# The Nature of Data in Early Modern Architectural Practice.

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# THE NATURE OF DATA IN EARLY MODERN ARCHITECTURAL PRACTICE.

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**Abstract.** In contemporary data-driven society, forces of capital increasingly seek risk-averse decision making through data and digital calculation, aligned to this the discourse around design intelligence in architecture has begun to embrace the role of data and the technical non-human as much as the human. In parallel, the cultural understanding of data, in technologically mediated societies, has become tied to the digital representation of information experienced in everyday life, which in turn influences human practices. A problem exists in the dominance of scientific thought around data in architecture that exerts disciplinary bias towards quantity rather than quality. In contemporary digital practice, data is assumed to offer an objective characterisation of the world and have faithful representation through the mechanisms of the computer. From this shift, a macro question exists concerning the influence of data's conceptualisation on the physical products of architecture. To contribute to this overall question this paper considers the register of data in early modernism identified as a moment when scientific abstraction and the mapping capacity of the machine combine to afford recognisable data practices and infrastructures.

**Keywords.** Data; Design Practice; Infrastructure; History; Theory.

The alignment of human decision making to the insights born from computational pattern recognition in data, labelled "data-ism" (Lohr 2015), increasingly provides a source of trusted information that influence the material world, and organises everyday life (Greenfield 2017). As architecture's expertise lies in the design and realisation of material assemblies towards the spatial organisation of social life, data-ism is a context that influences how the built products of architecture are both conceptualised, produced and experienced. Influenced by software studies that has exposed the inherent political control designed into the internet through software protocols governing "the architecture of the architecture of objects" (Galloway 2004, p. 75) architecture has become increasingly interrogated through a lens of infrastructure. Such a view characterises architectural space as an information technology that facilitates communication through spatial organisation but materialises through planning protocols and organisational standards (Easterling 2014). This focus on architecture as an infrastructure presents the material outcomes of architectural practice as an emergent assemblage governed by immaterial forces in decision making.

This paper contributes to a larger research question regarding the influence of data on the material assemblies produced through architectural design practice. This paper explicitly considers how data has emerged in past architectural practice see understand if it is registerable in the physical products of architecture during this time. The question this paper asks is - what is the nature of data in early modernist practice and is it associated with patterns of material outcomes through its use? The overall hypothesis presented is that data practice is detectable in the early modernist avant-garde and the cultural project of a "new architecture". The research finds that data becomes used in wider practice but is applied as a rhetorical device, and that data is used to compress and transmit the ideas of modernism internationally through the data assemblage of a handbook.

## 1. Lens of Data

In order to progress with the above hypothesis, it is necessary to define data and provide a lens through which it is possible to analyse its emergence in architectural practice, the sub-question, therefore, is what is data?

Rob Kitchin provides a useful starting point – "data are commonly understood to be the raw material produced by abstracting the world into categories, measures and other representational forms - numbers, characters, symbols, images, sounds, electromagnetic waves, bits - that constitute the building blocks from which information and knowledge are created" (Kitchin 2014, p. 2). However, where does data come from? From an epistemological perspective, data is regarded as the detection of "putative fact regarding some difference or lack of uniformity within some context" (Floridi 2017).

However recently it has become regarded by scholars that data does not exist as a raw and presumed fact, data is not a natural occurrence, rather than a given it is a cultural construct as it is a sampled version of reality (Gitelman 2013; Kitchin 2014; Shah 2013). What is more, depending on the informational agent that observes and processes data, data provides a set of affordances determining the space of information possibilities available (Floridi 2017). Therefore, for this research, data is understood as a material through which information is constructed, while also contributing to an environment of human practice that invites or resists certain constructs of information. From an architectural point of view, data is closely tied to the epistemological framework applied to understand reality for design, and registers in the communication and materials employed towards built outcomes.

## 2. Data Between Art and Science

Although data is detectable in the digitised representation of Leon Battista Alberti (Carpo 2011) and in the measurement, analysis and teaching of Jean-Nicolas-Louis Durand (Goudeau 2015), it is not until the 1900s that the idea of measuring and representing difference through data starts to become embedded into the wider architectural culture. This moment is traceable in the shift in pedagogy at the Bauhaus from a "new art of building", to an engagement with industrial mass production and wider "nature research", nature as a proxy for functionalism,

through scientific methods (Siebenbrodt & Schöbe 2009).  Data in the form of measurement and calculation shifts in significance between an architecture of expressive subjectivity, and a desire for scientific objectivity to operate in the new context of industrial production and to contribute to a broader political drive for knowledge and technology (Pommer & Otto 1991).

With Walter Gropius's replacement by Hannes Meyer in 1927, research became embedded into the Bauhaus's curriculum as a basis of design required to accurately determine the need of use and context through an analysis of social and economic questions (Siebenbrodt & Schöbe 2009).  Gropius's "nature research" gave way to Hannes Meyer's more radical scientific functionalism introducing data to objectively describe patterns of difference existing in the context of the project.  Meyer's techno-scientific-rationalism quickly established a design approach based on the perceived superiority of statistical certainty rather than human intuition (Siebenbrodt & Schöbe 2009).  This duality between certainty and human intuition is recognisable in modern-day attitudes towards data-driven design (Deutsch 2015). In addition, the manner with which Meyer employed data in design communication is useful for a contemporary comparison.

To understand the status of data in Hannes Meyer's time at the Bauhaus, (1927 to 1932), requires reference to the work completed by Meyer and his students. Although it is evident from the literature on Meyer about the importance of research in understanding the needs of architecture (Hays 1995), data is also recognisable in his schematic organisation of function through diagrams.  The relationship between data and function is evident in Meyer's San Carlos Academy lecture when he states "for without hygiene or climatology or the science of management he will have no functional diagrams, i.e. no data on which he can elaborate his architectural forms." (Wolfe 2018).  However, when considering Meyer's architectural schemes more closely, data appears more as a rhetorical device to aid his communicative aims (see Figure 1).  Additionally, this application of data is confirmed in Meyer's teaching where the visual display of quantities and scientific techniques of representations indicate a body of knowledge rather than drivers of architectural form (see Figure 2).  Instead, data appears to culturally appropriate the legitimacy of science onto the proposition and suitability of the architectural scheme.
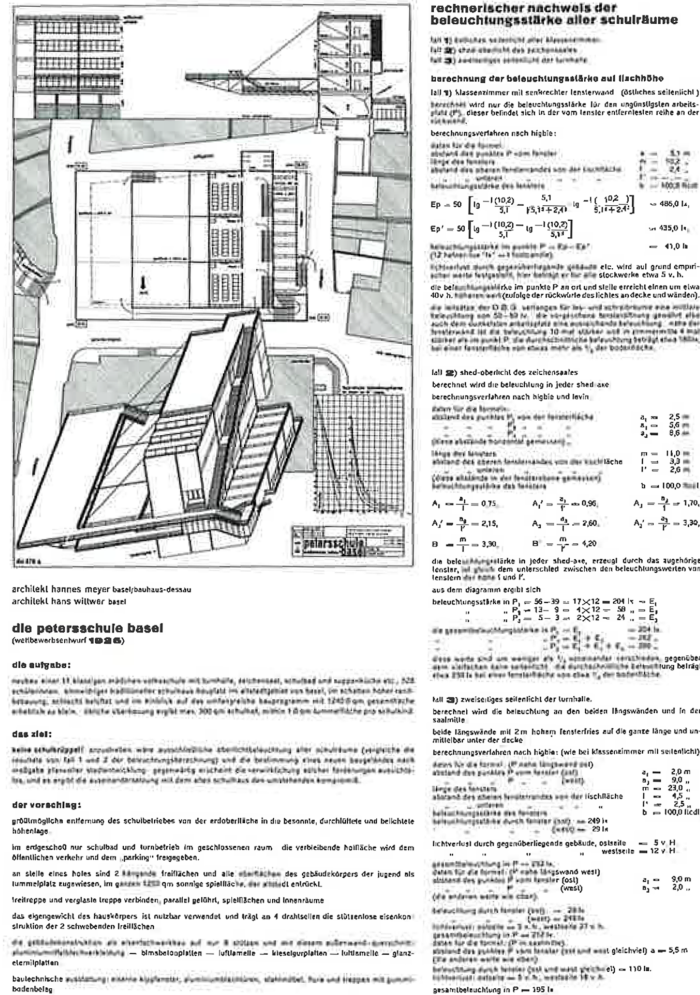
Figure 1. Hannes Meyer - Petersschule project with data related to the schemes lighting system
(Hays 1995).

Through the lens of data as described above, it is possible to locate a shift in data as a concept through the Bauhaus as it sought to reconcile artistic production with industrial mass production. Data shifts from a subjective understanding to an objective and scientifically rational view of the world for design. What emerges from this examination is a nature of data as a source of communicative aesthetic and visual style that appropriates the authority that science held at the time. An understanding of the world through data presumed that the scientific intelligence encapsulated in the method of knowledge generation would enrich architectural ideas; this was particularly the case in the modernist project of a "new architecture".
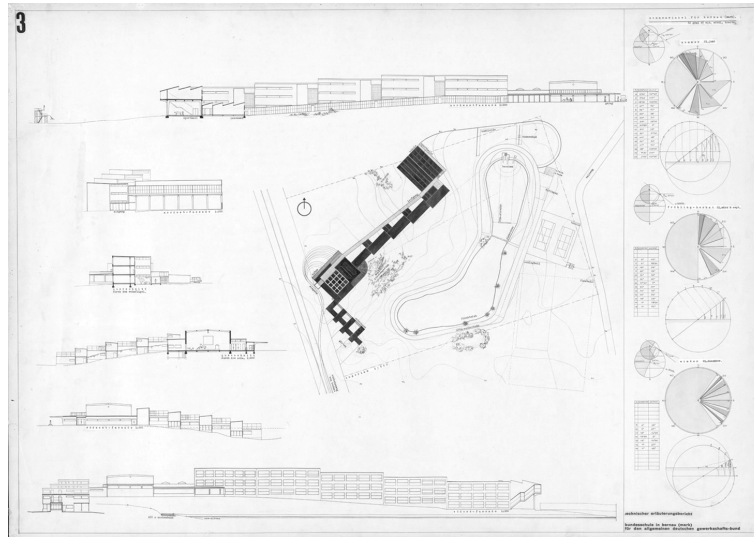
Figure 2. page from a study dossier by Heiner Knaub, from Hannes Meyer's Bauhaus course in 1930.

## 3. A New Architecture

Although the pedagogy of the Bauhaus seemed radical in academic terms, it sat within a broader European architectural avant-garde that argued for a material and spatial response to the social impacts of industrial mass production, through its technology. Within this context, the modernist project of "a new architecture" sought to assign architecture with the responsibility for elevating the quality of life through improved living and working conditions. As the first projects began to materialise in the 1920s, it is possible to identify a concept of data that became a means of cultural transmission, a medium as much as a message, under the guise of design method and supported by the infrastructure of the printing press and publishing logistics.

The Weißenhofsiedlung exhibition organised by the Deutsche Werkbund is readable as a moment that the ideas within a "new architecture" were materialised toward addressing German housing affordability. From an analysis of discourse surrounding the project, there is little reference to data in design, however, the use of data is present in the visual kitchen planning guidelines issued to all participants by Ludwig Mies van der Rohe.

As part of the project brief, Mies had shared Margarete Schutte-Lihotzky's research and design proposal for the "Frankfurt Kitchen". The Frankfurt Kitchen design absorbed the principles of Christine Frederick's scientific management of the house into a design for the "optimal" kitchen, centred on efficient energy usage in household activity (Kirsch 2013). Lihotzky's drawings communicated the kitchen layout through measurement and a set of guiding proportions and proximities (see Figure 3), distilling organisation of the room through an overlayed

set of governing data and rules. The Frankfurt and Stuttgart kitchens are detectable in many of the schemes as a repeatable spatial and material arrangement (Lupton & Miller 1996). Therefore communication of material arrangement through a set of given measurements, and encapsulated within the idea of an objectively optimal design outcome, operates as a mode of cultural transmission whereby ideas propagate through the visual overlay of data rather than a discourse or material experience.

A more extensive application of data as cultural infrastructure exists in Neufert's Bauentwurfslehre (Building Design) book published in 1936. What was later translated into English and renamed "Architects data handbook", represents a larger scale mobilisation of data and visual language found initially in the Frankfurt kitchen. The combination of the organising capability of a book, and Neufert's abstraction of architecture into data described spatial arrangements, compressed an architecture suitable for international publishing (see Figure 4). However, it is Neufert's design method, termed "Schnellentwerfen" (rapid design), that ties together data and management into a mode of synthesis (Vossoughian 2014). Neufert's rapid design, a response to the increased speed in industrial production and the parallel pressure on the architect's time and energy, introduced the idea of data as a material in design combinable at the architect's decision but dictated by functional demands. The book provided a mechanism through which to "work" the data material through design routines based on architectural types. Neufert's book provides a moment when data meets an environment for design contained within the rapid design theory and the organisational capacity of the book.
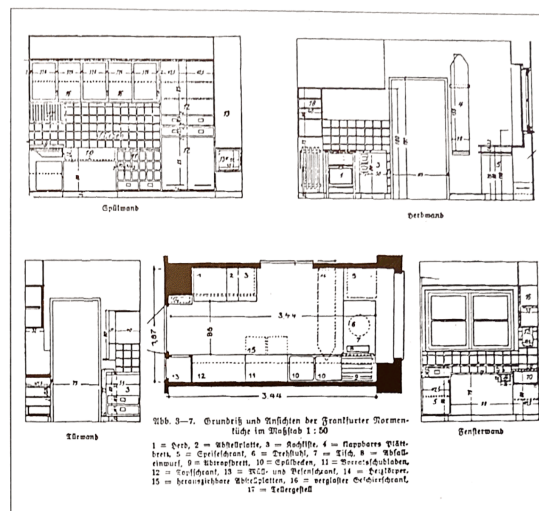


Figure 3. design drawings of the Frankfurt Kitchen, Margarete Schutte-Lihotzky (Kirsch 2013).
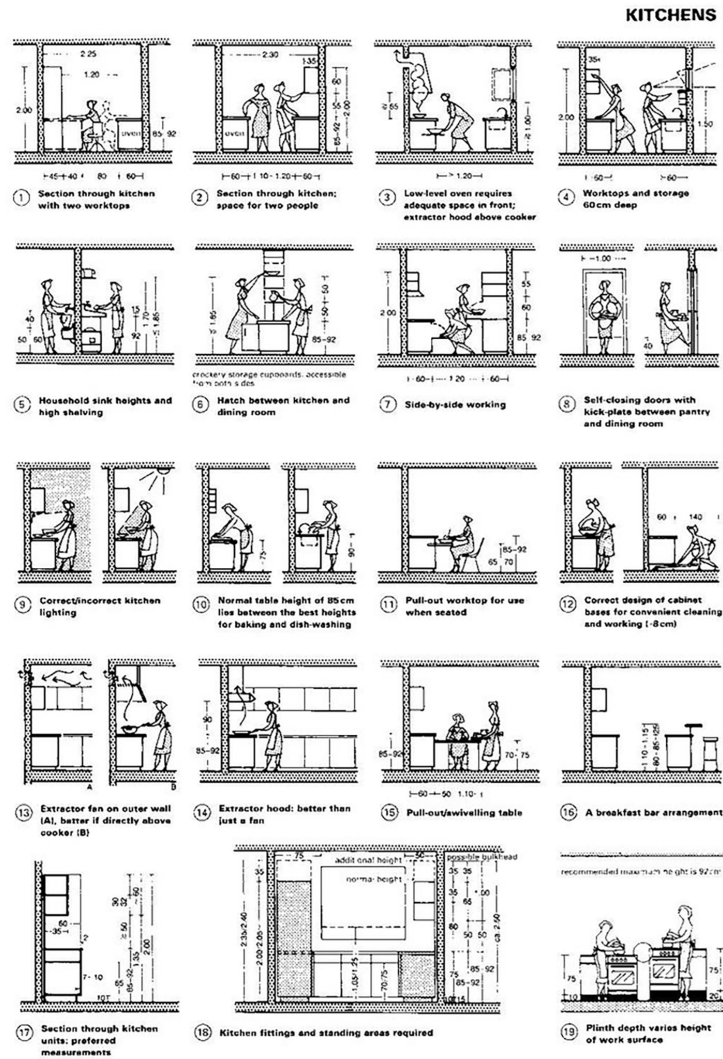
KITCHENS

Figure 4. Ernst Neufert – Architects Data Handbook – English Edition (Neufert 1970).

Although Neufert's book initially focused on Germany, there were similar efforts such as Charles Ramsey and Harold Sleeper's Architectural Graphic Standards in the United States, and subsequent English translations. Both books have been shown to operate as instruments within their respective state-driven industrial standards projects that were used to stimulate industrial and military production in the interwar period (Vossoughian 2014). Data and its organisation through a book, set within the broader project of standardisation, condensed and centralised intelligence into a system for architectural communication and design

justification. Neufert's book provided architects with a centralised and static assemblage of data, that facilitated a process of intelligence towards rapid form making. The data handbook promoted a materialisation of ideas through functional use to avoid the stylistic formalisms criticised in modernism (Banham 1960). However, given that the international style would be one of modernism's distinct legacies shows how an architecture communicated and justified through data, set within industrial standardisation and paired with a material infrastructure and method of design synthesis, produced architectural products that tended towards a specific aesthetic and spatial organisation.

A consideration of the modernist project of "a new architecture" shows how data's rhetorical utility, became transferable via physical infrastructures of representation, namely a housing exhibition, and a handbook. In the Weißenhofsiedlung, it is possible to detect the reliance of data as a set of "ideal" and "optimal" conditions accepted into a design as a given. Most important here is the spreading of the Frankfurt Kitchen across the project, easily expressed and absorbed into the housing designs due to its data description. Finally, Neufert's Handbook provides an example of how data became mobilised, providing a routinised approach to design through the organisational capacity of the book. This combination provides an example where data operates as a material but restricts possibilities as the book provides an environment for design. Data, as a result, is characterised as an immaterial infrastructure that influenced action through the ideas and routines held within the way the handbook presented and processed data.

## 4. Conclusion

This paper has argued that in order to critically consider architectures capacity to operate in increasingly data-driven contexts it is beneficial to understand data's historical conceptualisation and absorption into design practice. By examining early modernism through the lens of data as infrastructure, it is possible to trace an attitude towards data and detect an effect on the physical outcomes of architectural production. From the research the following key points arise;

The main findings in this paper relate to the increased use of data in early modernism to apply scientific objectivity to design decision justification and the use of science's cultural legitimacy to bolster the avant-garde's push for a "new architecture". The key point made is that the discourse around data in education and then practice is identifiable in the transition from artistic to scientific modes of knowing as a basis for design. The contrasting data practices in the Bauhaus, either side of 1923, show how data moved from a personal understanding and artistic response to an objective scientific measurement. This shift from subjective art to objective science enabled architecture to engage with mechanised industry as a new mode of production and means of material expression. Despite the detectable shift to data aligned design decisions it is possible to point to examples where data operates more as a rhetorical device than a driver of design. This rhetorical use is recognised in the modern movements wish to materialise their ideas, requiring an aesthetic for political and cultural engagement. Scientific representation, therefore, acts to contribute to knowledge and technology for a discipline without the traditional techniques to do so.

Within the framework of data as a rhetorical device, the connection of scientifically based architectural planning with efficiency and optimisation provides a moment where data begins to operate as a means of transmission in architectural ideas, using the authority of science to influence culture. The Frankfurt and Stuttgart kitchens within the Weißenhofsiedlung project offers a repetitive material precursor to Neufert's Bauentwurfslehre that helped propagate the homogenising effects of international modernism.   However, it is not possible to claim that data within Neufert's book had a causal relationship to internationalism as both industrial production and industrial standardisation also contributed, but the description of objectively optimal functional spatial arrangements presented architecture in alignment to the repetitive and homogenising capacity of mass production.  Neufert's book and approach to rapid design represent how design intelligence could emerge through a design synthesis of data as a building block, routinised by categories of function and architectural type.

This paper contributes to a macro question regarding data's influence on the material products of architecture.  Four trends have emerged that require closer interrogation to understand data's material influence in more depth.  Firstly the uncritical use and acceptance of data in design that can serve as a rhetorical device through the cultural conditioning of scientific epistemology. Secondly the infrastructural influence of data bound to material formats used in practice which is applicable to the use of software and file formats in contemporary computational design. Lastly there is a need to further understand the deterministic influence of data choice and availability on the material organisation of architecture.

This paper has aimed to introduce a historical lens to data use in architecture to better comprehend data in contemporary architecture, however, in doing so it must acknowledge its limitations. The research restricted archival sources to those concerned with post-1900 events and focussed on a predominantly German context of early modernism, therefore is unable to conclude about data in design practice before this time or across other geographic contexts. Further research taking in earlier periods, and other national and cultural responses would help clarify the relationship between data and the material outcomes of architecture.

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