Thinking Out of the Box - Advanced Façade Design and Technology

Winfried Heusler, Senior Vice President Corporate Building Excellence, Schüco
My Personal Past
… 33 years of „Façades“ and Lots of Excitement


1982: Gartner
1998: Schüco
Current Sphere of Activity
Senior Vice President of Global Building Excellence (since 2014)

... and honorary professor at the University of Applied Sciences OWL
Detmold School for Architecture und Interior Architecture / Faculty

- 31 Professors
- 50 staff members
- 1,300 students

- B. A. Architecture
- B. A. Interior Architecture
- B. A. Urban Planning
- M. A. Architecture
- M. A. Interior Architecture
- M. Sc. Urban Planning
- M. Eng. IFDC
- M. Eng. MCDC
Thinking out of the box
Advanced façade design and technology

1. Introduction
2. Innovating out of the box
3. Functional optimization of buildings and façades
4. Performance and appearance of façades
5. Modular systems outside the box
6. Continuous digitalization of the process chain
7. Summary
Introduction

- In the new millennium social systems, living arrangements and working patterns have changed faster and more radically than ever before.
- The unstoppable desire of people to live comfortably takes a heavy toll on the environment.
- The well-documented climate change has mutated to a global challenge.

What has to change to enable 9.5 bn people to live on earth in 2050?
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Innovating out of the box

Thomas Edison (late 19th century)
- great ideas do not pop fully formed out of brilliant minds
- the starting point is understanding customer needs
- the lone genius inventor is a myth
- the best approach to technological innovation is large-scale teamwork in a research laboratory (linking basic research to applied science)

… it is fruitless to simply invent for invention’s sake
Innovating out of the box
Innovation strategies

- Technology push strategy
  ... to identify technological trends
  (e.g. the “Internet of Things and Services”)

- Market pull strategy
  ... to identify currently inadequate satisfaction of customer needs
  ... anticipating the customer's needs
  (the method of scenario thinking creates more probable “futures”).

... successful innovations often rely on the targeted combination of market pull and technology push activities
Innovating out of the box
Clustering customer needs

- “performance factors”: specified in detail; if well developed, it results in corresponding level of satisfaction.

- “must-haves”: not generally expressed; if missing, it results in extreme dissatisfaction.

- “excitement factors”: unspoken; if they meet customer needs, it is the really differentiating feature

...satisfaction and dissatisfaction of customer needs (Kano 1984)
Innovating out of the box
The method of “design thinking”

- matching people’s needs
- with what is technologically feasible
- developing a viable business strategy

Source: HPI School of Design Thinking (Potsdam / Germany)

... converting an idea into customer value and market opportunity
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Functional optimization of buildings and façades

- **passive building concept**: passive façade components seal off the interior from external factors as far as possible (contemporary building technology ensures a comfortable interior environment).

- **active building concept**: dynamic façade components respond specifically to changing internal and external conditions (the aim is to minimize the use of mechanical systems).

- **cognitive building concept**: the façade and mechanical-system components are connected to each other through an intelligent building automation system (adaptive components of the building skin are capable of reacting to non-continuous, changing external and internal conditions).

... which one is the appropriate concept for the specific project?
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High tech or low tech concept?

- cost-efficiency (investment, operating and maintenance costs)
- energy requirements (heating, cooling, ventilating, lighting etc.)
- environmental and room comfort (thermal, visual, acoustic etc.)
- across the entire lifecycle (design, planning and construction, operation and usage, updating and upgrading, demolition with possible reuse or recycling)

Source: P. Günther (Schüco International KG / Germany)

Minimize complexity: use only as much technology as really necessary
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Advanced façade design and technology

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Appearance of façades

Aesthetical Aspects
- Observer: Product properties (form, structure…)
  and grammar of product language

Quality of use
- User: Product feature that show what the product should
  be used for and how

Symbolic Aspects
- Owner: … refer to social, cultural, historic, and ecological
  backgrounds

... an attempt of comprehensive evaluation of design quality

Styled after: „Offenbacher Ansatz“
Grundlagen des Industriedesign (Design als Teil der systematischen Produktentwicklung)
Aesthetic aspects concerning façades
Communication with the observer (sensory experience)

Design-Elements:
• form
• material
• surface (texture, structure)
• color
• transparency
• grooves
• glass panel holder

Design-Composition:
• complexity
• depth and plasticity
• distribution and arrangement of surfaces
• order (beat, rhythm, pattern)

Design-Concept:
• additive, integrative or integral

Torre del Agua / E-Zaragoza (Arch.: Enrique de Teresa, Arquitectos Asociados / Spain)

Design is the central subject of aesthetics and architecture
Indication Aspects concerning façades
Communication with the user

... ease of operating the façade
Symbolic Aspects concerning façades
Communication with the owner (societal experience)

... conceptions and associations that come to a person`s mind while contemplating an object (e.g. societal, socio-cultural, historical, technological, economic and ecological aspects)

... façades might be projection surfaces for meaning ...
... the architect as the façade designer could act as the “story-teller”...
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Performance and appearance of façades

... an attempt of comprehensive evaluation of façades

© Council on Tall Buildings and Urban Habitat
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Advanced façade design and technology

The principle of convergence

- The merging of trades as well as the blurring of existing lines, within which enterprises used to position themselves
- Different trades` competences are necessary for the successful solution of this cross-disciplinary challenge

Convergence represents the next evolutionary step towards value-added solutions for the building's life cycle
Convergence and modular systems
Integrated and scalable functional groups for the different trades

- a flexible cooperation between the functional groups through optimized interfaces
- interoperable components lead to easier integration efforts
- with standardized functional principles and carry-over parts across several series
- with system-specific construction characteristics as well as typical joining details and connection technologies.

...even complex project specific solutions can be planned and executed more efficiently and with a higher quality
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Advanced façade design and technology
Continuous digitalization of the process chain

To build and operate the whole building twice:
First of all virtually (by means of augmented reality) and finally in reality

Connecting all involved parties:
- architects and engineers
- main contractors, system suppliers, façade and maintenance companies
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The introduction of cyber-physical systems (CPS)

• Smart machines, storage systems, production facilities and building site terminals capable of autonomously exchanging information, triggering actions and controlling each other independently.

• Smart assistance systems (e.g. cyber glasses) release workers and maintenance staff from extensive and sophisticated product manuals and from having to perform routine tasks, enabling them to focus on creative, value-added activities.

CPS will radically transform the principles of operation of all involved parties
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Advanced façade design and technology

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Summary

1. cost-efficiency (investment, operating and maintenance costs)

2. design considerations (functional, formal and symbolic aspects)

3. energy requirements (heating, cooling, ventilating, lighting etc.)

4. as well as room comfort (thermal, visual, hygienic, acoustic etc.).

... taking into account environmental, economical, social and cultural aspects
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Summary

- Modularly designed façades - with scalable functional groups having optimized interfaces and standardized functional principles - can be planned and executed efficiently and with a high quality.

- Continuous digitalization of the process chain, connecting architects and engineers as well as main contractors, system suppliers, façade and maintenance companies with their specific activities.

This will radically transform the competence profiles of all involved parties.
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On our the way to a sustainable built environment

<table>
<thead>
<tr>
<th>Sustainability</th>
<th>Aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategies</strong></td>
<td>Ecology</td>
</tr>
<tr>
<td>Efficiency</td>
<td></td>
</tr>
<tr>
<td>Reduce effort</td>
<td></td>
</tr>
<tr>
<td>Consistency</td>
<td></td>
</tr>
<tr>
<td>Reduce side effects</td>
<td></td>
</tr>
<tr>
<td>Sufficiency</td>
<td></td>
</tr>
<tr>
<td>Reduce demand</td>
<td></td>
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</tbody>
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... neither the high tech nor the low tech but the smart tech concept is the best one
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Prof. Dr.-Ing. Winfried Heusler   SCHÜCO-International KG / Deutschland