

Factors Threatening the Cultural Heritage- the Windows of Europe

Paul Dettwiler¹

Abstract

Today, historical windows of Europe are disappearing from the façades in a magnitude that can possibly be compared to the destruction of the building stock during the World Wars. The purpose of this paper is to give a structure to the problematic and to discern factors that contribute to such circumstance. Even though the European legislation generally protects historical buildings since the last 30 to 70 years, the vigour of law seems toothless in favour of market forces and weak insights of the consequences of establishing sustainability policies. One factor that has in recent years grown in significance seems to be divergences of policies between sustainability and protection of the cultural heritage. Another contributing factor to the rate of destruction seems to be economic wealth that correlates to inappropriate change of windows. The paper proposes a more holistic view of the consequences when sustainability measures and decisions are taken. Finally the paper contributes to a proposition how the unfortunate development should be hindered or mitigated.

Keywords: Architecture, Change, Cultural Heritage, Sustainability, Windows.

1. Introduction

Windows are the openings in the walls of buildings, which originally were merely holes. In order to enable daylight entering the inside of buildings and in the same time excluding wind and cold temperatures, transparent material were sought as covering material in the wall openings. The first glass windows were already created in ancient times, when the Romans were capable to produce glass. Windows were a luxurious artefact of a building and grew continuously in importance and contributed with a development of specialized craftsmen in the field. In the middle ages windows of composed pieces of circular (or hexagonal) crown glass with plumb frames was the predominant way of creating a window. From the 17th century larger pane surfaces were sought, which lead to a development of the technique of producing cylinder (plain) glass. During hundreds of years until the last century the same technique of producing pane of glass remained the same, however with increased sizes and refinement. A mouth-blown glass square was produced through a two-step procedure: first a glass-cylinder was moulded in a form. After cooling, it was cut up alongside the height and a second time put into the oven where the cylinder opened to a flat rectangular pane of glass. (also called cylinder blown sheet glass). With this technique it is impossible to create a perfectly flat surface; instead it contributes to an almost inimitable and special character of windows and in a larger context: the perception of the façades. The thickness of glass panes is from 2 to 5 mm that render the panes quite sensible; a minor impact is enough to destroy

¹ F:A Arch. SIA, CTH, Schlossbergstr. 49, CH-8820 Waedenswil, Switzerland, cthdettw@gmail.com

a pane of glass. The cylinder glass windows relates to the architecture that succeeded the medieval building with crown glass. Larger glass surfaces became a significant architectural resource of expression of European architecture; e.g. from Versailles in the 17th century to every common buildings until the 1920s. During the early 20th century cylinder glass for windows were replaced with a number of new techniques of producing considerable large surfaces (e.g. float glass) with a perfection of a flat surface. Uncontestably the new glass production technique contributed together with the development of steel and concrete techniques to the characters of the various trends of modern architecture during the 20th century. However in the beginning of the modernistic era, when perfect plain surfaces were sought, particular unevenness of windows in buildings can be found until the 1930s. The window ratio of the façade area before the 1930 generally was 10% to 50 % and afterwards the span extended until 20% to 100%. This fact suggests that the character of the glass surfaces play undoubtedly a mayor role of how we perceive the architecture of a building. The texture of mouth-blown the glass panes get lost when they are replaces with modern windows. This paper want to raise the question if it is possible to maintain a more subtle and careful way to deal with windows in old houses, that in fact would be more sustainable in a holistic viewpoint and ultimately “is there any willingness to do so?”. (This article is limited to the topic of “Casement window” which is the traditional window of Northern and Central Europe, hence named here merely as “window”)

2. Architectural values

Old windows have generally a frame of timber (rare alternatives are iron, steel or lead), which in particular in Northern Europe have often a very high quality (often heartwood of pine and spruce) a low propensity to decay even if the coats of paint have fallen away. In central Europe hardwood like oak was the domineering material for the frames. Panes of glass are fixed in the wooden frames with small nails and putty. Traditionally linseed oil is an important ingredient in window manufacturing: (1) As impregnation as a primer of the timber frame, (2) As binder for the putty and (3) As binder of the coat of paint. Through the ages linseed oil loses its elasticity through an oxidation process; when it becomes dry it does no longer protect the window. Due to the winter season, parallel frames of windows were common from Northern Europe until the alpine region. In southern Europe sun protection is solved through shutters and blinds. In Northern Europe the whole year's windows are nearest to the façade and opens outwards. The windows for the cold season are hooked inside with opening inwards. In Switzerland and Central Europe the season windows are often contrarily hooked nearest the façades. Traditional window frames are subdivided into smaller sections because the glass panes were not technically possible to produce large enough for the size of one window frame. The glass panes are separated by slender timber parts; the horizontal are called saddle bar and the vertical bar: stanchion bars. Windows are often symmetrical; a vertical timber part, the mullion, separates the left and right window frames. The timber parts of a traditional window have often elaborated and refined design of profiles (www.buildingconservation.com).

2.1 Irreplaceable qualities

The concept of “Nordic Light” is related to early skills of milling appropriate profiles of timber of the interiors in order to optimise the daylight in morning and evenings and has thus a functional role apart from the decorative appearance. The timber profiles together with composition of multiple uneven glass panes enable daylight to enter a building smoothly without sharp contrasts that occur between shadow and light. The handicraft of windows of traditional windows consists furthermore of elaborated details of metal: fittings, hinges, catches and handles (e.g. Figure 1). All mentioned materials compose together a characteristic element of the architecture of a façade, and are consequently utmost significant for our cultural heritage.



***Figure 1. Details and Texture of old windows do not exist in modern windows:
Original Window 18th century, Skottbergiska Gården, Karlshamn, Sweden***

3. Energy Saving vs. Protection of Cultural Heritage

The oil crisis of 1974 gave rise to energy saving requirements in Europe and has since then continuously been a theme in European Governments and Financial institutions, which has given a rise in industry to produce windows with higher thermal insulation. The façades of existing buildings got an additional layer of thermal insulation; the windows were replaced with new windows with better U-value. Since the 1960s, city cores in Europe have endured a time when historical buildings, often several hundreds of years, have disappeared to larger extent than during the world wars. All cities cores in Sweden (that did not even participate in the world wars) must during the 1960s sacrifice an important stock of historical buildings in favour of new constructions for supermarkets (Primarily the chain “Konsum”, politically related to the Social Democratic Party with its ideology of “The People’s Home”) and office

buildings. The remaining historical buildings often have been radically changed from the 1970s due to energy requirements; new facade layers, new roofs and replacement of windows. Undoubtedly large amount of the historical values have thus vanished or been changed to a considerable extent.

3.1 Questionable Vigour of Protection of Cultural Heritage

Since the beginning of the 20th century, governments of Europe have to a various extent created regulations of protecting the cultural heritage; initially building of spectacular value like castles and churches became protection early whereas private buildings (dwellings, factories, offices and commercial building) from medieval to 19th century become protected after WWII. Despite status as protected heritage, changes of windows are frequently made. In the archives of the building authorities the blue prints of façades often have the scale of 1:100, which means that a window with measure of let us say 2 x 1 meter has the size on the blueprint 2 x 1 cm. Certainly on such tiny size, details of a window cannot be seen or evaluated of its architectural or historical quality, nor can a difference between old and new windows be distinguished. In reality, it is undoubtedly a considerable difference between an original window with substitute of a modern window: (1) modern glass panes a perfectly even, which can be easily detected in the mirroring of the glass pane. Instead of multiple glass panes, a single glass pane fill the entire frame where saddle bars and stanchion bars are often mere decoration and fixed inside the glass pane (2) Instead of wooden parts, the windows have frames are often of plastic or aluminium. The profiles of the frames (and the “false bars”) are of standardised form paying no heed to the above mentioned functions of the original windows profile. Furthermore, from inside the frame create a sharp contrast to the daylight instead of the particular character of the subtle light dispersion of old windows.

3.2 Movements of Protection in Academia and Practice

During the 1970s, a wave of demolition of old buildings took place. Voices of protecting historic values arose, often as a protest to market and political forces. The protests against the extensive demolition of historical building resulted in higher academic interests at the architectural schools in Sweden (primarily the Professors Boris Schönbeck at Chalmers and Ove Hidemark at the Royal Institute of Technology, Stockholm) where maintenance of old art and crafts within the building sector acquired new-born interest. Relations to artisans were established that were invited to architectural school to work-shops. One example was Hans and Sonia Allbäck from Ystad, Sweden who specialized in the art and craft of old window at its traditional materials. Hans Allbäck invented a glass-tube that heated the old putty of windows and thus facilitated removal of putty without damaging the mouth-blown glass panes. It must be said that specialists in repairing old windows have in the recent decades found its market segment in Europe. Another example is the firm Glomet AG in Horgen Switzerland (www.glomatag.ch) who as well has a stock of old windows and thus is capable to provide original window parts for their clients. The interests for preserving old buildings have become institutionalised phenomena in Sweden; outside academia organisations like The Swedish Association for Building Preservation (www.byggnadsvard.se) has been established. Contacts to specialised artisans and providers of traditional building material are provided from several sources.

Intermediary solutions between old and new windows were as well of interest; for example in the 1970s the firm EMDE Inredningar, (design Max Dettwiler) in Sweden pursued experiments by preserving the old glass panes and transferring them to new timber frames with an internal additional window frame with a modern isolation glass pane. Contrarily the authorities of building preservation (www.ag.ch/denkmalpflege, Switzerland) recommend a method of replacing old glass-panes with modern glass panes and preserving the timber parts of the windows. There are today some manufacturers of mouth-blown glass pane in Europe that have to reconstruct forgotten techniques of various times; for example the degree of organic pollution in the sand resulted in particular textures that are difficult to reconstruct (www.byggnadsvard.se). Moreover there is a large amount of modern glass panes with market label as “antique”. They are however far from the character of mouth-blown glass panes and cannot function as a substitute.

3.3 Two main categories of old windows

The character of a building in relation to an urban context must be paid better attention where details such as Figure 2 that render historical traces have great significance for the architectural understanding and historic traceability (Schönbeck, 1994).



***Figure 2. Details and Texture of old windows do not exist in modern windows:
Original Window from 17th century, Dijon, France***

Schönbeck (1994) suggests that if changes of a historical building must be made, it should be elaborated with prudence. Distinction is made between restoration and renovation: traditional techniques should be used in repairing measures (restoration); whereas new building parts must pay heed to the character of the place. The Venice charter of 1964

stipulates that new building elements should represent the present time, thus not being a pastiche of past times.

In this paper it is argued to divide the management old windows into two categories: (1). Buildings where the windows earlier have been replaced one or several times (medieval to 19th century) and (2) Buildings where façades and windows have the same age like Figure 3 (frequent example, houses from 1870, art nouveau buildings from beginning of 20th century). According to "The Venice Charter 1964" a new window might have its place in a historical building that have changed the character of the façade throughout the centuries and where the existing windows have little historical and cultural value. The second category however deals with historical buildings where a considerable part of the original surface is threatened; if possible it would have high value if the entire building to a maximum can maintain its original materials. Nypan (2009) compares short life cycle of modern windows and maintenance of old windows; thus put to question the necessity of a change. Dettwiler (2012) conclude that changes often occur without a rational reason and often the change per se can be of nuisance. An example are the art nouveau buildings in Eastern Germany that after the opening 1989 were renovated for symbolic reasons; having now lost their original windows the buildings must probably already have their second generation of plastic windows.



Figure 3. A residential building from beginning last century in Davos, Switzerland where the upper floors have changed to new windows, whereas the lower floor has maintained the original windows.

In several ways, the original windows can in fact have sustainable features: (1) they old windows were repairable, the new windows not, (2) maintenance consists of a layer of linseed oil each fifth year, enabling a quality as a new window (3) societal cost of energy

would be saved by avoiding manufacturing, transport, installation and waste, (4) cultural value would be maintained etc. (Ohlén, 2005).

4. Analysis of Sustainability

In recent decades Switzerland have agreed to achieve a so-called 2000 Watt Society (introduced by ETH in Zurich, 1998), which is a target of energy consumption per head in a future. Such a political target has resulted in requirement of energy savings among the existing building stock. If house-owners commit themselves to transform their houses to new energy standards they receive lower interest rates on the loans. Similarly cultural values seems to be forgotten when it matters of energy saving in historical buildings; methods of renovation is well spread in Germany. It means thus that Financial Institutions and Governments contribute to the disappearance of old windows. The manufacturing industry of plastic windows fulfilling the new requirement has grown and offers easy delivery and replacement of desired sizes.

The Swiss authorities accept that old glass panes of cultural heritage classified buildings are replaced with new glass panes and thus would the timber parts of the window saved (for example www.ag.ch/denkmalpflege). Windows in historic city cores have to a considerable extent been replaced by new windows (often of white plastic frames and false bars behind the glass pane): examples are Appenzell (Figure 4), Zermatt, Zürich, Geneva, Lausanne and more. Being classified as a Unesco Heritage more prudence of window repair and preservation can be seen in Bern.

4.1 Architectural Design vs. Energy Saving

The manufacturing of windows during the post WWII era has been developed from handicraft to large scale industrialisation. The technical qualities of windows has continuous been enhanced in terms of acoustic and thermal insulation. Glass panes have become thicker with a significant more flat texture and can be produced of considerable larger sizes than it is possible with mouth-blown glass panes. Together with steel and concrete as building materials, the technical development of glass production has incontestably contributed as an important material of the architecture of modern buildings. Old windows have poorer thermal insulation however compensated by its minor part of the surface of the façade. Modern windows often have a larger part of the façades with less wall surface. In Northern and Western Europe, the floor surface per capita grown as well as the floor size of apartments has as well continuously grown since WWII. On one hand we have thus an older building stock with smaller surface of windows with on the average small apartments. On the other hand we have an architectural trend of increasing glass surfaces and a design of larger apartments with more floor surfaces per capita. As a part of discussion on sustainability, this observation argues for not studying only the physical aspects of windows as an isolated building element but rather as in ingredient in a larger context in briefing, building physics and architectural design.

Sustainability labels generally do not pay heed on culture values, rather they tend to be directed to incorporate insulation materials and thus attain targets of energy saving. Ohlén

(2005) suggests that old windows in fact can be better than new windows; the differences should be about 4% of the entire heating cost between preservation and new windows. Energy can be saved in a number of other changes in a house like more efficient ventilation, roof insulation, efficient re-use, low energy household equipment etc. A balance with humidity and temperature is relevant; historical timber houses with historical painting layers suffer from damages of continuous level of heating because water evaporates and dry the timber with results of volume changes. It causes cracks and peeling of paint and plaster. The other extreme is too much humidity in the building which often were the case of the additional insulation of the 1970s (due to the oil crises 1973) were the condensation point felt inside the wall through openings in the moisture barrier.

4.2 A Philosophic Comment on Sustainability

It is remarkable that there seems to be a correlation between wealth and destruction of cultural heritage; Dettwiler (2012) exemplifies with the opening of Eastern Germany and how Art Nouveau houses were badly damaged through unskilled renovation. The same can be seen in Switzerland where cultural heritage seems primarily have an image role for tourists; one of the Landmarks of Switzerland; the Kappelbrücke in Luzern was completely destroyed in 1993 through an intense fire. It was originally constructed in the 14th century with 111 paintings from 17th century. A new copy was quickly reconstructed in its place. The newly built Kappelbrücke is still a photographic symbol of Swiss tourism.



Figure 4. A residential building from 17th in Appenzell, Switzerland after a “Sanierung” with a new coat of paint and new windows (NB. Plastic bars, without function, behind a single glass pane)

Furthermore; houses from 15th century until 19th century that are renovated (German: “Sanierung”, literally translated “Cleansing”) in Switzerland often got a new perfect facade with new layers of paint and new windows whereas more prudence can be seen concerning old houses in neighbouring countries with lower GDP. During the 1960s the Swedish word

“Sanering” (Cleansing) was as well frequently used when a considerable part of the historical building stock insensitively disappeared and is today avoided due to its negative associations. “Sanierung” is however today frequently used in Switzerland, which implies that there might be cultural differences of the attitude to cultural heritage (Figure 4). Through insensitive restoration the original character vanishes and a have a new “look”; a building with the same treatment of its surface can in fact easily be reproduced elsewhere in the world. It can be associated to newly built city centres aimed for tourist; e.g. the collection of copies of various European old houses in Macao or the copy of Venice in Las Vegas. The question arises “Is it indifferent whether buildings or building parts are original or copies?”

Investments in historical buildings have often a dual character. Buildings in city cores with high symbolic values and rentable surfaces are a subject of investment and speculation. Negative aspects are risks of costly and complicated renovations with restrictions due to protection of cultural heritage. Most frequently old windows of old houses seem disconnected to the value as an old house. The contractors specialised in renovation do seldom want to exhibit a renovated window as an enhancement of value, whereas ornaments of the walls are often new painted or cleaned. The outcome of a renovation is (as the name implies) a new “look”.

It is probably a matter of status of a building if a window renovation should take place. For example, we cannot accept that the glass panes of the royal castle in Stockholm should be replaced by modern glass panes. An extensive and most prudent renovation lead by Professor Ove Hidemark maintained all original glass panes, the oldest from 1741 (www.gardoctorp.se). Auditing of real estates is a fundamental element of valuation and information for real estate archives, where a multitude of physical aspects are documented. In Italy old building parts are included in the auditing process (Bellintani and Ciaramella, 2008). Documentation might in fact be a step to establish a value of old windows and other original building parts. It is a well-known fact that investment and value has a psychological background. As far, old windows have frequently been regarded as a financial burden where the easy solution is replacement. If old windows would be ubiquitously regarded as valuable objects, more balance could be found in the future between change alternatives.

The concept of “sustainability” deserves some analytical remarks. There is apparently a divergence of policies and interests between sustainability and the protection of the cultural heritage. Alternatives of managing old windows are highlighted in Table 1.

One can assume that the targeted 2000 watt society to a large extent is biased not only to fulfil political goals but as well of an emerging industry. If the approach of achieving sustainability would be to cause a minimum of nuisance by a change it is not certain that a manufacturing of new production, and its related processes, like transports would the best alternative. Decision of changes can be related to variables of pro- activeness, re-activeness and weighting of functional and symbolic values (Dettwiler, 2012): We might feel that we have done something good for the environment if we replace old windows by new ones when we actually are influenced by governmental and market goals. In the same time we have invested financial means that result in a new painted façade with new windows (that have a life-cycle of about 25 years and cannot be repaired). Certainly it would be a sacrifice

of renouncing for a short-sighted economic profit in favour of altruistic ideals of preserving cultural heritage for the benefit of coming generations.

A comparison between the two alternatives of managing windows in Table 1 can be further deducted to the utilitarian thoughts of Mill (1863) where a human action should be transferred to a satisfaction, ethics and moral. It is not evident that users and owners of buildings would be immediately happier by preserving old windows with the disadvantages of inferior acoustic and thermal qualities. Shall the mouth-blown glass panes be sacrificed in favour of comfort requirements of today or shall possibly moral and ethics be a means to fulfil conservation aspirations?

Table 1. Alternatives Maintaining existing Windows or exchanging them.

New windows (discharge of old windows)	Maintaining old windows (maintenance and repair)
<ul style="list-style-type: none"> • Loss of cultural heritage • Change of 10-50% of façade architecture • Improvement of Energy Cost for the building • Improvement of acoustic quality • Risk of humidity damages and contribution to “sick houses”. • Limited life cycles, Replacement with another window each 25 years>recurrent costs • Higher Societal energy cost of transporting, manufacturing and waste windows (thus less sustainable?) • Easy to realise accessible on market (Economies of Scale, Standardisation and Supply) • Governmental request of energy saving, promotion through financing • Gives jobs and business opportunity for manufacturing industry • Plastic, Aluminium cannot be repaired 	<ul style="list-style-type: none"> • Maintenance of cultural heritage • Maintenance of façade architecture • Some Improvement of Energy Cost for the building if maintained and repaired • Some Improvement of acoustic quality if maintained and repaired. Otherwise poorer quality than new windows. • Higher energy cost for owners • Undefined life-cycle if maintained and repaired • Recurrent cost of maintenance and repair • Lower societal costs of energy and material (assuming that maintenance and repair is less energy demanding than replacement, thus more sustainable?) • Difficulty to find competent artisans in the field • Timber repairable and easily maintainable. • Growth rebirth of old art and crafts
Sustainability from Political and Market Forces’ viewpoint	Sustainability from a scientific viewpoint?

5. Summary: What can be done?

Building authorities are the institution that primarily can promote a more sober and differentiated view on windows. Original windows that are repaired could be entered as part of the value enhancement of a historical building: information to the public has a preventive effect. Such information has a multidisciplinary duty: from historical, architectural values to technical advices and guidance to the few artisans in the field that are capable to repair and maintain old windows. The architectural (and engineering) school might have a course in preservation of cultural heritage and traditional arts and craft as a mandatory theme. An

advice for the future would be more prudence and balance by identifying the real needs and necessary changes.

5.1 Recommendations

Some ideas in the paper that can be transformed to practice:

- Profound investigation whether a certain change must take place. An analysis of consequences can be motivated. What is sustainability in a societal and larger context? Contradictions can be found in a limited context as that of a singular building. More subtle weighting should be made between energy saving and preservation. Finding alternative ways between preservation and fulfilling acoustic and energy saving requirements (like intelligent and variable heating of spaces) are motivated.
- Educational measures: (1) Education of more artisans capable to repair appropriately windows and in fact open a market to the public as an alternative to pre-fabrication window suppliers. (2) Historical values that might be transformed to economic values. Elite of educated real estate investor would appreciate original windows of a real estate. Might such attitudes be spread to a broad category of owners?
- Documentation performed by municipalities, investors and owners as a part of the auditing process and value creation. Better routines among authorities: details of façades should be better protected against changes with higher degree of details in drawings (from 1/100 to 1/20 for example). The development of technologies, ICT, BIM etc. gives large opportunity to manage large amount of data concerning windows.
- Energy savings of old building relate often lower interest rates of loans when original windows of old buildings are replaced with plastic or aluminium framed windows. Probably such rule has caused the high degree of disappearance of old windows during recent years. Governmental financial support of repairing old windows might give balance to the today's financial promotion of replacement alternative.
- Two categories of old windows have been distinguished that lead to various measures: (1) original windows with same age as the facade and (2) old windows, but younger than the facade itself. Repair and maintenance is more motivated in the first category in order to maintain an original facade, whereas the second categories represent another window in a succession of several previous generations of windows.

6. Conclusive Remarks

This paper has highlighted the imminent problematic of the loss of historical building and windows in Europe; in particular the loss of mouth-blown glass panes (cylinder blown sheet glass) has been treated. It is furthermore most remarkable that the institutionalised ideas of energy saving, sustainability labels, political and market targets seem more or less to have been forgotten the architectural and historical values of old windows. Recommendations are made in order to safeguard the remaining part of the old-window stock. A holistic view of the

consequences would be motivated when sustainability measures and decisions should be taken. New windows imply that energy can be saved in a limited perspective but is more doubtful in a larger and societal context. Various alternatives should be considered in the decision process before making a change. Ultimately, it can be said that this paper has an underlying research question: "What is sustainability from a scientific perspective?"

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