Architecture of Workplaces 1 Lecture 2

INDUSTRY1.0 – changing needs, new possibilities
Revolutions and industrial revolutions: people and machines

15. Telford was a Scottish civil engineer, architect and stonemason, and a noted road, bridge and canal builder. The bridges, viaducts, factories and warehouses of the eighteenth and nineteenth century were on the whole the work of practical men and engineers. Architects as such didn't deal of such mundane work. Their work had often been limited to adorning/ decorating an engineered building.

16. Design and construction of the Shrewsbury Canal. One of Telford's achievements on this project was the design of the cast-iron aqueduct at Longdon-on-Tern, pre-dating that at Pontcysyllte, and substantially bigger than the UK's first cast-iron aqueduct.
Telford used a new method of construction consisting of troughs made from cast iron plates. He had to invent new techniques, such as using boiling sugar and lead as a sealant on the iron connections.

17-18. Extending for over 300 m with an altitude of 38 m above the valley floor, the Pontcysyllte Aqueduct consists of nineteen arches, each with a forty-five foot span.
In 1793 the detailed design and construction of the Ellesmere Canal. Telford used a new method of construction consisting of **trough**s made from **cast iron plates and fixed in masonry**. He had to invent new techniques, such as using boiling sugar and lead as a sealant on the iron connections.

22. With the expansion of **cotton industry** in England (Lancashire), the demand for **industrialized production**, so for **mechanized mill** has arisen. Workshops changed to mills, mills changed to factories.
Factories were settled on river banks as the water was necessary to drive the partly mechanized production process. The invention of the steam engine and then the use of electricity as energy source enabled the location of production sites independent of naturally supplied drive propulsion.
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23. Based on the experiences in bridge-building, iron came into use in factory-building. An inner skeleton structure of round cast-iron columns supporting cast-iron beams enclosed by bearing brick walls.

24. Continuing the same principle: Spinning Mill in Salford (near Manchester) 1799-1801, George Lee, Boulton and Watt - **the building type of the multi-storey factory**. The slabs are made of brick vaults instead of wood, (fire protection!) span of the beams: 4,27m. The first industrial building with gas-lighting.
In such warehouse buildings the iron structure was contained within and remained partially supported by an outer load bearing wall. This remained the **most common construction of mills** and warehouses through the **nineteenth century**.

29. Today still a mainline station, was the London terminus of the Great Western Railway. Brunel astonished Britain by proposing to extend the Great Western Railway westward to North America by building **steam-powered iron-hulled ships**. He designed and built three ships that revolutionised naval engineering.
English mechanical and civil engineer, a definitive person of his age, an engineer in many fields. The most determining engineer of the 19th century. His designs revolutionised public transport and modern engineering.

30. The biggest span achievable had been round 40 m in architecture so far. (Pantheon, later the domes of Dom in Florence and S. Pietro in Rome.) This dimension was not altered, exceeded by cast iron constructions either. But here the span of **three-pin frame of trussed arches with a span of 115m**-s!, (48 m high). Even the shape of the frames was astonishing, quite new.
The Galerie des Machines formed a huge glass and metal hall with an area of 115 by 420 metres and a height of 48.324 metres, it was free of internal supports. The framework consisted of twenty trusses. The structure incorporated the **three-pin hinged arch**, developed for bridge building.

31. New building materials and new manufacturing processes characterize the development in second half of the nineteenth century.

37. A typical process: birth of Clydebank near Glasgow.
At the start of the 1870s, however, the **growing trade and industry in Glasgow** resulted in the Clyde Navigation Trustees needing additional space for shipping quays in Glasgow.

Gradually, as **the shipyard grew, so did the cluster of buildings grow nearby**. More houses, a school, a large shed which served as canteen, community hall and church.
In 1882 a railway line was built running from Glasgow out to the new shipyard (the Glasgow, Yoker and Clydebank Railway). This was followed by the Lanarkshire and Dunbartonshire Railway during the 1890s. Then, between 1882 and 1884, the Singer Manufacturing Company built a massive sewing machine factory in Kilbowie, less than half a mile north of the Clyde Bank shipyard. **More people moved into the area**, and finally, in 1886, the local populace petitioned for the creation of a police burgh, on the basis that the area now qualified as a "populous place". The petition was granted, and the new town was named after the shipyard which had given birth to it – Clydebank.

40. Industry's **increasing demand for workers** and the lack of means of transport led to **locating production facilities, factories near existing settlements,** which developed extremely through the influx of population. This development caused **chaotic social and infrastructural conditions**.
The high concentration of industrial settlements and the immigration of workers have led to enormous urban problems. **Need for flats lead to a building-boom** in an amount never seen before. Beginning in the second half of the 19th century urban planning and city building regulations were necessary.
In the **nineteenth century** enterpreneurs focused primarely on providing local services, so **industry was mostly settled in town centres.**
Later larger **industrial operations** were made **on the outskirts of the towns**. They recognized the possibility of later **expansions**.

41. The general headquarters of an American corporation in Europe. It was bombed to ruins in the World War II.
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42. Typical pictures from factories near Glasgow on the Clydebank.
At the beginning of the twentieth century, **the modern factory** was seen as **the perfect functional building**, with improved materials, building technology, and was designed to work with the organisation of the industrial process. The construction may have been the latest reinforced concrete system, or have up-to-date iron beam technology ensuring open spans of up to 4,88m (1900), even lit by the latest carbon arc electric light.

44. A two-storey high **empty glass-covered hall.** The structure: steel trussed pitch roof above the hall, trussed iron columns.

46. The development of infrastructure; traffic, electric lighting, pavement

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53. Louis Sullivan is widely considered **America's first truly modern architect**. **Instead of imitating** historic styles, he created original forms and details. Louis Sullivan believed that the **exterior of a building should reflect its interior structure and its interior functions**.
The bearing construction skeleton appears on the facade and gives the proportion of the facade with glazed fields (typical lying form openings).
Ornament, where it was used, **must be derived from Nature**, instead of from classical architecture of the past. Its beautiful rounded tower at the building's corner entrance features cast iron ornamentation.
The building served as a major retail destination until Carson's closed in 2007. The building is a **steel structure, allowing for wide, horizontal windows providing natural light** and handy spots to showcase merchandise.

55. In the early part of the twentieth century, architects who were starting to react against the superficial historical revivals of this time were **taking note of the potential of new materials, steel and concrete, and construction methods available in industrial building**. The two came together with the partnership between the German firm of AEG and the industrial designer/architect Peter Behrens. Industrialization in Germany was barely thirty years old and the electrical industry spearheaded by AEG (Allgemeine Elektrizitäts-Gesellschaft) was particularly new and full of enthusiastic ideas.

1907 Peter Behrens was commissioned for the **senior engineer of AEG**. He was asked to **design products** for AEG, the packaging, the advertising and the buildings, in short a "corporate image". The result, building was the AEG turbine factory in Berlin (1909), often claimed as the "first modern building".
The Turbine factory is standing on the **turning point from historismus to modern architecture**. Behrens understood **construction as form**. The monumentality of the **gable facade** is very strong, **still** from an engineer's point of view it was **unconsequent**, as the solid butt piers, **heavy gable and cornice have nothing to do with the three-pin frame steel construction behind.**

56. The construction is a consequent **three-pin frame of trussed girders**.
It is a hall with almost **monumental proportions constructed of steel and concrete**, its **sides of glass slope inwards as they rise** which gives it a heavy solid stance on the ground.
Behrens' turbine hall was **the first industrial building reaching a status of wide consideration like representative public buildings.**

57. A young assistant in Behrens office at the time was Walter Gropius. Other notable junior members at this time were Mies van der Rohe and Charles-Edouard Jeanneret later known as "Le Corbusier". They held positions in the **Deutsche Werkbund** who promoted the AEG turbine hall to iconic status and published it in their yearbook of 1913 along with Kahn's "daylight factories" built in reinforced concrete. The publication **argues for a new architecture that reflected the spirit of the age, that of mass production.**
Also involved with the Werkbund was Carl Benscheidt Sr., a client of Fagus, a shoe last company, in Alfeld an der Rhein. They had already had a reinforced "daylight" concrete factory built by the English agricultural engineer Ernest Ransome and had already **started to design the main body of a new factory** with the architect Eduard Werner.
Just after withdrawing from Behrens' office and becoming independent, **Walter Gropius** receives the **commission for the Fagus last factory.**
They asked Gropius in the spring of 1911 to **add modern exterior elevations to promote a progressive image**. The result was that Gropius imbued a **strong delineation to the facade**, marked by an emphatic two-storey brick entrance with its apparently floating staircase.

58. Possibly **the first use of glass in this way**, Gropius emphasised the glazing and apparently **structural innovation of the pier free corners** seemingly throwing away all means of support.
Gropius reacted to the **requirement of being well-lit by providing a glass facade** and dissolving the corners of the building. He used the **possibility of the skeleton structure for developing the building's corner free of columns**. With this he made an **enormous step from the symbolic architectural language** using heavy columns at the corners of the building – like by Behrens' Turbine hall.