

Energy Scripts and Spaces

Paper prepared for DEMAND Centre Conference, Lancaster, 13-15 April 2016

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Tineke van der Schoor^{a,b}

^a Corresponding author: email: c.van.der.schoor@pl.hanze.nl; phone: ++31610235466;

^b Hanze University of Applied Sciences, PO Box 3037, 9701 DA, Groningen, The Netherlands.

Abstract:

Technology is infused with scripts that indicate how we as users should behave around, live in or use an artefact. Drawing inspiration from literature discussing user scripts and gender scripts, we develop the notion of energy scripts. We apply this concept to buildings, to analyse if and how the energy demand of buildings is choreographed by architectural design.

We argue that dwellings have energy-scripts, for example kitchens are designed for housing separate appliances, instead of using cool storage. The use of technology for heating and lighting is ubiquitous in modern buildings, while the need to reduce energy demand often leads to the installation of even more technology, smart or otherwise. On the other hand, 'passive design' demonstrates that it is quite possible to design buildings that need almost no energy for heating.

Researching the concept of energy-scripts we contribute to our understanding of the constraints and flexibilities for reduced energy demand in buildings. Our approach also sheds light on the social construction of the 'resident' or 'house consumer' as an end-user. Investigating implicit expectations regarding energy use, which could ultimately assist in designing building scripts that specifically invite energy efficient use of a building.

Keywords: energy-scripts, buildings, cool storage, 'passive house' designs

1. Introduction

‘We shape our buildings, and afterwards our buildings shape us’, said Churchill in 1943, on the rebuild of the houses of parliament. This process of (re-) configuration goes on continuously as buildings are re-furbished, re-designed and re-interpreted. Although they may look static, in fact buildings are ‘halfway between agency and structure’, as Gieryn remarks (Gieryn 2002, 35-74). In this paper I contribute to our understanding of the way buildings shape us. I argue that scripts perform an important role in this process.

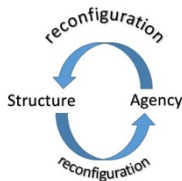


Figure 1

Buildings, just like other technological artefacts, are infused with scripts that indicate how we as users should behave around, live in or use it. Designers, regulators and commissioners embed their views on lifestyles and domestic organisation in the layout of dwellings, thus providing an opportunity where scripts ‘materialize morality’ (Verbeek 2006, 361-380). Furthermore, building materials and household technologies reflect priorities and opportunities from the period of building. The assemblage of buildings in a neighbourhood and the infrastructure for energy, water and mobility are also influential in determining our way of life. Together these heterogeneous elements form a script; a program or ‘choreography’ of use. So, although in the course of the 20th century welfare and lifestyle have changed dramatically, these scripts still influence our way of dwelling.

However, human actors are not necessarily the passive receptacles of these embedded scripts; they have opportunities to ignore, resist or even redesign built artefacts. If we interpret a building as a heterogeneous network, then a script is a ‘device’ that instructs the elements of the network how to behave regarding each other. These instructions or expectations are transmitted to the user in various manners; they can be embedded in materiality (Latour 1992, 225-258), in the layout of buildings, in regulations or in cultural habits. While some scripts may be easy to ignore or resist, others will be literally ‘in the way’ when users want to use the building for another function or wish to decrease its energy use.

The purpose of this paper is to investigate how building scripts are related to energy use: how is energy demand of buildings choreographed by architectural design? Drawing inspiration from literature discussing user scripts and gender scripts, I develop the notion of *energy scripts*. I propose to define an energy script as “the way the distribution of light, heat and power within a building choreographs its functional use and stimulates or discourages energy use”.

The concept of scripts can enhance our understanding of patterns of energy use in the built environment. Furthermore, script analysis allows us to move back and forth between the spheres of production and consumption, in order to understand the co-production of meaning. My contribution to the literature includes the application of script analysis to the built

environment, more specifically to the scripts that invite or inhibit household energy use and production.

In the second section of this paper I will further reflect on scripts, buildings and energy use. Scripts, however, should be related to actual practices where citizens enact the activity of ‘dwelling’. This is the purpose of the third section, which is devoted to four examples relating energy scripts to buildings. In the final section I reflect and draw some preliminary conclusions.

2. Scripts, buildings and energy

According to Akrich (Akrich 1992, 259-264) technology is infused with a script in which the designers define the ‘right’ way to use an artifact (Akrich 1992, 259-264). An extensive literature is devoted to user scripts (Oudshoorn, Saetnan, and Lie 2002, 471-483; Oudshoorn and Pinch 2003) as well as gender scripts (Oudshoorn, Saetnan, and Lie 2002, 471-483; Allhutter 2012, 684-707). Scripts act as choreographies that guide the actors in their daily movements and actions. According to the literature, scripts in general define or pre-figure a range of social expressions and relations, such as the relation with users; expression of status; specific functions; division of labour; gender and class roles.

However, scripts are not rigid, possibilities for resistance or noncompliance remain. Wyatt (Wyatt, Thomas, and Terranova 2002, 23-40) identifies a taxonomy of non-users in a study of internet use. Depending on their motivation and situation, Wyatt et al. divide non-users in *resisters*, *rejectors*, *excluded*, and *expelled*. Woolgar argues that scripts play a role in configuring the user (Woolgar 1990, 58-99).

There are several theoretical perspectives on the built environment that share an STS-background. First of all, Lewis Mumford relates functions, materials and social norms in *The city in history* (Mumford 1966), which spans from urban planning to the design of houses, from the provision of energy to the exercise of power, and from the stone age to the present. On a more modest scale, architectural historian Auke van der Woud (Van der Woud 2011) demonstrates the way that 19th century architecture kept the vast majority of citizens in sickening circumstances in the slums in the Netherlands.

Foucault relates power and buildings in *Discipline and punishment* (Foucault 1979). He links buildings and their specific architectural form with the disciplining of bodies in society, drawing on the example of the panopticon. He refers to the system of relations between the elements of an ensemble as the ‘apparatus’: ‘(Gordon 1980) *a thoroughly heterogeneous ensemble consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions*’. In Foucault’s work, however, the actual buildings are less important than the disciplinary system itself, which relates not only to prisons, but is a rationality, consisting of rules and expectations of behaviour. These ideas about how to behave like a useful and productive citizen have found their way into the architecture of schools, factories, mines, barracks and prisons.

Michelle Murphy (Murphy 2006) uses the term ‘assemblages’ to describe the loose interacting elements of office workers, health inspection, feminists, research tools and building parts. She defines an assemblage as *an arrangement of discourses, objects, practices*

and subject positions that work together within a particular discipline or knowledge tradition'.

While Foucault stresses the disciplining nature of our built environment, Kärholm (Kärholm 2013, 1109-1124) on the other hand stresses the freedom of users to redesign spaces, using the example of a child that designs hopscotch in a take-away restaurant.

The continuing reconfiguration of spaces is mentioned by Gieryn. He describes the way the Cornell biotechnology building is shaped by expectations and ideas about the development of scientific research, and how subsequently the building shapes the way research, commercial ventures and education are practiced at this department (Gieryn 2002, 35-74).

How is this disciplining nature built into our architecture? Is it possible to retrace the path of mixing power and ideology with design? In the literature it is argued that script analysis could be a useful tool to investigate how utilitarian functions, aesthetic expressions, social meanings, and cultural identities are constructed. Fallan aims to study how products transport and transform meaning, in order to better understand the interaction between product and user. *'The de-description, usually by the analyst, is the opposite movement of the inscription by the engineer, inventor, manufacturer, or designer.'* (Fallan 2008, 61-75)

Moore&Karvonen advocate a thorough 'de-description' of architecture, exposing the societal preferences that are embedded in concrete buildings. A building is usually designed for a specific function, thereby co-constructing cultural relations, discipline, division of labour, or the expression of wealth and power (Moore and Karvonen 2008, 29-46; Latour 1992, 225-258; Foucault 1979; Fallan 2008, 61-75). Markus and Cameron (Markus and Cameron 2002) elaborate the production of scripts by the use of language, as well as the uncovering of these scripts through content analysis of architectural texts, such as briefs. Architects and engineers imbue their designs with numerous indications for their use, thereby reproducing a historically developed lifestyle (Markus and Cameron 2002; Markus 1987, 467-484).

In the literature scripts are further specified as physical scripts, cultural scripts or portrayed as part of a disciplinary system. In this paper I treat scripts as socio-technical scripts, encompassing the design, production, materiality, symbolic meanings, functions and actual use of the built artifact. Users retain a certain freedom to redesign spaces, and can also can misunderstand, ignore, discard or reject the script. How does this tension play out in the case of energy and buildings? That is the subject of the next section.

3. Dwelling on energy

Dwelling requires energy. We need heating, lighting and ventilation to make our buildings comfortable. We need electricity for household practices such as cleaning, cooking, storing, or washing; for practices related to personal hygiene, such as showering (Shove and Walker 2010, 471-476), and for home entertainment devices, such as radio, television, and computers. All these practices have changed over time, and the layout of buildings has changed accordingly. Drawing on historical studies, I want to highlight some of the energy-using practices in houses and households, such as cooking, storing, and heating.

Building is creating and organizing spaces for us to live in, buildings provide for as well as determine our way of life. In this section I will investigate four examples of scripts, and how they influenced energy use in the built environment. A related question is if it could have been otherwise, are there paths not taken? Furthermore, counter-examples are useful instruments to expose existing arrangements that have come to be taken for granted. The examples are chosen on four levels: the organisation of domestic spaces (the kitchen), appliances for household practices (food conservation), the infrastructure providing energy to our homes (gas) and the building shell (passive building).

1. The kitchen

It may seem quite natural to us that every dwelling has a kitchen and a dedicated space for a dinner table, to cater for the feeding of the family. However, Hayden (Hayden 1981) asks herself ‘What would a non-sexist city look like?’ She demonstrates that in the first quarter of the 20th century feminist architects answered this question with: ‘without kitchens’. In their view cooking and dining was most efficiently done in communal kitchens and dining rooms. A house without a kitchen obviously influences the living arrangements of its inhabitants, as well as necessitating catering services. In the same way, the present layout of dwellings with kitchens also steers behaviour of consumers and has influence on service arrangements.

In her study, Hayden unearths a series of architectural designs that have in common the expectation that the provision of meals, the care for children, the provision of clean clothes and the cleaning of the interior, would be provided by shared facilities. Hayden presents layouts of apartment houses, with a common kitchen and dining room, but also terraced houses with a separate building housing a canteen, kitchen and child care facilities.

In the same period a similar debate took place in the Netherlands between proponents of the ‘living-kitchen’ and the ‘working-kitchen’, both under the adage of rationalizing household work (Oldenziel and Bouw 1998). The ‘living kitchen’ was supposed to be better adapted to daily practices of families, gave mothers more opportunities to combine household tasks and supervision of children, and would furthermore require less fuel for heating. However, after the First World War, the separated ‘working-kitchen’ became the national norm for new dwellings, codified in building regulations. Effectively this led to the banishment of the housewife to the kitchen for decades. Collectivization of cooking and washing was promoted by different social groups, such as the National Union of Housewives (NVvH), architects and municipal housing departments. However, the collectivization ideal gradually gave way to the compact family ideology with women as mother and housewife (Berendsen and van Otterloo 2002, 301-322).

If the collectivization vision had taken hold, the organisation of our households would have taken a very different path, instead of the atomized pattern we see today. Probably, the use of energy and materials in such a setup would have been much lower than our present household energy use. We would need only a fraction of the amount of fridges, washing machines and other facilities, to give an example. The path that historically was taken eventually led to an energy- and material intensive lifestyle, where a large part of household duties is shifted to the consumer (Schwartz Cowan 1989).

2. Cool storage and cooking range

Merritt Ierley (Ierley 1999) describes the development of kitchen technology from the 17th to the 20th century. For ages, the open fire determined cooking practices and kitchen design for centuries. As Bee Wilson says in ‘Consider the fork’, cooking was arranged around the open fire. A whole range of special instruments was needed to be able to reach out to the fire without burning oneself. Housewives had learned special skills to handle this, and reported difficulties and resistance to the learning of new skills to use the new type of kitchen range. Apparently, some people even reverted to the open fire because they could not get used to the new methods (Wilson 2012). The open fire needed a lot of fuel. In the 19th century many inventions had fuel economy as part of their goal. Take for example the Rumford range, which ‘tamed’ the open fire, used less fuel and at the same time provided more places for pots and pans. In the 20th century, according to Ierley, comfort and labour saving were the most important goals for innovators (Ierley 1999).

Schwartz Cowan (Schwartz Cowan 1989) discusses the development that took place in the US in the 20th century, focusing on household organization, the gendered division of labour and the role of marketing in creating the present ‘atomized’ households. The earlier envisioned shared facilities vanished, energy-efficient designs did not attract much attention or were actively repressed. Schwartz Cowan also investigated why the design of cool storage was discontinued. It turns out that the selling of appliances, such as fridges, was more in the interest of dominant economic groups. For the Netherlands, Van Overbeeke (Van Overbeeke 2001) followed the development of stoves, hot water appliances and furnaces. Jobse van Putten (Jobse-van Putten 1989) investigated earlier practices and technologies of food conservation in the Netherlands, such as drying, salting and ‘wecken’. These practices were gradually replaced by industrially conserved food products to consumers, and on the other hand the development of the freezer. The breakthrough of the refrigerator was apparently stimulated by a hugely successful supermarket campaign in the beginning of the 1960s (Lintsen, Bakker, and Lente 1992). In the meantime the cellar had disappeared from the standard layout of buildings after the 1950s, leaving dwellings without cool spaces. The refrigerator therefore was presumably very welcome to fill this gap.

3. Natural gas for every household

Heating technology has influenced the layout our homes considerably. Large cellars were needed for housing large boilers, in the past even small homes had dedicated storage for coal or turf. Although sometimes worker’s families had to use the turf shed as sleeping room for their children, as is sketched in Tilbusscher (Tilbusscher 2014). In Germany, it is still rather common to have a large oil fired boiler in the cellar, which is supplied once a year by an oilman.

In the Netherlands, this changed following the discovery of the Slochteren gas reserve in the Netherlands, in 1959. After the war the regulations for (social) housing were rather hesitant with respect to heating and hot water. These services were considered a luxury. However, the new and vast gas reserves gave rise to the idea that it would be best to sell these resources as quickly as possible, in order to be sold out before the then-expected cheap

nuclear energy would hit the market. Therefore, national housing regulations were relaxed; provision of gas, hot water and central heating became the new norm.

At the same time, the energy efficiency of buildings from that period is very poor, due to cheap materials and building techniques. Also, the layouts left out earlier features such as hallways and double doors, which used to keep cold and draughts outside.

These examples show that in the development of our built environment chosen paths have influenced the way we live, keep warm and do our chores. In the event, the paths that have been chosen not only laid the burden of household duties on individual citizens (mostly women), but at the same time these paths are very energy intensive.

Since the 1980s the practices of heating, cooking and storing are targeted by policies aimed at reducing energy use. EU rules and labelling have decreased the use of energy by fridges and other appliances. High efficient gas heaters decrease the use of natural gas for heating. Insulation policies aim to convince house owners to upgrade their property, in order to decrease the energy loss through the fabric of the building. However, all these measures are targeted at the moral responsibility and behaviour of consumer-citizens, and come with considerable costs and mess for homeowners. At the same time, the layout and functional characteristics of dwellings are not so easily changed. However, new designs have made it possible to proverbially heat your home with a light bulb (although this type of light bulbs is no longer sold). This is the so-called passive house, which is the subject of the next section.

4. The passive house

In the passive house the energy script is changed, although the user or gender scripts have not necessarily been altered. How is this accomplished? The 'passive house' is regulated by a European standard. These standards are primarily geared to ensure that the building envelope is heat- and draught proof, and can function within strict maximum of energy use for heating and in total. Within the envelope, the organisation of domestic space is up to the architect or the commissioner. Installations for heating are provided, and a central ventilation system safeguards the integrity of the draught proof concept.

Appliances have to be chosen carefully, to stay within the electricity use maximum. Furthermore, the heat that is emitted by appliances such as refrigerators is used in the total heat balance of the dwelling. The question is if old technologies for keeping cold have been incorporated, such as cellars for food storage? A preliminary search for cellars in combination with passive house delivers lots of hits concentrating on technical recommendations to avoid cold bridges between the crawl space and the passive construction, but only one layout with cool storage was found.

Examples of passive houses can be found all over Europe. In Austria the concept became almost identical with 'quality'. In the Netherlands there is considerable interest, although it is not yet mainstream. Keeping warm is no longer a problem with passive house technology, but for keeping cool these houses still rely on refrigerator technology. Maybe the design needs to incorporate cool spaces, comparable to the cellars in dwellings from the first half of the 20th century.

4. Discussion

We conclude that the embedding of energy scripts in our dwellings takes place in multiple ways, including organisation of spaces, government regulations, changing practices and new energy infrastructures. On the building level it appears that organizing functions and spaces is closely related to organizing heat and cold. Energy use is influenced in multiple ways by the layout of the dwelling. Hayden refers to American standard layouts as especially prone to leakage of heat, while the passive house is explicitly designed to preserve heat.

National building regulations were very influential in determining the organisation of spaces within dwellings. In the Netherlands, the abandonment of the housewife to the kitchen was strongly influenced by the design requirement of separate 'working' kitchens. The location and design of kitchens is discursively scripted, based on ideology of the nuclear family with a specific role for women as housewife. Furthermore, the separate kitchen made more stoves necessary.

The consumption junction also concerns furniture and appliances, which in some cases fulfil functions that in the past were integral to our dwellings. Parallel to the disappearance of built-in beds, drawers, iceboxes, and cellars, the sales of furniture and appliances saw an enormous increase in the course of the 20th century. For example, the lack of cool storage space led to the popularity of the refrigerator. Moreover, regulations regarding meat production got more stringent with the increase in population density. At the same time, increasing industrial food conservation and decreasing production of vegetables on allotments took away the need for food conservation at home. A whole range of practices and technologies for food conservation disappeared, together with the spaces in dwellings that provided room for these practices.

The use of cheap building materials became wide spread in the 20th century, leading to dwellings that have poor energy efficiency. The majority of these buildings are still extant, although several rounds of retrofit have taken place since the first oil crisis in 1973.

Not only the layouts and materials of our dwellings have changed, also the provision of fuel to our homes. After the discovery of gigantic gas reserves in the Netherlands, national regulations re-configured the design of dwellings in the 1960 by introducing new norms for the provision of gas for heating and cooking. Gas-fired central heating facilitated the heating of other rooms, instead of only the living room. With cheap gas, hot water was allowed to become a necessity instead of a luxury.

We argued that investigating implicit expectations regarding energy use could assist in designing building scripts that specifically invite energy efficient dwelling. The passive house movement sets rules by the adoption of a stringent European standard to ensure comparable quality across buildings and countries. Passive house designs seem to have solved the issue of heat preservation, however the provision of cold is not yet solved. Although individual examples with separate cool storage can be found. For the existing stock a promising innovation was recently published, which allows homeowners to install a cool storage space in their back garden.

The kitchen of the future, with the button-pushing housewife, did not materialize, or rather, it turns out to be quite different from early visions. Innovations have a tendency to

appear in unforeseen directions, for example, refrigerators do not yet manage their own supplies, however, new services sprang up to deliver boxes with fresh food and recipes to your door.

Although the utopian architectural visions from the 1920s are no longer relevant, the debate about autarchy and local self-sufficiency is recently revived. How can our buildings provide for energy production, individually and as a local community? In that respect, the present struggle for governance of community energy production can be understood as an attempt to (re)gain control of energy production and consumption and. A related question is about the role of smart grids and smart infrastructure.

This paper discusses the multiple ways energy scripts are embedded in our buildings, through the layout of domestic spaces, the incorporation of specific functions in the building itself or in separate appliances, the use of materials, and the provision of fuel to our homes. Furthermore, we have highlighted the importance of government regulations for the inclusion of the social, gender and energy scripts in our dwellings. This relates not only to building and (energy) infrastructure, but also to allowed practices for food and energy production.

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