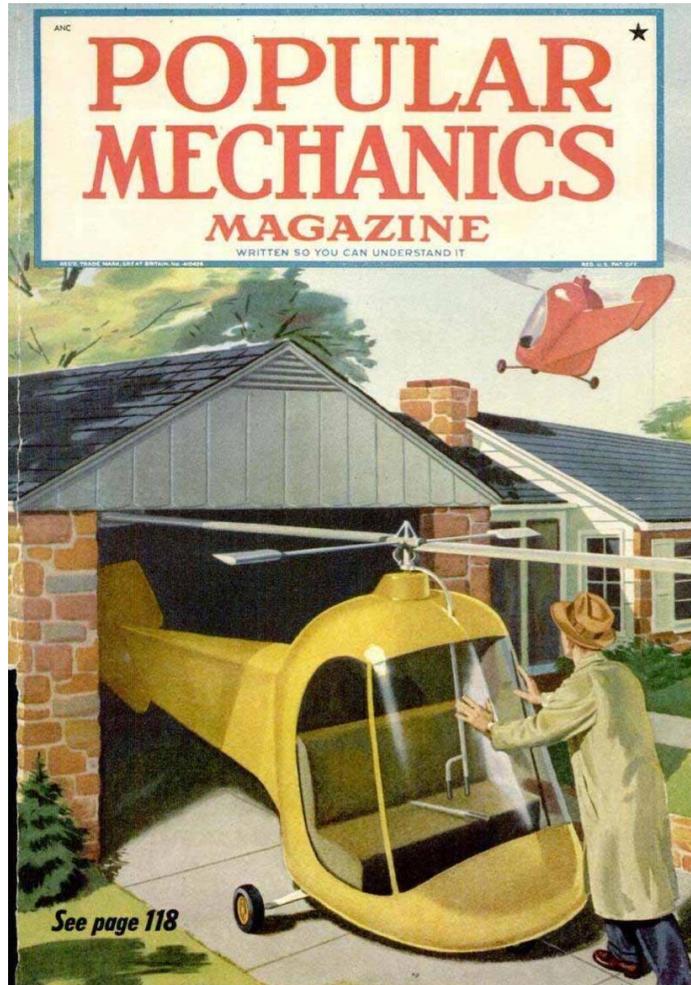
www.vub.ac.be/arch/transform
www.ovam.be/veranderingsgerichtbouwen



TRANSFORM
RESEARCH TEAM
Vrije Universiteit Brussel

In February 1951 the Popular Mechanics Magazine presents the "Hiller Hornet", a personal helicopter "ready for the civilian market".

Luckily, as this prediction turned out to be a mistake, new houses were not equipped with helicopter garages. After all, the future cannot be predicted.



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SOURCE [Archive.org/details/PopularMechanics1951](https://archive.org/details/PopularMechanics1951)

Here's Your HELICOPTER COUPE

By Thomas E. Stimson, Jr.

DO YOU WANT a helicopter that's small enough to land on your lawn and big enough to carry two people? A simple, practical, foolproof machine?

It's in production.

Stanley Hiller took me for a ride in one just in time to beat the presses for this issue of *Popular Mechanics*. Hiller is the 26-year-old president of Hiller Helicopters, the Palo Alto concern that in the last year has out-sold commercially all other helicopter manufacturers combined. His big "Hiller 360" is a weight carrier, a workhorse that dusts crops, flies the power lines and helps fight forest fires.

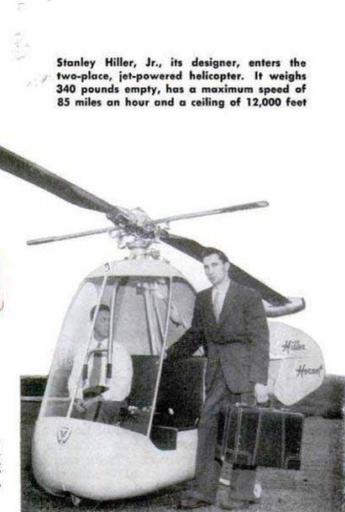
The new "Hiller Hornet" is a small, personal vehicle. It's priced under \$5000, one fifth the cost of an ordinary helicopter. Eventually, that price can be cut in half, at least. Except for Korea it would be ready for the civilian market this month. Right now military orders alone are being filled.

Hiller drove me from his modern factory to an old, ramshackle farmhouse to see the new vehicle. The farm looks like it has been abandoned for years and here, away from prying eyes, he conducts secret tests on advanced designs.

"You are the first person beside my own

Pilot and passenger sit on a seat above fuel tank. (1) Cyclic control stick guides direction of travel, (2) rotor r.p.m. register, (3) air speed, (4) altimeter, (5) starter button, (6) fuel-flow gauge and (7) is the throttle and "up and down" collective pitch control

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POPULAR MECHANICS

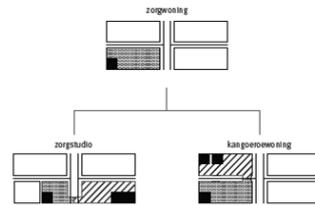


FEBRUARY 1951

Because the future cannot be predicted we build in a transformable way: multi-purpose assets, movable structures and demountable building elements.

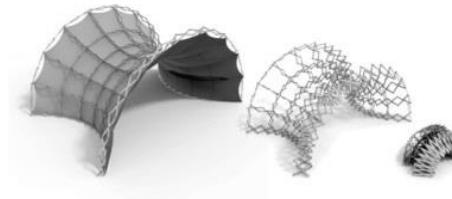
These strategies demonstrate the understanding that our requirements will always change. Their aim is to create buildings that support that change efficiently.

The only certainty is that the future is uncertain. Therefore, we design in a transformable way.



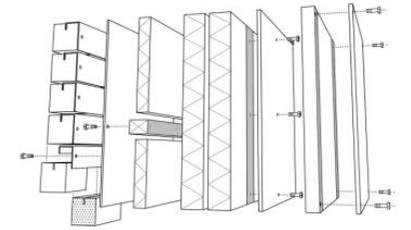
Multipurpose assets

SOURCE
KPW Architecten (2015).
www.kpw-architecten.be/hoogbouwplein
OVAM (2015).
www.ovam.be/veranderingsgerichtbouwen



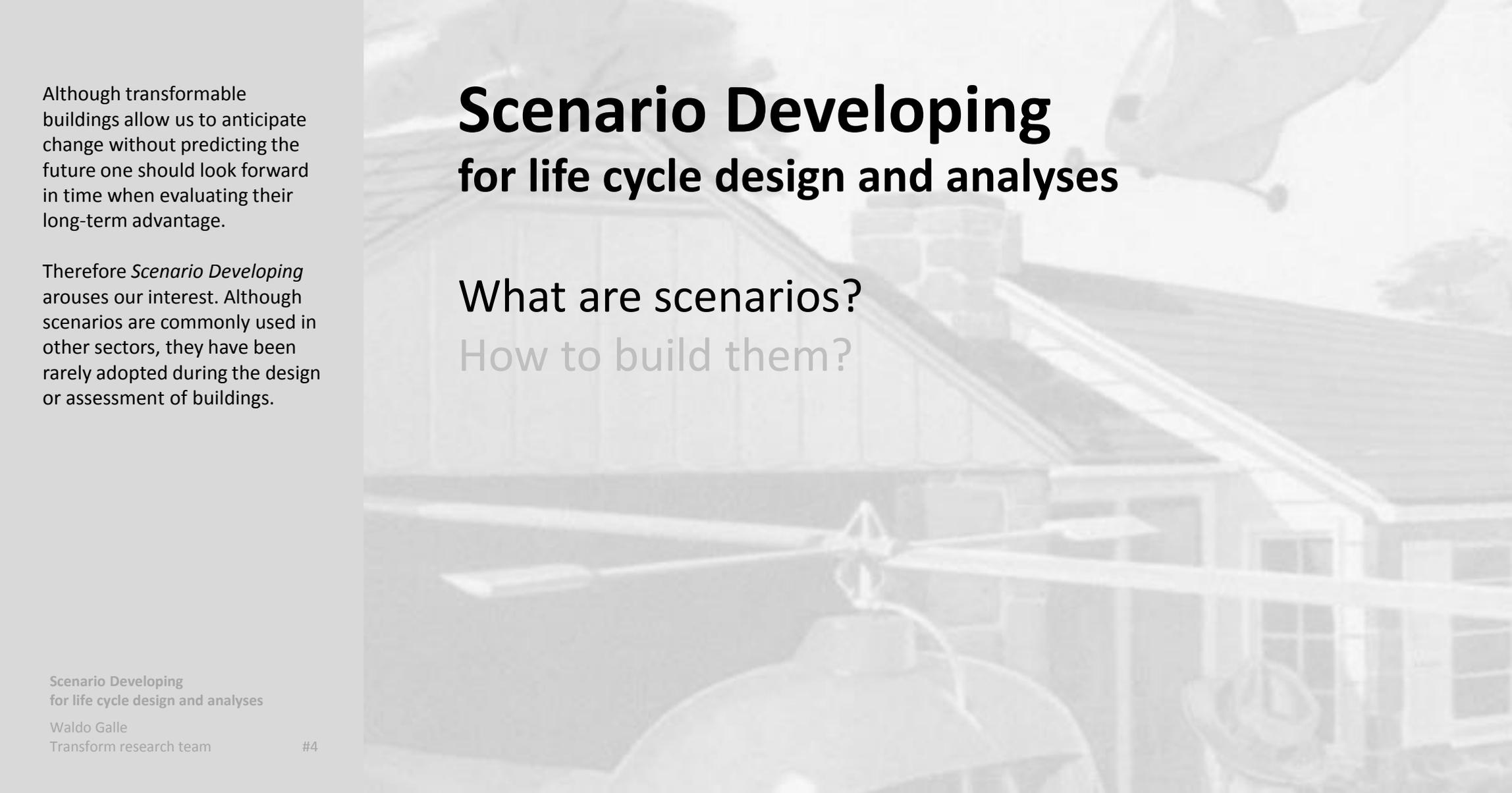
Movable structures

SOURCE
Roovers, K., Alegria Mira, L., & De Temmerman, N. (2013). From Surface to Scissor Structure. In *Proceedings of the First Conference Transformables*. (pp. 275-280). Sevilla: Starbooks.



Reversible design

SOURCE
Paduart, A. (2012). *Re-design for change: a 4 dimensional renovation approach towards a dynamic and sustainable building stock* (doctoral thesis). Vrije Universiteit Brussel, Brussels.



Scenario Developing for life cycle design and analyses

What are scenarios?
How to build them?

Although transformable buildings allow us to anticipate change without predicting the future one should look forward in time when evaluating their long-term advantage.

Therefore *Scenario Developing* arouses our interest. Although scenarios are commonly used in other sectors, they have been rarely adopted during the design or assessment of buildings.

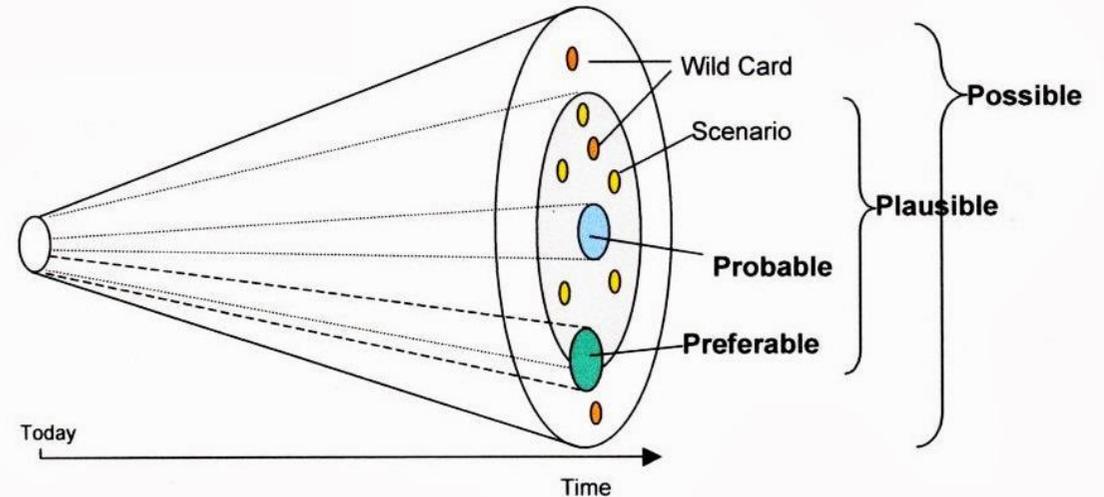
Scenarios express how a building might change. They take into account the owners' knowledge about future requirements and the designers' insight in the building's adaptability.

Subjecting subsequently each design alternative to those imaginable futures allows appraising their robustness and saying "I am prepared for whatever happens".

What are scenarios?

Scenario are stories, exploring imaginable but divergent futures.

Plausible versus possible scenarios
Probable or preferable scenarios



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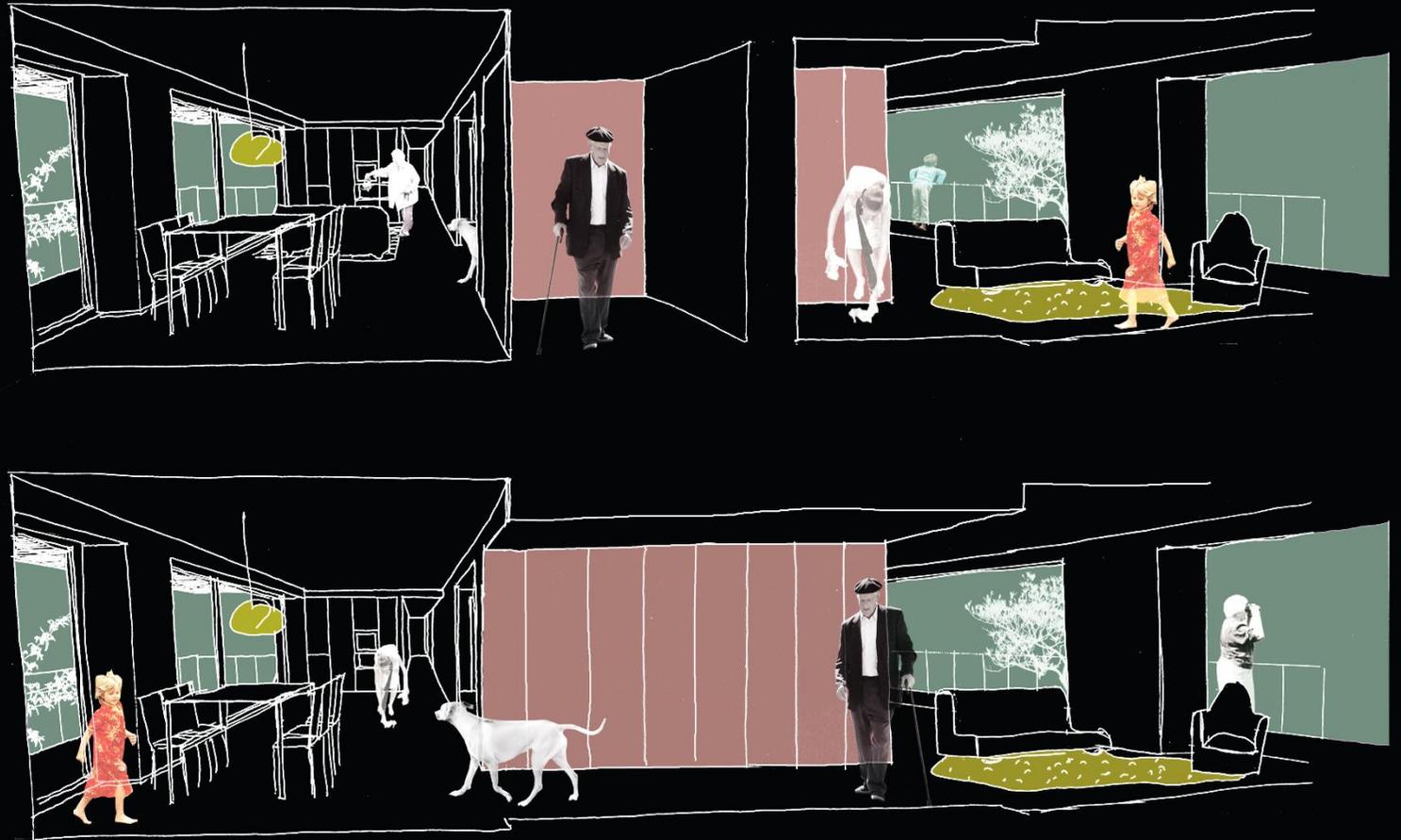


Scenario Developing for life cycle design and analyses

Waldo Galle
Transform research team

Scenarios, being narrative by nature, relate easily to architecture and its users. For example Friedman (2002) developed scenarios resembling the growth of a household.

To each of the subsequent expansions relate changing requirements. Thinking in terms of scenarios allows evaluating the house's potential to change and fulfil those requirements.



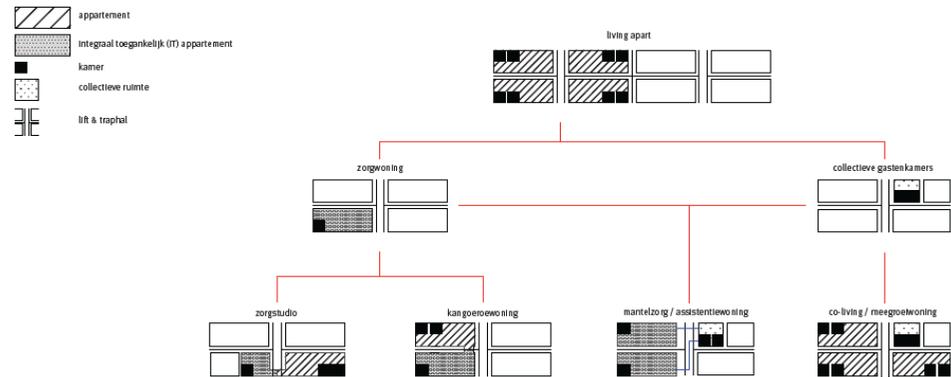
Divergent scenarios support qualitatively the design process. They raise awareness about the uncertainty the future holds and facilitate the co-creation of alternative design solutions.

Thereafter, scenarios allow evaluating quantitatively the variability of the long-term impact of those solutions. The resulting insights support the final choice that has to be made.

What are scenarios?

Scenarios support the design process and evaluation.

Raise awareness about an uncertain future
Allows co-creating design solutions
Support decision making



In reaction to the various household types KPW Architecten encountered during the development of scenarios, they shifted their design process from just 'programming' to the implementation of a 'building strategy', i.e. a family tree of apartment types expressing how dwellings can transform during future refurbishments.

SOURCE KPW Architecten (2015). www.kpw-architecten.be/hogbouwplein
OVAM (2015). www.ovam.be/veranderingsgerichtbouwen

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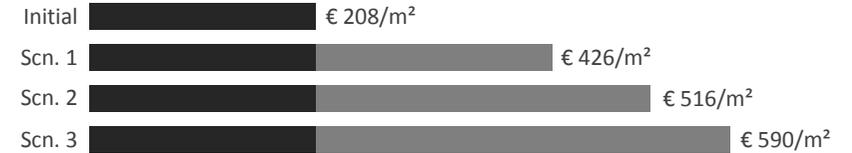
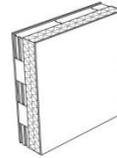
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Raise awareness about an uncertain future
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Support decision making

Conventional external wall



Transformable external wall



SOURCE Galle, W., Vandenbroucke, M., & De Temmerman, N. (2015). Life Cycle Costing as an Early Stage Feasibility Analysis: The Adaptable Transformation of Willy Van Der Meeren's Student Residences. *Procedia Economics and Finance*, 21, 14–22.

Before scenarios can support the design process of transformable buildings in a qualitative and quantitative way they should be developed deliberately.

According to the method Schwartz describes in his book *The art of the long view* three major steps can be distinguished.

Scenario Developing for life cycle design and analyses

What are scenarios?
How to build them?

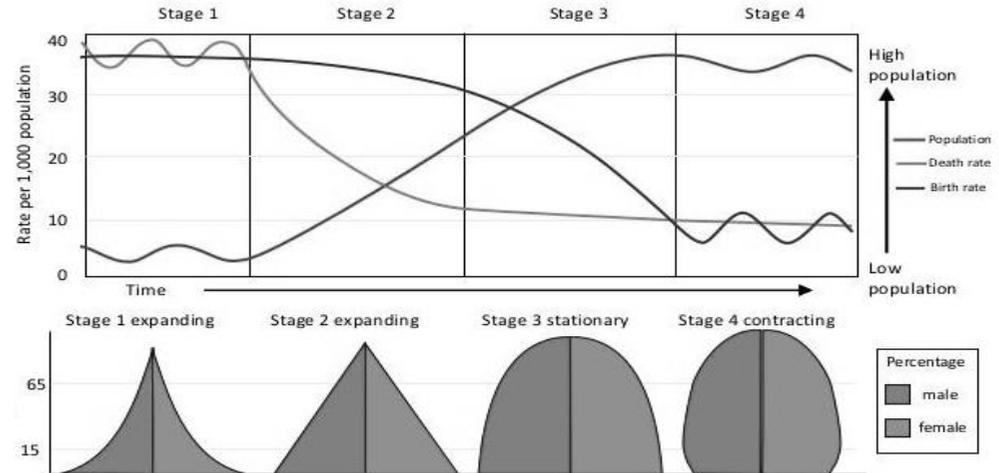
First, the scenarios' building blocks have to be identified. Known unknowns such as demographic evolutions are well-studied and can be predicted with historic data.

Unknown unknowns are in contrast unpredictable. Different trend reports might however inspire their identification. These critical uncertainties determine the differences between the developed scenarios.

How to build scenarios?

Identify the scenarios' building blocks.

Known unknowns
Unknown unknowns



The ageing of our population, constantly declining family and household sizes and raising housing demand are known unknowns. During long-term surveys these evolutions could be observed and translated into diverse models. Such models allow to project future changes with a defined level of certainty.

SOURCE Author unknown (2014). *Population structure and the demographic transition model*. Via [slideshare.net](https://www.slideshare.net)

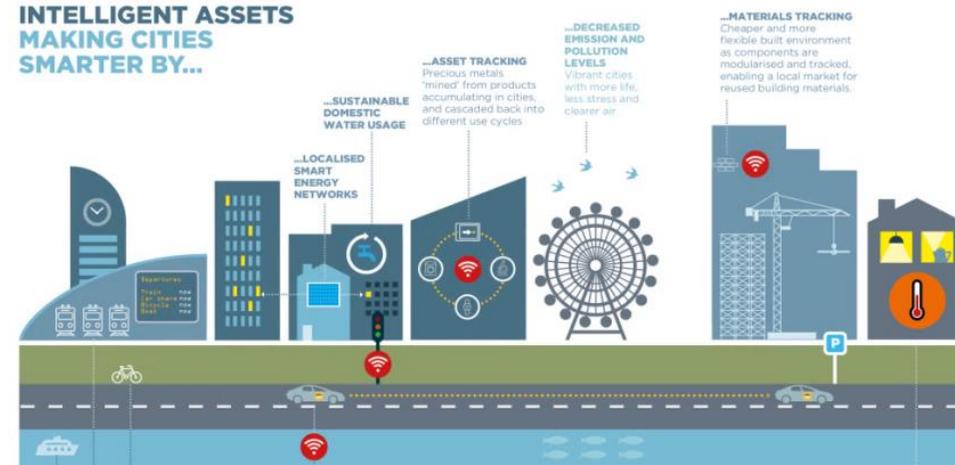
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Known unknowns
Unknown unknowns



The development and acceptance of new housing types, mobility of families (as a result of short term renting) and the spatial requirements per dwelling size and type are new, emerging and unpredictable trends. These critical uncertainties are often identified in futurist and prospective reports.

SOURCE WEF. (2016). *Intelligent Assets, unlocking the circular economy potential*. Ellen MacArthur Foundation and World Economic Forum, part of Project MainStream.

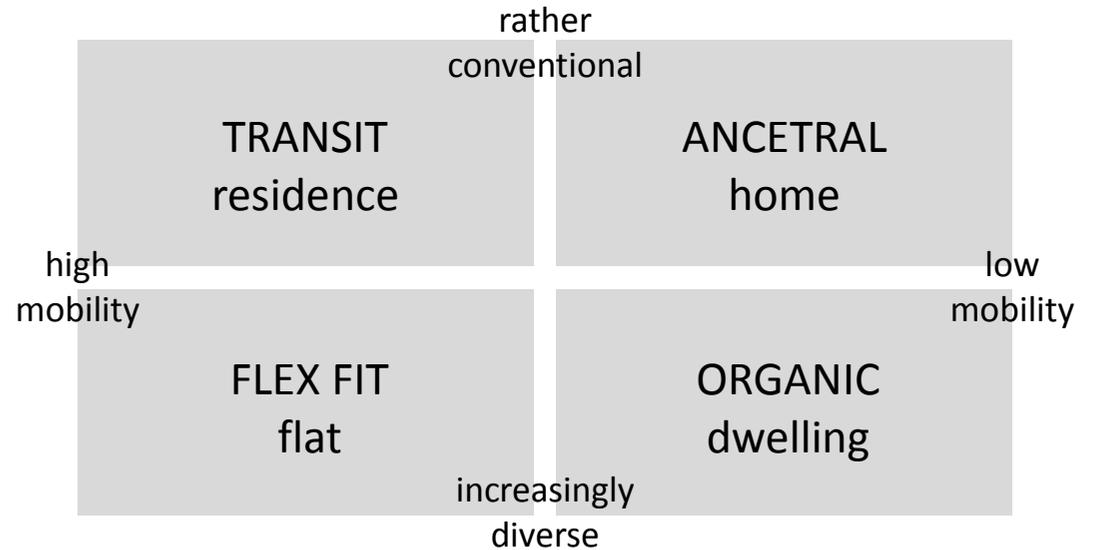
Second, stories have to be developed from the identified uncertainties. Therefore scenario plots and inspiring names have to be selected.

Thereafter is studied how each design alternative will respond in each scenario. Architects are well-placed to imagine and detail these future refurbishments.

How to build scenarios?

Develop the scenario stories.

Select a scenario plot and choose a good name
Identify life cycle options



SOURCE Galle, W. (2016). *Scenario Based Life Cycle Costing, an enhanced method for evaluating the financial feasibility of transformable building* (Doctoral Thesis). Vrije Universiteit Brussel, Brussels.

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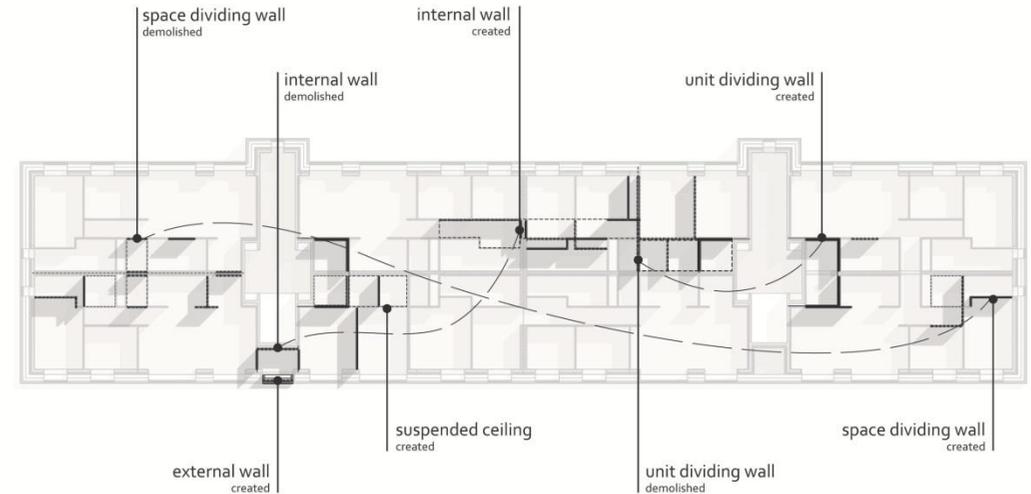
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Third, scenarios can be quantified and the proposed design alternatives can be evaluated. Therefore, a digital BIM model can be created per scenario.

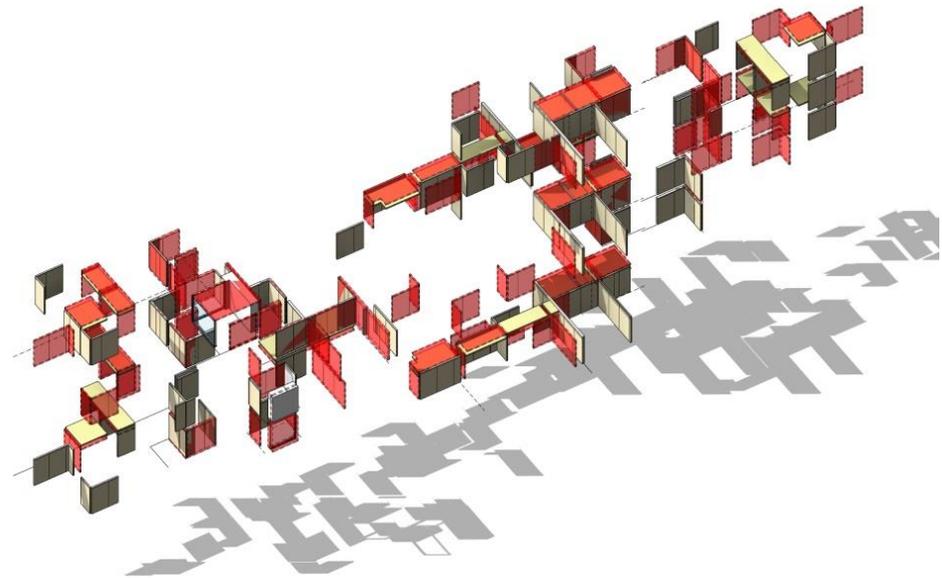
Assigning to the modelled scenarios environmental burdens, construction costs or other impacts in a parametric way allows assessing the alternatives' robustness for various assumptions.

How to build scenarios?

Quantify and evaluate design alternatives and scenarios.

Create a BIM model

Assess and evaluate the robustness



SOURCE Galle, W. (2016). *Scenario Based Life Cycle Costing, an enhanced method for evaluating the financial feasibility of transformable building* (Doctoral Thesis). Vrije Universiteit Brussel, Brussels.

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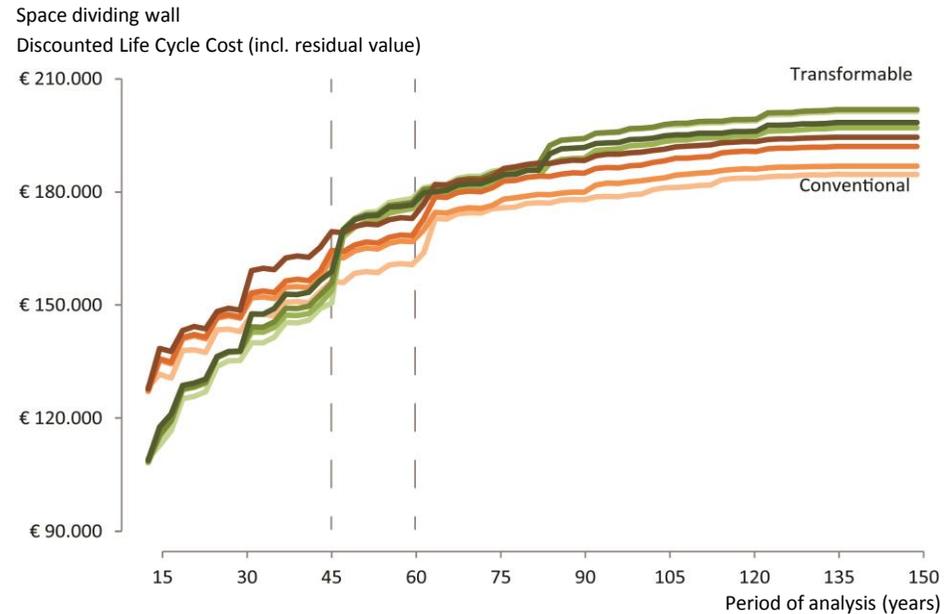
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Scenario Developing for life cycle design and analyses

In conclusion, scenarios or imaginable futures relate easily to architecture and its users. For that reason, they own the potential to support the design and life cycle assessment of transformable buildings.

Building effective scenarios starts with identifying critical uncertainties. From these building blocks divergent stories can be developed. Quantifying them returns the insights designers need to make a deliberate choice.

What are scenarios?

explore imaginable but divergent futures
relate to architecture and its users
support design and evaluation

How to build them?

identify the scenario building blocks
develop the scenario stories
quantify and evaluate