On the unseen parallel resources of the built environment

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Title: On parallel resources of built environment

Abstract

Buildings are representing parallel resources in terms of identity capital, energy capital and economical capital. In post-industrial urbanity it is relevant to develop strategies which include all those aspects in order to manage urban transformation processes with a minimal loss of identity, energy and economic resources. Important tasks related to such strategies are the reuse of remaining production buildings of industrialism but also the need for quality solutions for energy saving refurbishment purposes. To optimize value in the processes of transformation, designers and public administration might extend their conception of resources becoming conscious that:

1. Energy resources are embedded in materials and building processes
2. Identity resources exist detached and independent from authorship, high culture traditions and historical events.
3. Economical resources are not only a conditioning framework but also an instrument of managing building transformation.

The paper suggests on the basis of three examples that building preservation strategies might converge with climate preserving strategies, employing economical incentives, resulting in a sustainable condition of perpetual transformation and a dynamic view on preservation.

Intro

Building preservation is relevant as a powerful resource-saving approach in itself[1]. However, it is by nature aimed towards a minority of the building stock and concerns mostly the protection of qualities such as historical features and architectural authorship. By turning focus towards parts, components, and materials of buildings, a potential arises for a more widespread strategy for preservation of all kinds of buildings - based on reuse, recycling and capacity for transformation.

Expanding the scope of preservation

When building preservation is conceived of as a matter of public interest through regulations aiming at the protection of cultural values, assessment strategies has until today mostly been based on the detection of historical characteristics combined with the professional judgment of architectural qualities[2]. Though this kind of operation might not be uncomplicated in itself, it might at least narrow the field of candidates for preservation

considerably. Also, the necessity of assessing buildings for preservation has been limited to buildings and urban areas threatened by demolishing, typically in connection with urban transformation and development. Building preservation has mainly been a matter of defending cultural identity against the forces of the market. However, more interests are attached to preservation of buildings:

New focus on process energy

Today, and in the nearest future, a new concern of building preservation arises in the light of the general necessity of energy-refurbishing of the existing older building stock. Bringing down the energy consumption for this major part of buildings to the level of new buildings is crucial in order to escape the dependency of not renewable energy-sources and the related economic and political risks. It is inevitable that the future process of insulation of buildings will change their appearances. This raises the discussion about the status of cultural identity if the major part of the existing building stock becomes partly un-recognizable by transformations for energy saving purposes? As preservation practice shifts its focus from singular objects to a mass of objects, it ascends from the scale of architecture to the scale of urbanity, and the call for new preservation strategies becomes acute.

Buildings as a multiplicity of resources

A perspective which might be fruitful can be generated from looking at buildings as a complexity of multiple *resources*. A building is at the same time a resource functioning as a reservoir of time, culture, energy and economic capital. As the latter is connecting to the notion of a *capital*, this concept might be expanded to comprise all three resources in terms of different stocks of capital: Cultural, energy, and economic capital. The metaphoric concept of capital has the dual character of both a value to protect and a volatile subject of change - a generic amount of matter with a plasticity encouraging the calculating acts of investing, spending, gaining and increasing.

The capital concept is originally describing traditional factors of production[3] and the inclusion of identity or embodied energy as types of capital is suggested on the basis of the fact that these are implicit actors in the production of buildings as the production process is endless; In relation to preservation, the production process always has the special character of *re*-production.

Interrelating resources

When assessing preservation on a mass-scale, the interrelations between incommensurable types of capital become relevant to consider in order to optimize legislative regulations as well as decisions on the level of developing, designing and public administrating: Cultural criteria for preservation must be negotiated against the rationales of energy and economy. Refurbishments for energy-saving purposes must pay respect to cultural factors. The call for protecting cultural identity and embodied energy might employ economic strategies. The plastic nature of each kind of capital must be evoked in order to provide a starting point for negotiating. In short, the dynamic characteristics attached to each resource can be described as below:

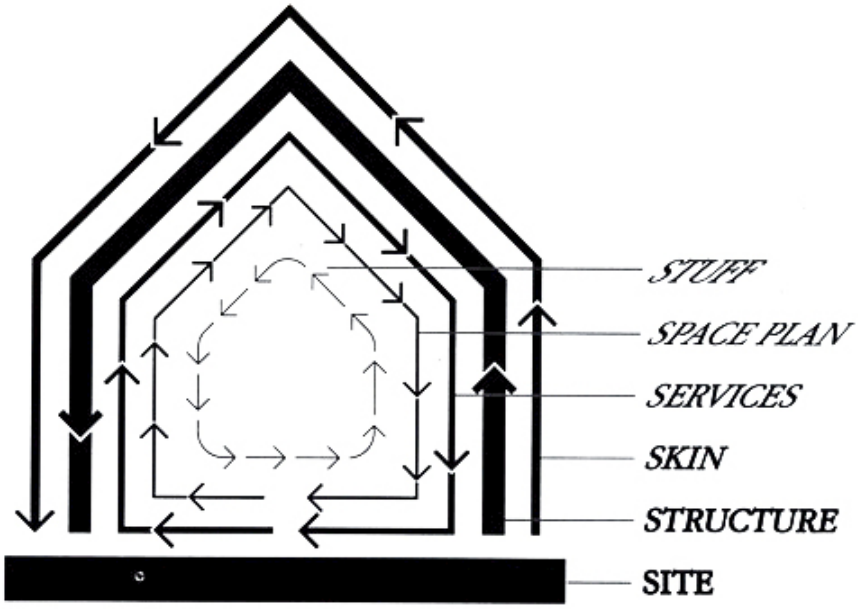
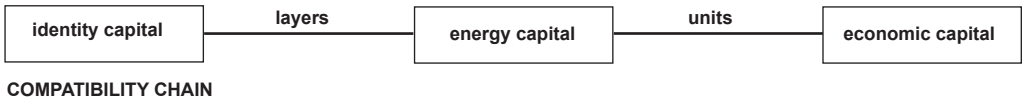


Fig. 1: Duffy / Brands diagram of shearing layers with variable lifetime. Source: Brand 1994



COMPATIBILITY CHAIN

Fig. 2

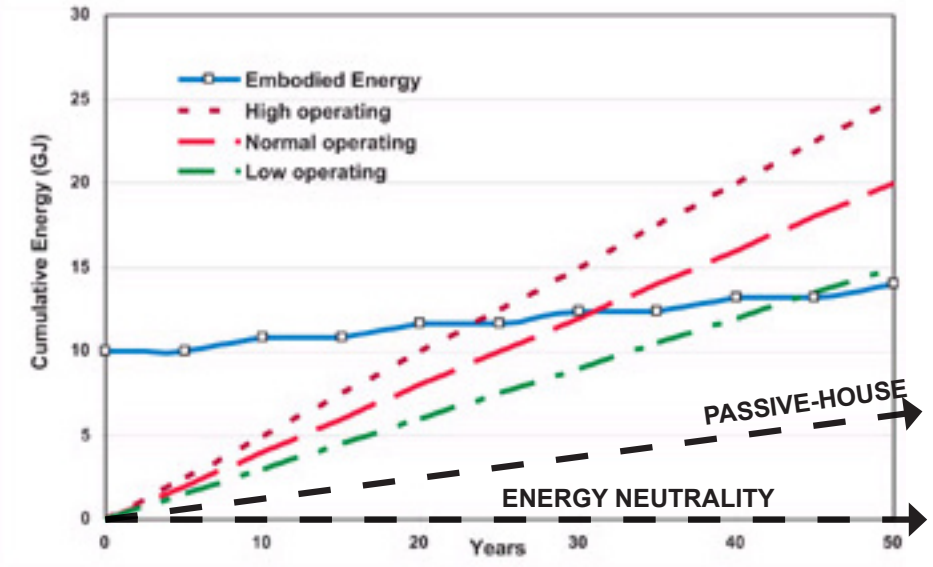


Fig. 3. Process energy (blue curve) compared with operational energy in buildings with different performance. By passive house building operational energy is minimal, by energy neutrality it is zero. Source: www.recovery-insulation.co.uk/energy.html. Black curves are additions by the author.

Cultural capital

Cultural identity has traditionally been following a rationale of protecting the collective memory of civilizations, nations and groups of individuals, recognizing that human identity is closely related to objects. Buildings have been ranking high as they are durable and relatively permanent entities. Also, buildings function as time-meters by exposure of their period-specific features and patina of surfaces. Buildings, in their quality of time-meters, convey the fruitful concept of *layering*; Cities, and most often singular buildings as well, contain a multitude of ages which are presented simultaneously and un-prioritized to the spectator. Thus, urbanity can be considered as an 'archaeological', poly-layered structure referring to historic events of many levels and extensions. In most cases layers have been changed, displaced, short-circuited, hidden or eroded through generations of transformations related to changes in function, technology, fashion and/or economic conjunctures.

The concept of layering is correspondingly reflected in the physical layers of buildings which can be divided into several levels according to the functional, technical and social lifetime of each layer[4]. Fig 1. In this, there is a concordance between the physical level and the level of identity. Each layer performs a technical, functional and social service of the building and there is an energy capital embedded in the physical materials of the layer. As these layers are also depositing energy capital from processes, there is compatibility between identity capital and energy capital. As energy capital can be calculated, there is a chain of compatibility between all three capital concepts, although cultural identity might not be capitalized directly in terms of CO2-equivalents and/or economic currency. Fig. 2.

Energy capital

Energy consumption related to building has traditionally been understood as energy for operations needed for its use such as heating, cooling and power. Energy for building operation has until lately made out the major part of consumption in comparison with energy needed for processes of building, such as mining, manufacturing, transportation, site operations, maintenance and renovations. In buildings erected according to building regulations of recent years, the proportionality between operational and process energy has switched completely into a stage where the embedded energy of the building, its part and components forms an equal part of the total energy consumption[5]. When future even stricter regulations are implemented, process energy will form the major part and in so-called zero-energy buildings process energy makes out the total energy consumption. Fig.3. This means that the materials of the building possess an energy capital, as a certain amount of CO2-equivalents are invested in the processes of building. The actual possibility of calculating and quantifying energy-capital provides a close parallel to the methods of accounting economic capital which makes the two entities compatible for mutual cost-benefit considerations.

Economic capital

Buildings function as a double stock of economic capital: real estate value and building cost value of materials, labour etc[6]. Changes in the market can motivate the decision of rebuilding or reconfiguring the building, renouncing some or all of the capital originally invested (cost value) often induced by the fact that amortization diminishes the importance of cost value over time.

However, the market context is dependent on legislation and regulation through local planning and such regulations are very efficient since buildings are local per definition. Very often buildings are demolished as a consequence of a local building ratio which makes reuse or refurbishment of existing older buildings economically unviable, either if the ratio is too low or if it is too high - both resulting in wasted energy capital. The balance between capital resources can, as a measure of legislation and administration, be obtained by incentives and regulations with impacts on economic decision - not only restrictive measures such as taxation of landfill, preservation obligations and conservations, but also liberal measures such as rewarding preservation with increased exploitation ratios or giving dispensations for regulation codes applied to new buildings.

Three cases

In the following three examples, all by the Danish architectural office Vandkunsten, the three types of resources are followed and the interactions observed:

1. MTB, private housing, Copenhagen 1999-2003

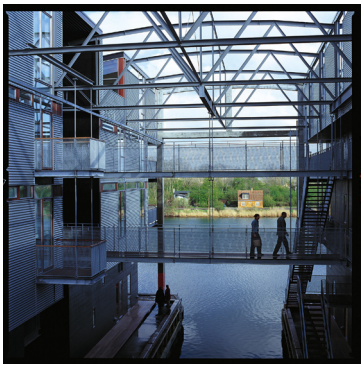
The MTB-building is a transformation of a naval torpedo-boat shipyard from 1953 into 60 housing units as part of a conversion of the area to civil use after relocation of the naval facilities.

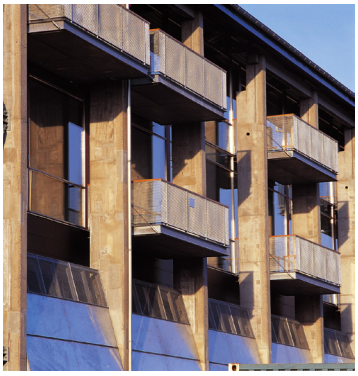
Identity

The identity of the building is primarily embedded in its scale and shape: In a context of sheer new housing schemes the fifty year old industrial building stands out as a monument despite its profane and ordinary containment. The conversion to domestic purpose has made a downscaling of the volume necessary, generating an interior street-like space in extension of the gable's open entry from the waterside which gives access to the building by canoe. The original structure, characterized by deep and narrow pillars is continuously dominating the exterior. The former steel-panel cladding has been changed into full width windows, some supplied with balconies. Furthest away from the harbour the lower storeys are arranged as parking area for the residents and part of the neighbourhood as well. The parking facades are covered with pitched cement panels between the pillars, resembling the original industrial character.

The transformation of the building, which was not covered by conservation regulations, has generated local identity in terms of:

Urban heterogeneity. The size, shape and structure have provided a monumentality which is difficult to create artificially within a planning framework.



The MTB Building



Horsens Community House


Ny Ellebjerg

Historical depth. The MTB-building has the quality of a time monument in the midst of new buildings as patina and important traces of past events are preserved, for instance the repair work on the pillars is left visible in the exterior surface.
Residential differentiation. The homes are situated in a unique position, individually related to the water, orientation and the interior street. Variations of housing types and access routes add further, designed, individual identity to the identity of the context. Visible structures, such as steel trusses going through living rooms, provide a strong presence of the site's history.

Energy

The refurbishment of the MTB-building has preserved the embedded energy of the structural part of the building – pillars and steel-trusses for roof construction - prolonging its life from one functional lifecycle to the next. Layers with shorter life-time such as facades were replaced by completely new. However, the energy saving is limited in this case as the steel-trusses were dismantled for restoration, transported twice, and re-mounted.
The building has been rewarded which increases the probability of protective behaviour of future actors.

Economy

The preservation of the MTB-building was basically not economically sustainable and according to a traditional calculation routine it would have been more profitable to replace the building with a complete new one. The preservation was conditioned partly by an idealistic approach from the developer, supported by the architect, and partly by the fact that it showed to be viable to integrate parking facilities in the construction. The free outdoor area required by the local plan could not be provided if preserving the building. However, with the capacity to offer surplus parking lots, neighbour buildings' parking area was exchanged to free area in deficit. Parking in construction is an expensive solution which must be counterbalanced by an accordingly high building ratio. In this case the building was saved by a flexible municipal administration which accepted the exchange of open area and parking.
The investment turned out to be far better than if the building had been replaced. Most economic value accrued to the first generation of residents who can reap a fair capital gain when selling - all derived from the unique and strong identity of the place in terms of its placement and history.

2. Horsens Community Centre, Horsens, Denmark 2006

Horsens community centre is a refurbishment of a robust, former production building from about 1850 which has through times been serving a variety of functions related to production, trade and storage - a history involving multiple transformations through time.

Identity

The new, heavy insulated façade covers the existing brick surface except for a number of glazings parallel to the existing window-less openings, exposing the brick wall from the

outside. Inside the building the brick walls are preserved without removing the worn character and patina. New and old layers are equally visible and by exposing the transformation the building is given an open identity that invites future changes according to new needs.

The merging of time and ages in terms of materials, architecture, and detailing produces a mature identity by puncturing any attempt to fixate the building in a specific period. Once this defloration of original authorship or compositional perfection has taken place, the building is irreversibly open for further transformation, and the question of a preservation strategy becomes limited to a judgement of the aesthetical potential of the next intervention.

The original building in Horsens was not a subject of conservation but merely seen by users and architect as a source from which could be produced a robust, un-staged atmosphere, capable to be a framework for multiple activities.

Energy

A thorough energy refurbishment has been made by outside insulation of the façade in order to bring the energy for operation down to the standard of new buildings. The structural parts are preserved and reinforced when necessary, increasing the amount of embedded energy in the building layer with the longest life-time. New facades are mounted on the old structure with reversible techniques allowing easy dismantling, reuse or recycling.

The refurbished building has received architectural reward which increases the likelihood of protective behaviour of future actors, thus saving the energy capital from processes.

Economy

Being a public building, market relations have had less influence on decisions about preservation or not - compared to private developing. The building was declared suitable for preservation by the city council despite its poor technical condition and its ordinary architecture – for sentimental reasons, so to speak. Some of the weakest parts were demolished, others were reinforced. In comparison with erecting a completely new building, preservation was cost neutral. As a public building the potential sales price is less relevant, but it is interesting that the projected was granted support from private funds because of the will to preserve the building combined with the ambition of renovating according to contemporary standards for energy consumption.

3. Ny Ellebjerg, masterplan, Copenhagen 2008

Ny Ellebjerg is a masterplan for an abandoned industrial area in which a new traffic hub has been placed, connecting three trains and several bus lines. The scheme which won a competition posed by the municipality suggested a comprehensive reuse of existing buildings. The buildings are conceived of as a resource of patina and history without particular regard to their conservation values in terms of architectural or technical qualities. Avoiding the conservatory perspective, existing buildings is looked upon as a site specific condition similar to the individual qualities of virgin land – as an artificial

nature. Consequently, new structures are superimposing existing structures and thus built besides, over and on those.
The developing of the area is in progress. However, for economical and political reasons, explained below, the preservation strategy is only sporadic implemented.

Identity

The architectural identity of the area will have the character of an assemblage at two levels: Firstly, the main volumes will be a composition of heavy and light elements of different sizes and, secondly, there will be differences in age of both heavy and light parts. To the extent that reused building components are applied, patina and perhaps other traces of past events will be imported to the place. This complex poly-layered collage of time and materials is rich in sensuality and historical depth but contains no other originality than the local specificity of the collage itself.

Energy

Existing buildings are largely preserved and insulated from inside or outside keeping operational energy close to the level of new buildings. The load-bearing capacity of the existing buildings may selectively be reinforced in order to carry new buildings added to the roof construction. The majority of the older buildings has brick facades and in order to adapt to these, it is recommended that parts of the added buildings has facades of reused bricks in combination with materials with low CO2 impact, such as wooden constructions and claddings. By adding light-weight elements on top of buildings with heavier materials this strategy supports the structural conditions.

Economy

It was suggested by the architects that the preservation strategy was supported by awarding private developers for reusing and renovating existing buildings by raising the exploitation ratio proportionately to the area of older buildings preserved. The municipal administration would not support this suggestion as they feared protests from neighbour residents and did not find it politically viable to award private investors. The result was that all existing buildings in the first stage of the development were demolished on the basis of cost-benefit calculations. As there was no administrative coordination between the developing schemes, the components of the dismantled building, mainly bricks, were not deposited locally for reuse but discarded as waste.
There is no information about the actual profitability of the building investment and, of course, no way to compare with the profitability of an alternative solution based on preservation.

Findings

In all three examples, there is a radical transformation in terms of: Change in function, reconfiguration of main composition of spaces and volumes, change in the appearance on many levels by over-layering of new structures and surfaces. In this, the identity of each building has changed significantly - in Horsens and Ny Ellebjerg even beyond recognition. It is significant that the quality of the identity has not been diminished when judged by

users, the market or the architecture-awarding establishments. Also, in all examples, the old building is still very visually and tactilely present to the spectator. This indicates that there is a broad framework for change by addition of new layers as long as the older are still strongly present.

In all three examples, the existing buildings are robust, ordinary production buildings in a relatively anonymous architecture. No renowned architects were connected with the buildings, making irrelevant the discussions about authorships or original concepts. The refurbishing design is a sheer matter of synthesizing respectively the program and the understanding of the nature of the existing building. This indicates that identity is not merely a matter of authenticity or originality but rather a state of relevance to users and spectators, and the transformed buildings can be as rich in identity and as original as the original.

In all three examples, the local legislative and administrative authorities have had a significant influence on the role of preservation in the developing schemes. In the MTB-building and in Horsens the cultural identity of the existing structure was given priority over economic conditions, whereas parts of the Ny Ellebjerg scheme were sacrificed for political reasons. Also, Horsens community house was only rescued due to a political will to ignore cost-benefit calculations, and not on the basis of advice from conservation specialists in the public administration. This indicates that the destiny of buildings without a high conservational status is unpredictable and arbitrary.

In none of the three examples, embodied energy of the buildings was a factor in the administrative decision. In the Horsens example, energy saving is a programmatic issue but only with respect to operational energy. In Ny Ellebjerg, the salvaging of embodied energy in materials was an explicit part of the preservation strategy but this was ignored. This indicates that there is too little knowledge and too weak a legislation to generate an efficient protection of energy resources related to processes.

In those examples where preservation approaches were followed, MTB and Horsens, the will to preserve has been a very profitable strategy. This indicates that previous research in profitability of preservation[7] is confirmed by the examples.

On the basis of the relationships between parallel resources, as observed in the examples described above, it might be possible to suggest a couple of adjustments in the practise of administrating and designing for preservation of existing buildings.

Dynamic preservation

Buildings and urban areas can be seen as multilayered organisms in a perpetual, dynamic state of change. The identity of an urban situation is profoundly dependent on the visual and tactile presence of layers associated with past activities. Buildings functions as depositories of time and as tie lines between past and present, and hence buildings constitute the physical manifestation of collective memory of a society. By introducing

building parts and components as the primary carrier of the traces of the past, encouraged by the necessity of salvaging building materials for re-use, preservation becomes as dynamic as the building parts can be: Reused bricks, timber, panels and boards etc. will be the basic elements in an atomized and distributed preservation of buildings[8].

By considering buildings as dynamic multi-level resources, the notion of identity becomes to some extent detached from historical fixation, architectural authorship and specific functional programme. In this perspective, transformation might imply the loss of a *specific* identity whereas the *amount* of identity might even be increased. Preservation value might then be attached to the very existence of different time and ages embedded in building parts. Traces of the past, the history, the collective memory is mobile and can be transported, imported and exported. The testimonies and relics are not necessarily specific to the single building, and the history needs no longer to be rewound or investigated as a 'backward narrative', since traces has been replaced, removed or switched. History will be told by the material qualities rather than by the architectural organization of materials. The architectural organization will still have an important impact on building identity, but with a high capacity for transformation, anticipating future transformation[9], the materials are lasting longer than architecture. This will contribute to narrative entropy and perhaps push architecture further towards a practise of distributed authorship, also known as *open work*[10].

Energy preservation

The energy resources embedded in buildings and infrastructure through lifetime processes can be managed both as a value to protect in the preserved building as a piece of architecture, and in the buildings' parts and components. A possible, future preservation practice might include the energy capital as an assessment parameter, possibly in combination with economic incentives or restrictions. For instance, might permissions for demolishing be conditioned by the salvaging of materials. A future energy protecting legislation might also provide the basis for the proliferation of a material up-grading industry with a huge economic potential.

Economic tools

The preservation of identity and energy capital of existing buildings is vulnerable to the economical conditions of the developing scheme and in turn to restrictions in area utilization and exploitation. At the same time, conservation strategies for saving buildings of special cultural value are of little help when it comes to ordinary architecture. An administrative practice based on the public interest in preserving resources of many kinds – and not only cultural heritage - might suggest a more widespread local employment of economical incentives and restrictions - with the ironic gesture of nurturing, stimulating and cultivating the open market economy in order to ensure the profits of property investors.

Notes

[1] Selwyn Tucker, “Embodied Energy,” pp. 2-3; Dan Lake, (1997), http://ecodesign.arch.wustl.edu/546a/STRATEGIES/BUILDINGS/EMBODIED%20ENERGY/Audubon.html

[2] The Danish Institute for Cultural Heritage recommends the assessment principles of SAVE:
http://www.kulturarv.dk/publikationer/publikation/artikel/save-vurdering-af-bygninger/

[3] Definition of the capital concept is found in:
Samuelson and Nordhaus 2004: Economics, 18th ed., McGraw-Hill, in which capital is defined as productive factors, such as financial capital, human capital, infrastructural capital etc.

[4] Brand, S. 1994: How Buildings Learn – and what happens after they are built, Viking Press / Penguin

[5] www.recovery-insulation.co.uk/energy.html. Black curves are additions by the author.

[6] Scarret, D: Property Valuation. The Five Methods, Routledge 2008

[7] This literature review refers to a number of economic analyses documenting the profitability of preservation:
http://www.brookings.edu/~/media/Files/rc/reports/2005/09metropolitanpolicy_mason/20050926_preservation.pdf

[8] Nordby, A.S. 2009: Salvageability of building materials. Doctoral thesis NTNU

[9] Durmisevic, E.2006: Transformable Building Structures, Doctoral thesis TUD
The transformation capacity is crucial in order to re-use and re-cycle building parts. Design for disassembly is the prominent technical strategy for obtaining a high transformation capacity..

[10] Eco, U. 1989 (orig. 1962): The Open Work, Harvard University Press USA. An open work is a work in which the spectator or user are influencing and co-producing the artwork or design.