Nature meets the human soul

A redesign framework for neo-gothic churches
*Graduation project - **Research paper***

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Summary

Abstract

This paper is part of the graduation studio "Zero waste church", within the chair of Heritage and Architecture at TU Delft.

It explores the potentialities of neo-gothic churches' preservation and redesign in order to re-connect people and nature. It aims to identify elements of neo-gothic churches that are compatible with a biophilic and nature-inclusive mindset. At the same time, it reflects upon incompatibilities and how these can be overcome in order to create a more comprehensive redesign framework.

Additionally, it creates a precedent of incorporating natural features into adaptively redesigned heritage buildings.

Key words: *Neo-gothic, church, biophilia, nature-inclusive, redesign, nature connection, framework.*
Word count: *3200 words*

1/ Introduction

1.1 The climate urgency

At the same time as the research presented in this paper is conducted, the 6th IPCC report on climate change has been published.

One of its main conclusions is that humans need to cut global carbon emissions by 50% until 2030 in order to reverse global warming. The construction field is responsible for a big part of the pollution worldwide and at a local scale (fig.1).

The adaptive reuse of a building is, therefore, the most environmentally-friendly choice in our current context, and should be prioritised over new construction wherever possible.

fig.1 - Construction field impact on different scales. Author: N.Cozma

1.2 Church adaptive reuse

In the Netherlands, with the rise of the number of atheists, the number of active church buildings has been decreasing. The decommissioned churches have been either abandoned, sold or demolished *(De Hart, J. & Van Houwelingen, P., 2018)*.

At the same time, these buildings are heritage, as defined by the 2020 Heritage Council1. This creates an opportunity to adapt and reuse them as an alternative to demolition, and as a means of their material preservation.

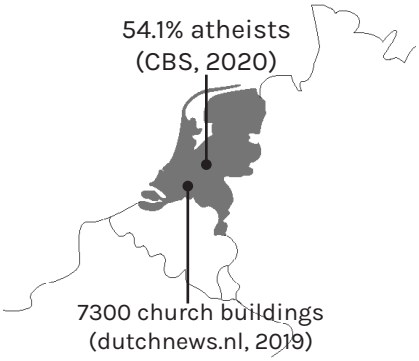


fig.2 - Big number of atheists vs number of buildings. Author: N.Cozma

1.3 The need of (re)connecting with nature

The COVID-19 lockdown period has challenged the purpose of our living spaces. The functional shift of our homes has put a strain on our mental and physical well being *(Vyas L, 2022; Palgi Y. et al, 2020; Robb C.E. 2020)*. In 2017, an average person spent 92% of their time inside *(road.cc, 2017*). This is a higher number compared with 100 years ago.

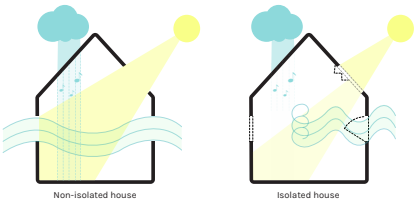


fig.3 - Insulated (new) vs non-insulated (old) house Author: N.Cozma

Staying inside to this degree has impacted our lifestyles to the point that as little as 20 minutes of natural exposure daily could significantly improve the level of stress hormones in our bodies *(M.C.R. Hunter et al., 2019)*.
It is therefore paramount to challenge the status quo of the way we build.

More specifically, incorporating nature and natural features into our buildings would facilitate increased access to nature and improve the collective wellbeing.

1 - "Our heritage is our inheritance - what the past has conceded to us, what we value in the present and what we choose to preserve for future generations." - Heritage Council, IE, 2020

1.4 Neo gothic churches and their inherent link to nature

At its core, architecture has always been inspired by nature *(Ramzy N.S., 2015)*. Religions have always had ideas of ecology and stewardship of nature as foundations of their doctrines *(Clark M., Buenfeld G., 2020)*.

Traditional architecture takes inspiration from nature in its shape and proportions *(Ramzy N.S., 2015*). In his representation of "The good architect" (fig.2), Philibert de l'Orme (16th century) has implied that a good architect has "roots as hands'' and derives their designs from nature.

Although their exact amount is unknown, some of the aforementioned churches at risk for demolition in the Netherlands are also neo-gothic.

As previously religious buildings, ethically, their adaptive redesign has been a dilemma. However, they represent an important resource, both as heritage representatives and for sustainability purposes.

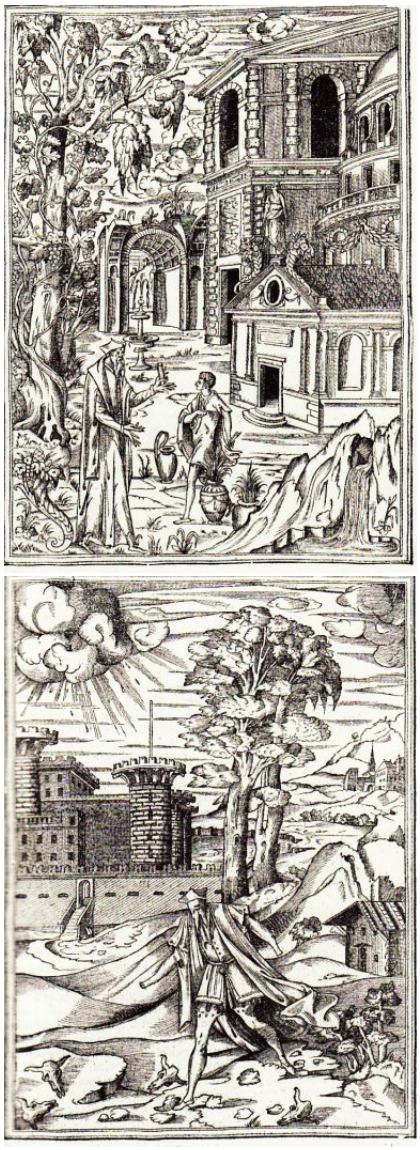


fig.4 - Allegories of the Good and Bad Architect.
Author: Philibert de l'Orme, source: The first volume of architecture (Le premier tome de l'architecture), 1567

1.5 Research goals and problem statement

Integrating nature and natural features in buildings and their benefits for humans has been a recurring topic in the case of new designs. For heritage adaptation, as a sustainable alternative to the newly built, the focus is usually on the existing values and how to preserve them.

The goal of this research is to change this paradigm by adding a new dimension to it - that of the nature-connected user experience. This can be done by looking at the redesign not as a new intervention added to an existing building, but as a whole transformation of an entire entity. For this, the main question to answer is:

> **How** *can the adaptive transformation of neo-gothic churches improve the connection with nature of its inhabitants?*

This paper is therefore tackling the question of neo-gothic church values, while experimenting with ways of improving the sense of connection with nature. To demonstrate the above thesis this paper serves as a basis for the redesign of the neo-gothic Augustinus Church in Amsterdam North. Although the main outcome of this research targets a general case situation, some of the illustrations will have the church as a subject of analysis.

By putting forward a precedent, through this paper's example other types of heritage can be redesigned with connection with nature in mind.

2/ Methodology and theoretical framework

2.1 Introduction

To achieve these goals, this research was based mainly on literature reviews. This method allowed the identification of precedents and inconsistencies in the available theory. At the same time, it facilitated the adaptation of the existing frameworks to neo-gothic church aspects.

The topics of interest have been focused on neo-gothic churches and their values, and then on modern strategies to enhance the link between nature and architecture.

In the architectural discourse, there have been different interpretations of ways to achieve a better connection with nature. For this research, two dimensions have been identified. The first, biophilia, is human-centric. It represents how natural features in human-used spaces bring benefits to people. The second, nature-inclusiveness, reflects upon how buildings can be useful to biodiversity.

In the context of neo-gothic churches, the research first identified the general values of neo-gothic churches. Then, it compared these values with biophilic design and nature-inclusive principles. As a result, it identifies overlapping elements and incompatibilities, in order to create a redesign framework. This document pinpoints elements of neo-gothic churches that feed into the feeling of natural connection and those that should potentially be modified in order to deepen it.

In the end, problematic elements overall are identified and redesign recommendations are given (fig.5).

How can the adaptive redesign of neo-gothic churches improve the connection with nature of its inhabitants?

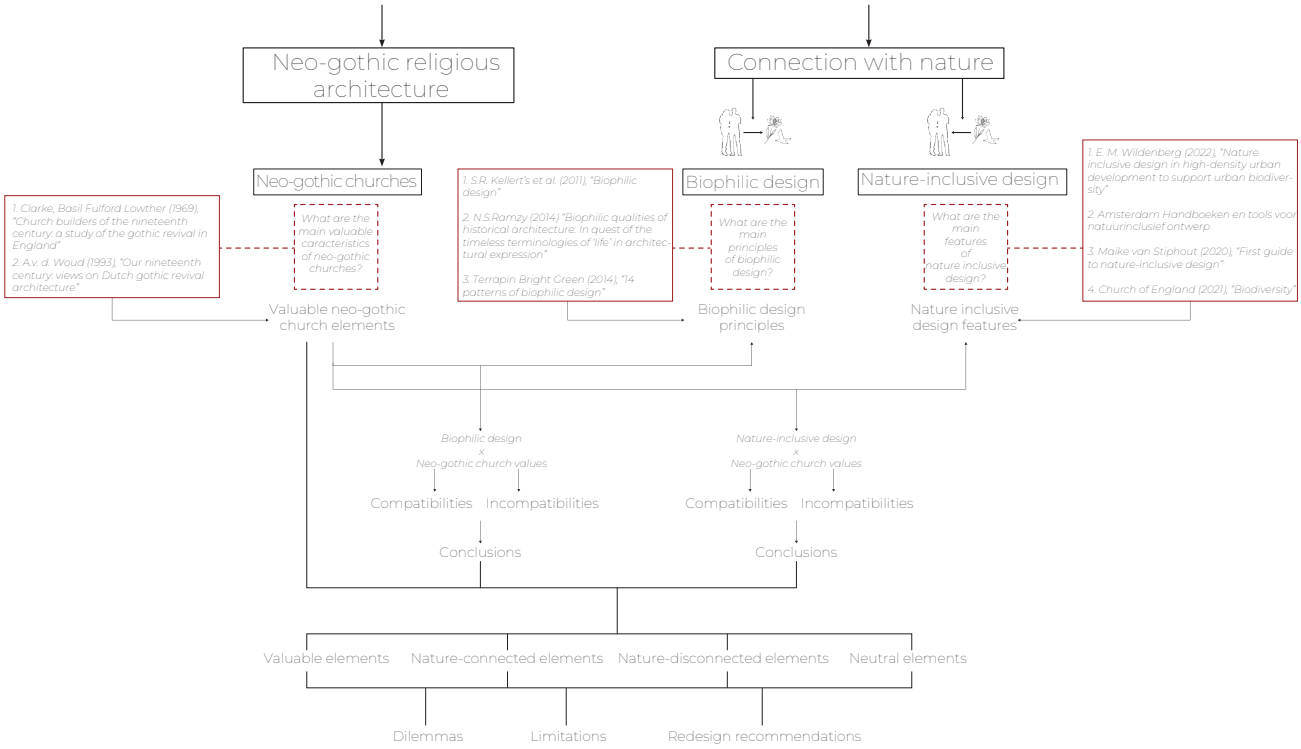


fig.5 - Methodology work chart
Author: N. Cozma

2/ Methodology and theoretical framework

2.2 Neo-gothic church values

To start, the research positioned the important elements of neo-gothic churches. The main source for identifying them was the book “Church builders of the nineteenth century: a study of the gothic revival in England” by Clarke, Basil Fulford Lowther (1969).

In the Netherlands, neo-gothic churches are divided into two main schools of thought: that of Tepe and that of Cuypers. Cuyper’s neo-gothic focuses more on architectural logic and expression. Tepe’s interpretation accepts the Church as being the main director of how the church needs to behave (*A.v. d. Woud, 1993)*. Because this research focuses on a general scenario, the main emphasis was on general features, identifiable in all neo-gothic churches (Annex 1).

2.3 Biophilic design

Biophilia, as coined by E.O. Wilson (1990), is the “human bond with other species”. The philosophy of biophilic design represents taking inspiration from nature in all aspects of a building.

For this research, through literature review, working sources have been identified. Multiple authors have theorised on the elements that create a truly biophilic space, all of them presenting different categorizations (Annex 2).

None of the existing interpretations of the subject are checklists. Instead, they are adaptations of a theory to certain needs. The main resource for this research was the book “Biophilic design” by S.R. Kellert’s et al. (2011). The book is the precursor for all the other interpretations.

The early sources on the subject are focused on the identification and definition of biophilic aspects in already existing designs. The article “Biophilic qualities of historical architecture: In quest of the timeless terminologies of ‘life’ in architectural expression”, by N. S. Ramzy (2014) served as a basis for interpreting the biophilic elements in historical architecture.

Both Kellert’s and Ramzy’s interpretations have served as a basis for the identification of biophilic elements in neo-gothic churches and in understanding how the two overlap.

A second group of sources arose as a need of having a tool that could be easily implemented into new buildings. It is the case for the “14 patterns of biophilic design” by the design firm Terrapin (2014). This article was used to identify critical spaces that could be improved biophilically. It is also used to give recommendations about valuable neo-gothic elements incompatible with a biophilic redesign.

2/ Methodology and theoretical framework

2.4 Nature-inclusiveness

"Nature inclusive design" represents the symbiotic cohabitation of man and nature within architecture. In a sense, it has overlapping features with the general term of biophilic design. As with biophilic design, a general understanding of the concept was created first. Then, features in neo-gothic churches that are attracting different kinds of species have been identified. For this, the research focused on news articles and personal observations.

Through time, the term "nature inclusive design" has been approached differently by several entities. Although an universal definition hasn't been coined, in the master thesis "Nature inclusive design in high-density urban development to support urban biodiversity", E. M. Wildenberg (2022) defined the term as giving "significant attention to the natural world in the early stages of the design", taking into account "the possible benefits of the built environment for the animals and plants" and "improving the living conditions for animals and plants in the building".

For this research, the "nature" that needs to be included was considered the local animals and plants. The place where they must be included is the material body of the (redesigned) neo-gothic churches.

In order to understand the prerequisites of nature-integration in a church building, several sources have been analysed.

In the Netherlands, several municipalities offer documentation that explain how to integrate nature into buildings (Fisher et al., 2018, Amsterdam Handboeken en tools voor natuurinclusief ontwerp).

Additionally, in the book "First guide to nature-inclusive design", Maike van Stiphout (2020) has compiled different species' needs in an urban setting. These documents indicate solutions that allow the integration of local biodiversity within a building.

Simultaneously, the Church of England (2021) created a checklist of dealing with biodiversity in a church setting, not focusing, however, on neo-gothic buildings, but instead on a broader guide of cohabitation between religious buildings and biodiversity.

These sources indicate the importance of several elements so that nature can thrive: the presence of food, a place to rest and a good environment for mating.

At the same time, they indicate the need of having a barrier between humans and biodiversity, so both can thrive together (Annex 3). These elements will be used for the further analysis of neo–gothic churches. The research will focus on the types of animals present in the material body of a neo-gothic church, their needs and living conditions. In the end, it will identify important elements in neo-gothic churches that should be preserved and therefore incompatible with nature-integration.

3/ Results

3.1 Neo-gothic x Biophilia

3.1.1 Compatibilities

IIn neo-gothic churches, some of the constructive elements are biophilic even though not intentionally so. The biophilic element of pre-modern architecture lies in its visual aspect. The pointed arches, ribbed vaults, and decorations are inspired by natural, organic shapes. These elements create tall, light filled spaces, with columns like a forest, which reinforces the sense of awe and wonder.

At the same time, the function of the church is highly symbolic and incorporates natural light as a means to represent divinity (A. Crompton, 2002). Large stained glass windows, emblematic of neo-gothic churches, reinforce the link between interior and exterior, allowing the people inside to be aware of the passage of time.

B.C. Talbot (2019), indicates the use of natural materials in neo-gothic churches. This is also the recommendation for biophilic designs.

The decorative details found in neo-gothic churches are oftentimes portraying nature-inspired ornaments such as foliage, animals, flowers and other such motifs (M. Aldrich, 2014).

Lastly, although not necessarily present at all times, neo-gothic churches, as churches in general, sometimes integrate green spaces in their vicinity (A. Salisbury et al, 2020). Whether these spaces are graveyards or just simple gardens, it promotes a connection to nature and a place to meditate and feel connected to the surroundings. (fig. 6)

3.1.2 Incompatibilities

Being religious buildings, neo-gothic churches focus on the relationship between human and divinity in the interpretation of the religion they represent.

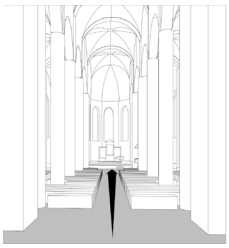
This means that, in a neo-gothic church, people should find refuge from the outside for introspection and meditation (C.C. Smith, 2015). This creates closed spaces, windows placed above the sight line, and stained glass limiting a direct visual link with the exterior.

Because the focus is on the rituals happening inside, dynamic views incorporating natural elements are not present at all. In conclusion, the space is an, isolated shelter from the external world (fig.7)

3/ Results

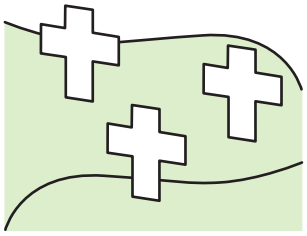
SPATIAL FEATURES

1. Tall spaces



2. Light-filled spaces

3. Green spaces

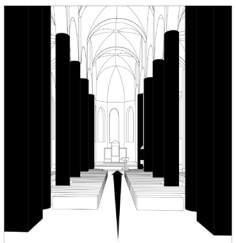


PHISICAL FEATURES

4. Natural materials

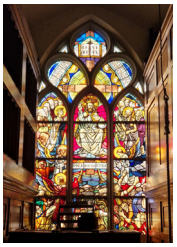
5. Columns and vaults, like a forest

6. Sense of rythm



7. Nature-inspired ornaments

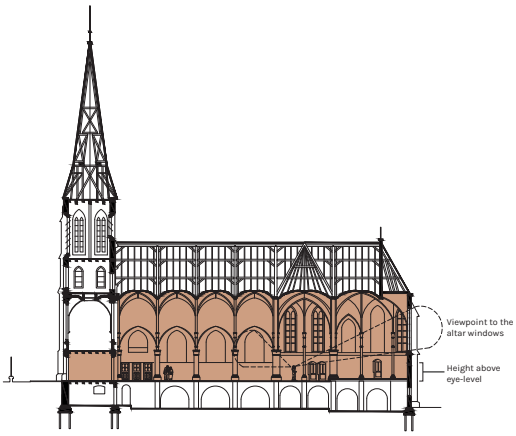
8. Stained-glass windows



9. Patterns and repetitions

fig.6 - Neo-gothic churches compatibilities with biophilic design features
Author: N. Cozma

- Visually closed up spaces



- Designed as a refuge, not linked with airflow and light intake

fig.6 - Neo-gothic churches incompatibilities with biophilic design features
Author: N. Cozma

3.2 Neo-gothic x Nature-inclusiveness

3.2.1 Compatibilities

The species identified to live in neo-gothic churches are mainly Bats, birds, rodents and insects.

As explained by the nltimes.nl (2022), and also indicated by the Church of England website (2022), bats mostly live in the high, inaccessible towers and roofs of the churches. This is possible because of the usual openings in the bell towers.

Local birds are making use of the eaves and rafters of the building that are usually protruding. In the Netherlands, the bird species include pigeons, swallows, sparrows etc.

Rodents hide mostly in the lower parts of the neo-gothic churches, in the basements and especially in places where food might be stored. They are also inhabiting the intricate stonework, which is also the place for all kinds of insects.

Insects like beetles, moths and spiders are feeding from the natural materials of the building, but also from books, paper, textiles that can commonly be found (fig.8).

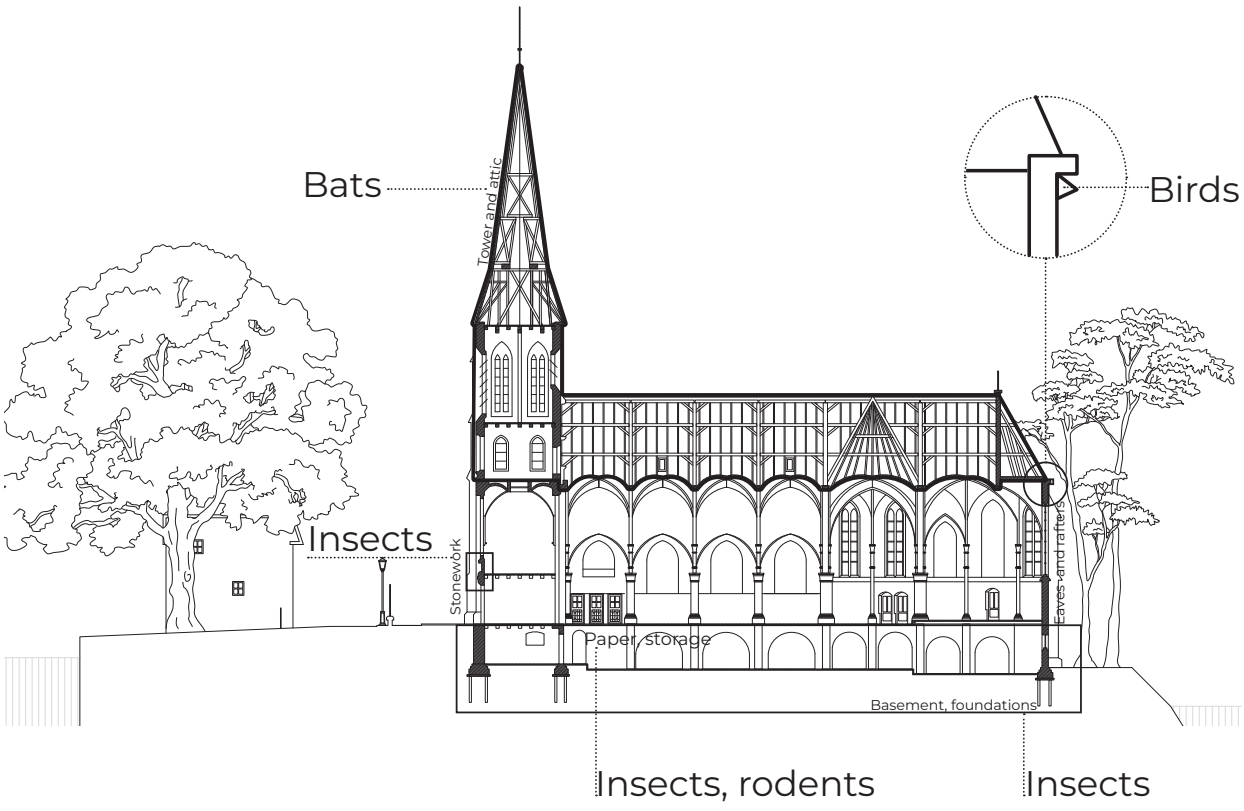


fig.8 - Neo-gothic churches compatibilities with nature-inclusive features
Author: N. Cozma

3.2.2 Incompatibilities

Generally, different religions look upon the idea of nature differently. As neo-gothic churches are linked in their vast majority to the catholic church, they tend to showcase an attitude towards nature specific to the catholic dogmas: Churches were made for the people and animals were not allowed inside, therefore they don't integrate animals by default.

Allowing nature to take over the churches would mean allowing the building's deterioration. This is the main incompatibility between heritage buildings and nature-inclusiveness. The intactness of the structural elements is paramount for the existence of the building, and are the main elements inside of a church that are incompatible with animal inhabitation. (fig.9)

fig.9 - Neo-gothic churches incompatibilities with nature-inclusive features
Author: N. Cozma

3.3 Redesign recommendations and conclusions

3.3.1 Conclusions on the results - redesign framework

The modern applications of both biophilic design and nature-inclusiveness represent ideas that can easily be implemented into a new building. This transformation implies a high amount of porosity between the realm of people and that of nature. However, with neo-gothic churches, as heritage buildings, enhancing their link with nature is a result of compromise between existing values, functional specificities of the redesign and nature integration.

The final framework (fig.10) is a basis for the future redesign of neo-gothic churches in a human-centric, but nature-connected way. It reinforces the idea that neo-gothic church buildings should be repurposed and that they have the potential to become spaces that truly connect their inhabitants with their natural environment.

Nature connected elements:

- Tall interiors
- Vaults
- Columns
- Towers and spires
- Tall windows
- Attics
- Protruding eaves and rafters
- Succluded corners
- Stonework
- Repetitions
- Intricate detailing
- Stained-glass and patterns
- Natural materials

Nature disconnected elements:

- Massive structures without eye-level openings
- Valuable structures or elements
- Dark middle naves

Valuable elements:

- Neo-gothic values
- By church

Neutral elements:

- Finishings
- Technical elements (ex. gutters)
- Movable objects
- Doors and frames

fig.10 - Redesign framework scheme
Author: N. Cozma

3.3.2 Dilemmas and limitations

Although created on theoretical bases for a practical implementation, nature-inclusiveness and biophilic design elements are not quantifiable. Integrating these features in a redesign is about having an attitude that promotes nature connection, and not a checklist. This is also why this framework shouldn't be interpreted as a rigid set of rules, only general recommendations.
Neither biophilic design nor nature-inclusiveness represent points that can be added up so they reflect a final result on a scale from 1 to 10. Although several sources have tried to quantify (new) biophilic buildings, there is currently no universal measure.
Separated from the architectural factor lies the societal one.

As a society, we frown upon letting insects or other fauna representatives into our homes. Cities are not usually looked at as biodiverse, although they certainly are. People generally like to have control when it comes to interacting with nature and wouldn't, for instance, welcome ants in their beds.

At the same time, animals are generally wary of human activity, and might not want to use the places an architect designs for them in a building.

3.3.3 Recommendations

1. Usually massive, the bearing walls of the churches are the main barrier between interior and exterior. Allowing nature inside through the creation of new light sources would allow both lighter interiors and the creation of new visual connections between interior and exterior.
2. Incorporating interior greenery could further encourage a feeling of connection between people and nature. The green spaces that are created should encourage interactions between people, nature, and the existing structure.
3. Open green spaces should be incorporated, like interior gardens, green roofs, green facades, in order to create inviting conditions for the local biodiversity.
4. New interventions should involve natural, bio-based materials and textures as much as possible structurally, and existing biophilic shapes should be preserved and used as important spatial features. Choosing biobased and carbon neutral materials and building techniques for the redesign will neutralise the impact of the redesign on the bigger environment.
5. The use of natural airflow should be maximised.
6. Retrofitting biodiversity enclosures like bird and bat nests to allow the biodiversity to thrive without damaging the existing structure of the building.
7. Some of the species can also be incompatible with a new function, as they can prove to be invasive. It is important therefore to consider, in a redesign, the human/animal borders.

4/ Discussion

This research has presented a framework that encourages the redesign of neo-gothic churches so it improves the connection between its inhabitants and nature. It showcases a matrix to be considered in a redesign, which consists of elements compatible, incompatible, inherently valuable and neutral within heritage, biophilic and nature-inclusive standpoints.

By working with a generalisation, not all the elements included in the framework fit all the neo-gothic churches. This research doesn't represent, as a conclusion, an universal paradigm. It is, however, a starting point that can be adapted for the nature-connected redesign of all heritage buildings, through the reinterpretation of the showcased elements. There is, therefore, a liberty to adapt, shrink or further add elements to the framework.

The final result of the research relies on the assumption that not all the elements in a neo-gothic church are extremely valuable and the building can be modified to some extent. The question of heritage preservation is valid, but it is left to the designer's discretion to decide on the amount of intervention they want or can perform. In the end, of course, for highly valuable buildings, there wouldn't even be the question of a redesign.

Annex 1

Annex 1: Neo-gothic churches - identifiable elements
Author compilation: N.Cozma, 2023
Author images: 1a, 9 - T. Sarma; 1b to 8 - N.Cozma

Identifyiers source:
Clarke, Basil Fulford Lowther (1969), “Church builders of the nineteenth century: a study of the gothic revival in England”
Represented on the images:
1, 2b, 3a, 4 to 9 - St Augustinus church in Amsterdam North
2a, 3b - St Paul church in Strasbourg, France

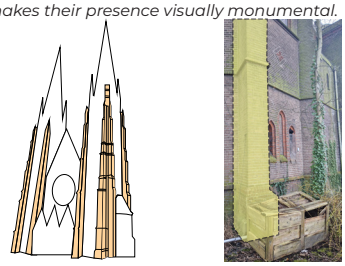
Neo-gothic churches - identifiable elements

1. Pointed arches and ribbed vaults

They usually have massive structures from natural materials such as brick or natural stone, which makes their presence visually monumental.

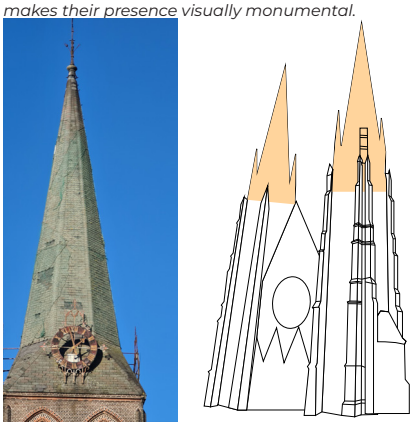
2. Flying buttresses

They usually have massive structures from natural materials such as brick or natural stone, which makes their presence visually monumental.



3. Tall spires

They usually have massive structures from natural materials such as brick or natural stone, which makes their presence visually monumental.



4. Carvings

They usually have massive structures from natural materials such as brick or natural stone, which makes their presence visually monumental.

5. Decorative stained glass

They usually have massive structures from natural materials such as brick or natural stone, which makes their presence visually monumental.

6. Natural materials

They usually have massive structures from natural materials such as brick or natural stone, which makes their presence visually monumental.

7. Organ

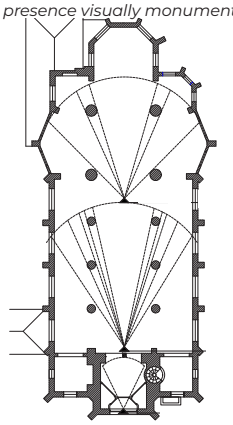
They usually have massive structures from natural materials such as brick or natural stone, which makes their presence visually monumental.

8. Sculptures

They usually have massive structures from natural materials such as brick or natural stone, which makes their presence visually monumental.

9. Open interior

They usually have massive structures from natural materials such as brick or natural stone, which makes their presence visually monumental.



Annex 2

Annex 2: *Interpretation of biophilic design attributes as per different authors. Author: N.Cozma, 2023. Reformatting from original sources.*

Sources:

1- *Kellert S.R., Heerwagen, J., Mador, M. (2008) Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life. John Wiley & Sons*

2- *Kellert, S.R. (2018) Nature by Design: The Practice of Biophilic Design, Yale University Press*

3- *Terrapin Bright green (2014), 14 patterns of biophilic design, available online at: https://www.terrapinbrightgreen.com/reports/14-patterns/#the-patterns*

4-

Kellert, S.R. (2018) Nature by Design: The Practice of Biophilic Design, Yale University Press

GOALS, PRINCIPLES, EXPERIENCES AND ATTRIBUTES OF BIOPHILIC DESIGN

DIRECT EXPERIENCE WITH NATURE

-Light
-Air
-Water
-Plants
-Animals
-Weather
-Natural Landscapes and ecosystems
-Fire

EXPERIENCE OF SPACE AND PLACE

-Prospect and Refuge
-Organized Complexity
-Integration of Parts and Wholes
-Transitional Spaces
-Mobility and Wayfinding
-Cultural and Ecological
-Attachment to Place

INDIRECT EXPERIENCE WITH NATURE

-Images of Nature
-Natural Materials
-Natural Colors
-Simulating Natural Light and Air
-Naturalistic Shapes and Forms
-Evoking Nature
-Information Richness
-Age, Change, and the Patina of Time
-Natural Geometries
-Biomimicry

Terrapin Bright green (2014), 14 patterns of biophilic design, available online at: https://www.terrapinbrightgreen.com/reports/14-patterns/#the-patterns

14 PATTERNS OF BIOPHILIC DESIGN

NATURE IN THE SPACE

1. Visual Connection with Nature
2. Non-visual Connection with Nature
3. Non-rhythmic Sensory Stimuli
4. Access to Thermal & Airflow Variability
5. Presence of Water
6. Dynamic & Diffuse Daylight
7. Connection with Natural Systems

NATURAL ANALOGUES

8. Biomorphic Forms & Patterns
9. Material Connection with Nature
10. Complexity & Order

NATURE OF THE SPACE

11. Prospect
12. Refuge
13. Mystery
14. Risk/Peril

Annex 2

Kellert S.R., Heerwagen, J., Mador, M. (2008) Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life. John Wiley & Sons

SIX ELEMENTS AND 70 ATTRIBUTES TO BIOPHILIC DESIGN:

ENVIRONMENTAL FEATURES

-Color
-Water
-Air
-Sunlight
-Plants
-Animals
-Natural Materials
-Views and Vistas
-Façade Greening
-Geology and Landscape
-Habitats and ecosystems
-Fire

NATURAL PATTERNS and PROCESSES

-Sensory Variability
-Information
-Richness
-Age, Change and the Patina of Time
-Growth and Efflorescence
-Central Focal Point
-Patterned Wholes
-Bounded Spaces
-Transitional Spaces
-Linked Series and Chains
-Integration of Parts to Wholes
-Complementary
-Contrasts
-Dynamic Balance and Tension
-Fractals
-Hierarchically organized ratios and scales

PLACE-BASED RELATIONSHIPS

-Geographical connection to place
-Historic connection to place
-Ecological connection to place
-Cultural connection to place
-Indigenous materials
-Landscape orientation
-Landscape features that define building form
-Landscape ecology
-Integration of culture and ecology
-Spirit of Place
-Avoiding placelessness

NATURAL SHAPES and FORMS

-Botanical Motifs
-Tree and Columnar Supports
-Animal (mainly vertebrate) motifs
-Shells and Spirals
-Egg, Oval, and Tubular Forms
-Arches, Vaults,
-Domes
-Shapes resisting straight lines and right angles
-Simulation of Natural Features
-Biomorphy

LIGHT and SPACE

-Natural Light
-Filtered and Diffused Light
-Light and Shadow
-Reflected Light
-Light Pools
-Warm Light
-Light as Shape and Form
-Spaciousness
-Spatial Variability
-Space as Shape and Form
-Spatial Harmony
-Inside-Outside Spaces

EVOLVED HUMAN-NATURE RELATIONSHIPS

-Prospect and Refuge
-Order and Complexity
-Curiosity and Enticement
-Change and metamorphosis
-Security and Protection
-Mastery and Control
-Affection and Attachment
-Attraction and Beauty
-Exploration and Discovery
-Information and Cognition
-Fear and Awe
-Reverence and Spirituality

Annex 2

Table 1
Elements of biophilia-based architecture criteria.

Criteria			
Prospect and refuge	Complexity and order	Enticement and mystery	Savanna-like Environment
Strategies:			
	Connective Symmetry/Hierarchy Universal Scaling Fractal Theory of centers The geometry of Golden Ratio (*) Quasicrystalline structure (*)		Exposure to natural light Wide/open spaces with topographic variations Real or symbolic trees Deep overhanging eaves Alcoves and recesses Anti-Gravity elements Petrification (*) Courtyards (*)
Prospect Larger space with Raised ceilings Wide views on surrounding spaces Elevated site and Balconies Increased lighting conditions The geometry of Golden Ratio (*) Courtyards (*) Refuge Reducing lighting conditions Small windows enclosed by thick walls. Petrification (*)		Enticement Opportunities for exercising imagination Details and diversity Kinetic systems (*) Mystery Partially visible areas Overhanging balconies or elevated passageways Kinetic systems (*)	
Settings:			
(In historical styles):	- Ornaments, mosaics, stained glass and tiling - Orders - Human scale - Cascade of niches - Modular System - Repetitive arches, domes and spires on different scales - Stalactites - Domed structures - Volutes - Penrose pattern - Philotaxian symmetry		- Column, with base, stem and crown - Canopy-like branching structures - Palm vaulting-domes - rotundas - Colonnaded layered terraces - Building into the land not on it. - Lighting through dome's base - Aligning with astronomical events - Floral and foliage motives
- High ceiling in the main area flanked by lower aisles - Enclosing windows by thick walls along lower sides while increasing lighting conditions in the central area, - Courtyards with Fountains - Ornaments (vegetative elements) - Columns and interlocking arches (tree-like) - Views to a distant scene through arches or arcade		- Triforia - Overhanging balconies and pulpits - Grand staircases - Light/shadow effect - Strong contrasts of planes that reflect and refract light - Automated operable systems - Drawbridges and Open elevators - Retractable/folding roofs - Rotating structures	

(*) **Strategies suggested by the researcher in part (4) of the study**

Annex 3

Annex 3: Nature - inclusive features and needs as per different authors

Author compilation: N.Cozma, 2023
Source:
1 - *E. M. Wildenberg (2022), "Nature inclusive design in high-density urban development to support urban biodiversity"*
2 - Amsterdam Handboeken en tools voor natuurinclusief ontwerp
3 - Maike van Stiphout (2020), "First guide to nature-inclusive design"
4 - Church of England (2021), "Biodiversity"

E. M. Wildenberg (2022), "Nature inclusive design in high-density urban development to support urban biodiversity"

Nature-inclusive features:

- Attention for the relationship animal-human
- Healthy living enviornment for humans and animals
- Attention to the animal needs
- Incorporation of spaces for flora and fauna by design
- Identifies the animals usually found in the Netherlands and their needs

Species	Endangered	Migration	Food	Lives in	Breeding / gestation
House sparrow	Yes, Red List species in the Netherlands	No	Insects, seeds, grain, flowers, bread, berries, peanuts	Colonies, socially, nesting boxes	March-August 4-6 eggs 11-12 days
Common swift	No	Yes, spends winter in Africa	Flying insects	Colonies, nesting boxes	May-June 2-3 eggs 18-22 days
Black redstart	Yes, protected indigenous species in the Netherlands	Yes, spends winter in Southern Europe / Africa	Insects, seeds, berries, fruit	Solitary, territorial, nesting boxes	From April 4-7 eggs 12-14 days
Common pipistrelle	No, although existing roosts in buildings are protected by law	No, max. 25 kilometres from summer roost	Insects, mosquitos, moths, beetles	Colonies or solitary	From June 1-2 babies 4 months

Table A1, showing a model of detailing bird and bats species needs, E. M. Wildenberg (2022)

Annex 3

Amsterdam Handboeken en tools voor natuurinclusief ontwerp

Recomendations and ideas for retrofitting nature-inclusive features

- Focuses on the needs of animals
- Gives retrofit solutions to improve biodiversity
- Focuses on the needs of the animals

3. Hotels en stenen voor insecten

Inbouwstenen, gestapelde stenen en insectenhotels dragen bij aan een gezonde wilde bijen- en vlinderpopulatie in de stad. Wilde bijen en vlinders zijn een belangrijke schakel in de voedselketen, ook voor de mens. Zij zorgen voor 60% van de kruisbestuiving van onze groenten en fruit. De insectenhotels en -stenen zijn geschikt voor bestaande bebouwing en nieuwbouw.

Goed voor:
- Vlinders, bijvoorbeeld kleine vos, dagpauwoog en verschillende soorten koolwitjes en blauwtjes
- Wilde bijen

Waar plaatsen
Plaats de insectenhotels en -stenen op een plek die beschutting biedt tegen regen en wind en dichtbij inheemse nectar- en stuifmeeldragende bloemen, planten en/of struiken.

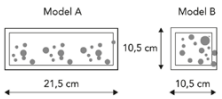
Bijenstenen moeten aan de zonzijde van een gebouw worden ingemetseld.
Insectenhotels kunnen ook op de grond staan als ze maar niet in de schaduw van een gebouw of boom worden geplaatst. Hoe meer zonuren op een dag, hoe beter. Het hotel moet op het zuidwesten gericht zijn. Bijenhotels kunnen ook op het dak worden geplaatst.

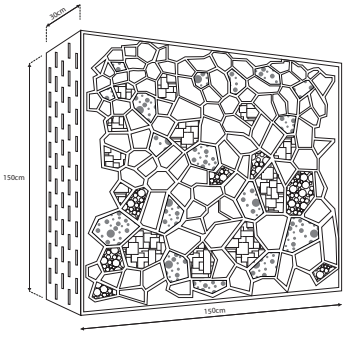
Zie ook Specifieke eisen per maatregel, blz 47.

Insectenhotel Vondelpark

Bijenbaksteen

Bijenbakstenen
Soorten: solitaire bijen, hommels
Oriëntatie: zuid, zuidoost, zuidwest, west
Ophangen: vanaf maaiveld: h= 1-10m
Grootte: model A) 21,5cm x 10,5cm x 6,5cm
model B) 10,5cm x 10,5cm x 10,5cm
Materiaal: beton met houtvezel
Diameter holtes/gaatjes maximaal 6 mm
Diepte holtes/gaatjes minimaal 6 cm





Insectenhotel
Soorten: allerlei soorten insecten, bijen, vlinders
Oriëntatie: zuid, zuidoost, zuidwest, west
Locatie: op maaiveld of dak
Grootte: ± 150x150x30cm
Materiaal: houten constructie gevuld met natuurlijke materialen zoals hout,takken, rietstengels, hooi, stenen en kiezels
Diameter holtes/gaatjes maximaal 6 mm
Diepte holtes/gaatjes minimaal 6 cm

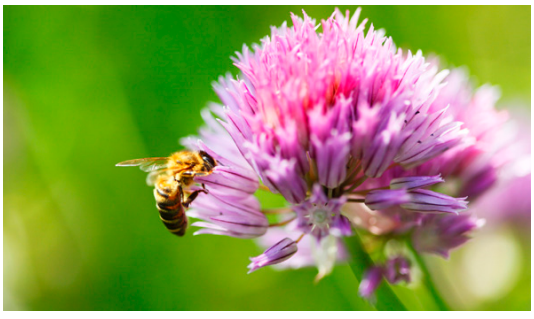


Table A2, showing a model of solution for insect integration, Amsterdam Handboeken en tools voor natuurinclusief ontwerp

Annex 3

Maike van Stiphout (2020), “First guide to nature-inclusive design”

Recomendations and ideas for creating nature-inclusive features

- Focuses on technical aspects of nests for animals
- Focuses on the needs of the animals

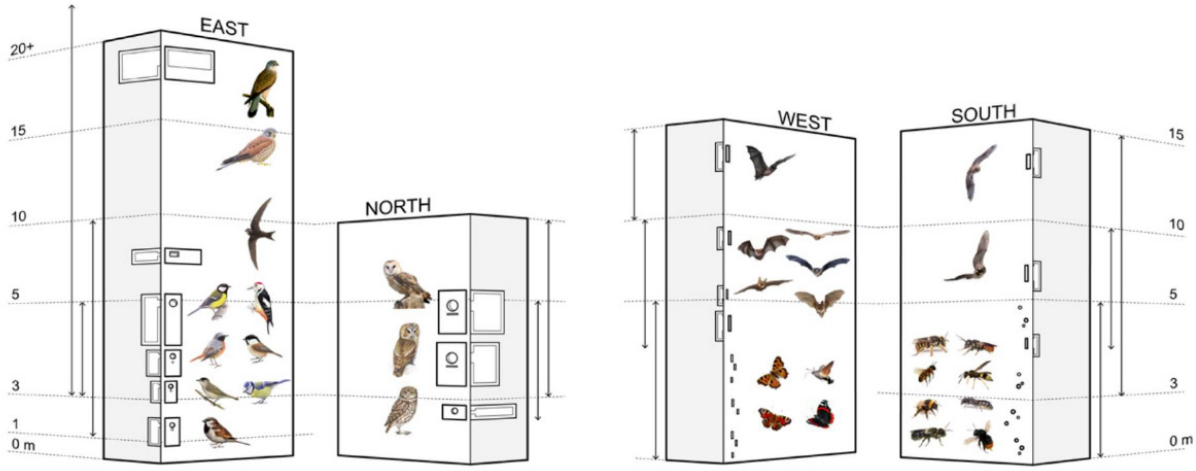


Table A3, showing an example for animal integration requirements, Maike van Stiphout (2020)

Table A4, showing design solutions for animal integration, Maike van Stiphout (2020)

Annex 3

Church of England (2021), "Biodiversity"

Recomendations and ideas for maintaining biodiversity in churches

- Focuses on biodiversity usually found on church premises
- Gives indications about improving biodiversity and cohabitation with the church building

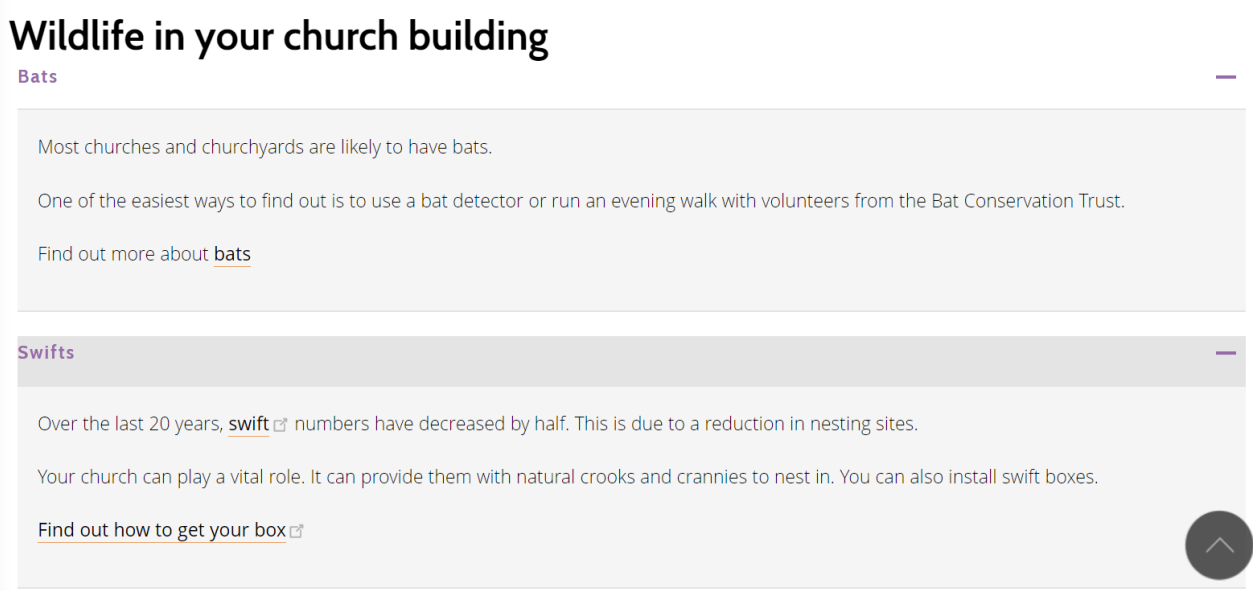


Table A4, showingthe question of bats and swifts within church buildings, Church of England (2021)

Timing of common works with suggested optimal times to avoid bat disturbance

Works	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minor roof repairs												
Re-pointing and render repairs												
Replacement of rainwater goods												
Lime washing												
Timber treatment												
Doors, windows and porches												

Key:	Optimal	Sub - optimal	Not advised

Table A5, showing the optimal time for construction work so the bats are not disturbed, Church of England (2021)

Figures

Figures

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