PROYECTO PROGRESO ARQUITECTURA

ARQUITECTURAS PARA LA INDUSTRIA

31

EDITORIAL UNIVERSIDAD DE SEVILLA
AÑO 2024. ISSN 2171–6897 – ISSNe 2173–1616
DOI http://dx.doi.org/10.12795/ppa

P R O Y E C T O
P R O G R E S O
A R Q U I T E C T U R A

31
ARQUITECTURAS PARA LA INDUSTRIA

EDITORIAL UNIVERSIDAD DE SEVILLA
AÑO 2024. ISSN 2171–6897 ISSNe 2173–1616 DOI: http://dx.doi.org/10.12795/ppa

REVISTA PROYECTO PROGRESO ARQUITECTURA

N31

arquitecturas para la industria

PROYECTO PROGRESO ARQUITECTURA
GI HUM-632 UNIVERSIDAD DE SEVILLA

UNIVERSIDAD DE SEVILLA
us eus
Editorial Universidad de Sevilla

EDITORIAL UNIVERSIDAD DE SEVILLA AÑO 2024. ISSN 2171–6897 ISSNe 2173–1616 DOI: http://dx.doi.org/10.12795/ppa

PROYECTO, PROGRESO, ARQUITECTURA. **N31** NOVIEMBRE 2024 (AÑO XV)

arquitecturas para la industria

EDITA
Editorial Universidad de Sevilla. Sevilla

DIRECCIÓN CORRESPONDENCIA CIENTÍFICA
E.T.S. de Arquitectura. Avda Reina Mercedes, nº 2 41012–Sevilla.
Amadeo Ramos Carranza, Dpto. Proyectos Arquitectónicos.
e–mail: revistappa.direccion@gmail.com

EDICIÓN ON–LINE
Portal informático https://revistascientificas.us.es/index.php/ppa
Portal informático Grupo de Investigación HUM–632
http://www.proyectoprogresoarquitectura.com
Portal informático Editorial Universidad de Sevilla
http://www.editorial.us.es/

DISEÑO PORTADA:
Rosa María Añón Abajas – Amadeo Ramos Carranza
Fotografía: NURMINEN, Teemu, 2012. Kattilahalli. [Fotografía digital en línea] Flickr.com. Disponible en: https://www.flickr.com/photos/51223781@N02/7943524108/in/photostream/

DISEÑO PLANTILLA PORTADA–CONTRAPORTADA
Miguel Ángel de la Cova Morillo–Velarde

DISEÑO PLANTILLA MAQUETACIÓN
Maripi Rodríguez

MAQUETACIÓN
Referencias Cruzadas

CORRECCION ORTOTIPOGRÁFICA
DECULTRURAS

ISSN (ed. impresa): 2171–6897
ISSN–e (ed. electrónica): 2173–1616
DOI: http://dx.doi.org/10.12795/ppa
DEPÓSITO LEGAL: SE–2773–2010
PERIOCIDAD DE LA REVISTA: MAYO Y NOVIEMBRE
IMPRIME: PODIPRINT

GRUPO DE INVESTIGACION HUM–632
PROYECTO, PROGRESO, ARQUITECTURA
http://www.proyectoprogresoarquitectura.com

VII PLAN PROPIO DE INVESTIGACIÓN Y TRANSFERENCIA DE LA UNIVERSIDAD DE SEVILLA.
Ayuda competitiva para revistas, Modalidad B, anualidad 2023.

SERVICIOS DE INFORMACIÓN

CALIDAD EDITORIAL

La Editorial Universidad de Sevilla cumple los criterios establecidos por la Comisión Nacional Evaluadora de la Actividad Investigadora para que lo publicado por el mismo sea reconocido como "de impacto" (Ministerio de Ciencia e Innovación, Resolución 18939 de 11 de noviembre de 2008 de la Presidencia de la CNEAI, Apéndice I, BOE nº 282, de 22.11.08).

La Editorial Universidad de Sevilla forma parte de la U.N.E. (Unión de Editoriales Universitarias Españolas) ajustándose al sistema de control de calidad que garantiza el prestigio e internacionalidad de sus publicaciones.

PUBLICATION QUALITY

The Editorial Universidad de Sevilla fulfils the criteria established by the National Commission for the Evaluation of Research Activity (CNEAI) so that its publications are recognised as "of impact" (Ministry of Science and Innovation, Resolution 18939 of 11 November 2008 on the Presidency of the CNEAI, Appendix I, BOE No 282, of 22.11.08).

The Editorial Universidad de Sevilla operates a quality control system which ensures the prestige and international nature of its publications, and is a member of the U.N.E. (Unión de Editoriales Universitarias Españolas–Union of Spanish University Publishers).

Los contenidos de la revista PROYECTO, PROGRESO, ARQUITECTURA aparecen en:

bases de datos: indexación

SELLO DE CALIDAD EDITORIAL FECYT Nº certificado: 385–2023

WoS. Arts & Humanities Citation Index.
SCOPUS.
AVERY. Avery Index to Architectural Periodicals
REBID. Red Iberoamericana de Innovación y Conocimiento Científico
EBSCO. Fuente Académica Premier
EBSCO. Art Source
DOAJ, Directory of Open Access Journals
PROQUEST (Arts & Humanities, full text)
DIALNET
ISOC (Producida por el CCHS del CSIC)

catalogaciones: criterios de calidad

RESH (Revistas Españolas de Ciencias Sociales y Humanidades).
Catálogos CNEAI (16 criterios de 19). ANECA (18 criterios de 21). LATINDEX (35 criterios sobre 36).
DICE (CCHS del CSIC, ANECA).
MIAR, Matriu d'Informació per a l'Avaluació de Revistes. Campo ARQUITECTURA
CLASIFICACIÓN INTEGRADA DE REVISTAS CIENTÍFICAS (CIRC–CSIC): A
ERIHPLUS
SCIRUS, for Scientific Information.
ULRICH'S WEB, Global Serials Directory.
ACTUALIDAD IBEROAMERICANA.
CWTS Leiden Ranking (Journal indicators)

catálogos on–line bibliotecas notables de arquitectura:

CLIO. Catálogo on–line. Columbia University. New York
HOLLIS. Catálogo on–line. Harvard University. Cambridge. MA
SBD. Sistema Bibliotecario e Documentale. Instituto Universitario di Architettura di Venezia
OPAC. Servizi Bibliotecari di Ateneo. Biblioteca Centrale. Politecnico di Milano
COPAC. Catálogo colectivo (Reino Unido)
SUDOC. Catálogo colectivo (Francia)
ZBD. Catálogo colectivo (Alemania)
REBIUN. Catálogo colectivo (España)
OCLC. WorldCat (Mundial)

EVALUACIÓN EXTERNA POR PARES Y ANÓNIMA.

El Consejo Editorial remitirá el artículo a dos expertos revisores anónimos dentro del campo específico de investigación y crítica de arquitectura, según el modelo doble ciego.

El director de la revista comunicará a los autores el resultado motivado de la evaluación por correo electrónico, en la dirección que éstos hayan utilizado para enviar el artículo. El director comunicará al autor principal el resultado de la revisión (publicación sin cambios; publicación con correcciones menores; publicación con correcciones importantes; no aconsejable para su publicación), así como las observaciones y comentarios de los revisores.

Si el manuscrito ha sido aceptado con modificaciones, los autores deberán reenviar una nueva versión del artículo, atendiendo a las demandas y sugerencias de los evaluadores externos. Los artículos con correcciones importantes serán remitidos al Consejo Asesor para verificar la validez de las modificaciones efectuadas por el autor. Los autores pueden aportar también una carta al Consejo Editorial en la que indicarán el contenido de las modificaciones del artículo. Los artículos con correcciones importantes serán remitidos al Consejo Asesor para verificar la validez de las modificaciones efectuadas por el autor.

DECLARACIÓN ÉTICA SOBRE PUBLICACIÓN Y MALAS PRÁCTICAS

La revista PROYECTO, PROGRESO, ARQUITECTURA (PPA) está comprometida con la comunidad académica en garantizar la ética y calidad de los artículos publicados. Nuestra revista tiene como referencia el Código de Conducta y Buenas Prácticas que, para editores de revistas científicas, define el COMITÉ DE ÉTICA DE PUBLICACIONES (COPE).

Así nuestra revista garantiza la adecuada respuesta a las necesidades de los lectores y autores, asegurando la calidad de lo publicado, protegiendo y respetando el contenido de los artículos y la integridad de los mismo. El Consejo Editorial se compromete a publicar las correcciones, aclaraciones, retracciones y disculpas cuando sea preciso.

En cumplimiento de estas buenas prácticas, la revista PPA tiene publicado el sistema de arbitraje que sigue para la selección de artículos así como los criterios de evaluación que deben aplicar los evaluadores externos –anónimos y por pares, ajenos al Consejo Editorial–. La revista PPA mantiene actualizados estos criterios, basados exclusivamente en la relevancia científica del artículo, originalidad, claridad y pertinencia del trabajo presentado.

Nuestra revista garantiza en todo momento la condifencialidad del proceso de evaluación: el anonimato de los evaluadores y de los autores; el contenido evaluado; los informes razonados emitidos por los evaluadores y cualquier otra comunicación emitida por los consejos Editorial, Asesor y Científico si así procediese.

Igualmente quedan afectados de la máxima confidencialidad las posibles aclaraciones, reclamaciones o quejas que un autor desee remitir a los comités de la revista o a los evaluadores del artículo.

La revista PROYECTO, PROGRESO, ARQUITECTURA (PPA) declara su compromiso por el respeto e integridad de los trabajos ya publicados. Por esta razón, el plagio está estrictamente prohibido y los textos que se identifiquen como plagio o su contenido sea fraudulento, serán eliminados o no publicados por la revista PPA. La revista actuará en estos casos con la mayor celeridad posible. Al aceptar los términos y acuerdos expresados por nuestra revista, los autores han de garantizar que el artículo y los materiales asociados a él son originales o no infringen derechos de autor. También los autores tienen que justificar que, en caso de una autoría compartida, hubo un consenso pleno de todos los autores afectados y que no ha sido presentado ni publicado con anterioridad en otro medio de difusión.

EXTERNAL ANONYMOUS PEER REVIEW.

Editorial Board will be sent to two anonymous experts, within the specific field of architectural investigation and critique, for a double blind review.

The Director of the journal will communicate the result of the reviewers' evaluations to the authors by electronic mail, to the address used to send the article. The Director will communicate the result of the review (publication without changes; publication with minor corrections; publication with significant corrections; its publication is not advisable), as well as the observations and comments of the reviewers, to the main author.

If the manuscript has been accepted with modifications, the authors will have to resubmit a new version of the article, addressing the requirements and suggestions of the external reviewers. The articles with corrections will be sent to Advisory Board for verification of the validity of the modifications made by the author. The authors can also send a letter to the Editorial Board, in which they will indicate the content of the modifications of the article.

ETHICS STATEMENT ON PUBLICATION AND BAD PRACTICES

PROYECTO, PROGRESO ARQUITECTURA (PPA) makes a commitment to the academic community by ensuring the ethics and quality of its published articles. As a benchmark, our journal uses the Code of Conduct and Good Practices which, for scientific journals, is defined for editors by the PUBLICATION ETHICS COMMITTEE (COPE).

Our journal thereby guarantees an appropriate response to the needs of readers and authors, ensuring the quality of the published work, protecting and respecting the content and integrity of the articles. The Editorial Board will publish corrections, clarifications, retractions and apologies when necessary.

In compliance with these best practices, PPA has published the arbitration system that is followed for the selection of articles as well as the evaluation criteria to be applied by the anonymous, external peer–reviewers. PPA keeps these criteria current, based solely on the scientific importance, the originality, clarity and relevance of the presented article.

Our journal guarantees the confidentiality of the evaluation process at all times: the anonymity of the reviewers and authors; the reviewed content; the reasoned report issued by the reviewers and any other communication issued by the editorial, advisory and scientific boards as required.

Equally, the strictest confidentiality applies to possible clarifications, claims or complaints that an author may wish to refer to the journal's committees or the article reviewers.

PROYECTO, PROGRESO ARQUITECTURA (PPA) declares its commitment to the respect and integrity of work already published. For this reason, plagiarism is strictly prohibited and texts that are identified as being plagiarized, or having fraudulent content, will be eliminated or not published in PPA. The journal will act as quickly as possible in such cases. In accepting the terms and conditions expressed by our journal, authors must guarantee that the article and the materials associated with it are original and do not infringe copyright. The authors will also have to warrant that, in the case of joint authorship, there has been full consensus of all authors concerned and that the article has not been submitted to, or previously published in, any other media.

PROYECTO, PROGRESO, ARQUITECTURA. **N31**, NOVIEMBRE 2024 (AÑO XV)

arquitecturas para la industria

índice

TEXTOS EN INGLÉS EN LA EDICIÓN ON–LINE. https://revistascientificas.us.es/index.php/ppa

LA FÁBRICA CLAUDE ET DUVAL DE LE CORBUSIER EN SAINT-DIÉ. UNA MÁQUINA PARA HUMANIZAR

LE CORBUSIER'S CLAUDE ET DUVAL FACTORY IN SAINT-DIÉ. A MACHINE TO HUMANISE

Patricia de Diego Ruiz (0000-0003-0974-0016)

P. DE DIEGO RUIZ. "La fábrica Claude et Duval de Le Corbusier en Saint-Dié. Una máquina para humanizar". Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171-6897 / ISSNe 2173-1616 – RECEIVED 15-10-2024 / ACCEPTED 18-11-2024

p.13 INTRODUCTION

Volume 5 of the *Complete Works* edited by William Boesinger begins with the work of the Saint-Dié factory, presented in a way that induces a series of relationships that have not been sufficiently studied. A floor plan and a perspective of Le Corbusier's 1945 Plan for the reconstruction of part of the city destroyed in World War II graphically introduce the reader to a large-scale urban approach in which to frame the factory project. The text reinforces this approach, highlighting this small factory as the only "*pure flame*"[1] that remains from that effort to conceive a possible evolution in modern terms for the devastated French city. This factory is therefore linked to the Plan's industrial area located on the southern bank of the Le Meurthe River (Figure 1).

LE CORBUSIER'S THINKING IN THE INDUSTRIAL FIELD

Le Corbusier's main theoretical ideas on industrial architecture and urbanism are embodied in the project of "La
p.14 Usine Verte", built for the Ministry of Armament in the town of Moutiers-Rozeille, and in the theoretical approach of the self-sufficient morphological structure called "*the industrial linear city*". Both were synthesised in the book L*es trois établissements humains*[2] (The Three Human Establishments) published in 1943.

The "*industrial linear city*" was in the countryside, organised along four parallel bands: the roads for the circulation of goods; the secluded area for factories; the highway; and the residential space and facilities forming the modern industrial settlements. The territorial layout was based on an architectural materialisation developed by Le Corbusier
p.15 years earlier for the armaments minister Raoul Daforty as a possible prototype for an industrial building (Figure 2). The 3,500-employee military cartridge factory Aubusson was definitively shut down in the foundation phase in June 1940, when France was defeated in the war, but Le Corbusier presents it as "t*he pretext for proposals that could lead to important reforms in the way of building industrial establishments and in the art of providing work with favourable conditions both for technical exploitation and for the physical and moral well-being of the workers and staff*"[3].

The analysis of this proposal leads us to interpret that the principles of Taylorist and linear Fordist specialisation of the American industrial environment have an architectural translation consequently reflected in the division of the production process in several halls, according to the materials they transform, and in the linear sense of a single direction that, as a work chain, establishes the productive path that interrelates them. An additional level of 'scientific' division applied to the agents operating in the factory explains why Le Corbusier proposes a segregation of material and pedestrian flows both in plan and in height. The ground level is reserved for the transportation of goods and products, while the large mass of workers is led with discipline through a network of tubular passages elevated up to the roofs, with stairs leading down to a mezzanine of changing rooms, and then down to the workstation inside the building. The whole complex is thus designed as a complex spatial order through the mechanisation of thae circulations understood as circuits of an effective three-dimensional gear.

A new level of subclassification is applied by establishing different typologies associated with the two major groups of functions to make them clearly distinguishable. The support or auxiliary buildings with a predominance of human use, such as administration, control, canteens, social services or infirmary, adopt parallelepiped shapes with flat roofs. The manufacturing buildings that make up the productive heart and occupy most of the complex are the large "machine rooms", with a traditional configuration of a rectangular building with sawtooth-shaped roofs.

That industrial iconography directly assumed by Le Corbusier of concrete structure, brick panels and repetitive trusses, is altered with the intermittent interruption of its lateral opacity by large windows to give the operator views of the natural environment. Looking out to feel the sun and reconnect with nature, figuratively resting from mechanised work (Figure 3) is therefore the sine qua non condition that the architect defines to achieve the new working conditions that he considers typical of the second mechanised era and the concept of 'green factory'[4], whose main value would
p.16 be "*that work is truly performed in natural conditions. The site, the sun, the landscape perspectives and a number of other sensitive factors are taken into account*"[5].

THE FACTORY IN SAINT-DIÉ. AN EXAMPLE OF INDUSTRIAL ARCHAEOLOGY

The resounding rejection of Saint-Dié's plan by local authorities, neighbourhood associations and victims' associations generated a more complex reality in which the Swiss architect would have to operate to rebuild the Duval family's factory. Bombings and a fire set by the Germans during the occupation caused the partial destruction of several of its industrial units, leaving production inoperative. Le Corbusier initially proposed moving to another more favourable site, but, given the limited damage suffered, the Ministry of Reconstruction indicated that the location of the new factory
p.17 on the same plot was unavoidable if the official compensation was to be used. Economic restrictions and the scarcity of materials forced a two-phase approach. The first of these urged the conditioning of the undamaged parts and the reactivation of the activity with minimal intervention. In this way, a context was generated that was completely removed from the ideal of a *ex novo*, broad and landscaped scenario of the theoretical Corbusierian factory environments,

in order to deal with a casuistry of urban acupuncture operations; under an approach that today we could call of industrial archaeology.

The Claude and Duval hosiery was founded by Paul Duval in 1909 in Saint-Dié, a city that became one of the main nodes of French textile production during the last century. It was built on a privileged site, close to the cathedral, then an important abbey church, and almost in continuation of the main urban axis of the city called Rue Thiers (figure 4). The plot had an irregular shape, bounded on the north by *Côte Callot Street*, from where the discharge of materials took place, and bordered on the south by the Robache stream[6] (Figure 5). The layout of the factory was articulated in simple juxtaposed volumes of masonry walls and metal structure that concatenated gable or sawtoothed roofs with glazed openings to north. The activity of the unit was divided into two distinct stages that could operate individually: the production of fabric bobbins and the manufacture of garments[7].

Le Corbusier, with his studio ATBAT, took charge[8] of the reconstruction, which included an extension. For this p.18 purpose, the Duval family acquired two additional parcels of land to the north and south, located on either side of the remaining buildings. (Figure 5). The urgency to get the factory up and running again as soon as possible meant that the first phase involved the refurbishment of the rear buildings that remained as a joint area for the hosiery and garment workshop, the temporary reconstruction of the small remaining part of the original office block and the construction of a temporary building on one of the acquired plots of land. All this made it possible to recover 30% of production as early as June 1945, and to mitigate, in part, the unusual delay that total reconstruction entailed until 1951.

For the second phase of the reconstruction, it was agreed to design a new linear building to house the entire garment manufacturing activity, and thus, subsequently, re-purpose the pre-existing buildings for the first stage of fabric bobbin manufacturing. The aim was to achieve a doubling of production, and since the garment section alone accounted for about 67% of the personnel and 60% of the space required, concentration in the new building satisfied both parties. The detailed explanation of the inner workings of the two manufacturing cycles together with some general dimensioning data provided by the property in mid-1946, were the starting point on which the ATBAT studio developed an internal organisation scheme of areas[9] and interrelationships between the various production activities involved in the manufacture of clothing, used as the basis for the design.

The linear descending sequence of the two production cycles was maintained, but the aim was to distinguish them in volumetric aspect, thus clarifying the overall organisation and imposing a clear order to the tendency of the manufacturing environments to add small sheds or pavilions in a cumulative manner according to needs. Their attachment to their company's history motivated the Duval family to request ATBAT not to occupy the entire site, in order to preserve its character, and to match the northeast end of the linear block of the blueprints with the corner of the remaining standing portion of the original office building (Figures 5 and 6). Thus, the will to give a certain continuity to the memory is manifested with the raising of the new, precisely on the outline of the old. Le Corbusier adopted this attitude and relocated the new technical rooms in the same place as the bombed-out remains of the basement, after previously refurbishing them.

A NEW ORDER FOR THE 'URBAN' FACTORY p.19

The existence of several sketches shows that the original idea was to design a vertical factory; with previous attempts at a compact square or rectangular block of up to six levels[10], which was finally limited to a linear block of three floors, approximately 80m long by 12.5m wide, with a partial fourth floor for offices and roof (Figure 7).

The proposal represents a radical change in the approach of the functional distribution of the factory by elements p.20 isolated and horizontally connected warehouses that Le Corbusier had been defending, towards a compact structure by stacking along with a sequential descending organisation of activities. In this turn of Corbusier's industrial architecture towards the development of the production chain within a single building and vertically, the Van Nelle tobacco factory of Brinckman and Van der Vlugt, visited by Le Corbusier in the thirties, stands out[11] as a reference. His enthusiastic praise of the modernity and well-being of its workspaces, and the similarities with this manufacture in facets such as the descending factory route, the location of a double-height space facing north and the spiral staircase for internal connection, seem to endorse it[12].

Le Corbusier's recognition of the efficacy of Fordist thinking is evident in his explanation of the genesis of 'The Green Factory': "*The 'chain' describes, in fact, a real system imposed on manufacturing in order to try to divide up all the stages*"[13]. A consistent application is traced in the organisational structuring of the program for Claude and Duval, segregated by floors with different heights according to their functions. The reels manufactured in the first process that are destined for the second garment manufacturing process are housed on the second floor of an intermediate volume, which acts as a link and articulates the transition from the pre-existing sawtooth halls cluster to the new transversal linear block (Figures 5 and 8). From this level, they are transferred through the large freight elevator in the circulation block into the cutting area located in the gallery on the third floor, and descend to the double-height tailor's workshop on the second floor. The sewn parts are then sorted and stored on the second floor, where from the adjoining store area on that level, they are packed and prepared for shipment going down from a small elevator in the first floor to the loading dock for distribution (Figures 8 and 9).

While the circuit of materials and products is carried out by means of mechanical elevators and a chute, now defunct, the transit of people was initially conceived as exclusively pedestrian, in line with the swiss architect's idea p.21 of stimulating physical exercise as a counterpoint to the growing sedentary lifestyle. The Duval family demanded the

P. DE DIEGO RUIZ. "La fábrica Claude et Duval de Le Corbusier en Saint-Dié. Una máquina para humanizar". Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 15-10-2024 / ACCEPTED 18-11-2024

P. DE DIEGO RUIZ, "La fábrica Claude et Duval de Le Corbusier en Saint-Dié. Una máquina para humanizar". Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 15-10-2024 / ACCEPTED 18-11-2024

installation of an elevator for staff and visitors, which was placed juxtaposed to the large freight elevator. The access sequence devised for the workers at the Aubusson factory remains the same in this project, with the progressive parking of their means of transport (bicycles and motorcycles gathered under the first floor of the building), accessing from the entrance to the adjoining changing rooms on the first floor, ascending to the corresponding floor, and after passing through the toilets, taking placement in the workstation. In the Claude et Duval factory, organisation is approached through the precise interweaving of its program where the itinerary "*reproduces the phases of a blood or nervous circuit in the body of an organised being*"[14] (Figure 9).

The next important qualitative leap that this work introduces compared to Le Corbusier's previous factory projects is the alteration of the settlement of the industrial building. The former examples show a firm contact with the ground. p.22 This arrangement seems to be based on the logic of the greater ease of transit of materials that it allows and on the economical transfer of the machines' weight to the ground. However, the moderate size of the machinery needed by the Duval textile factory and the unevenness between the two ends of the plot, allowed the architect to propose an inversion in relation to the ground plane. The factory is now raised on *pilotis* in a modern gesture (Figure 10). The epic of a continuous green plane allowing passage under the buildings in the residential and public use areas envisioned for its modern cities is also transferred to the industrial field in this small factory.

The translation avoids the simple suspension of the block on pillars. The design of the floor contains small complexities in its topography and materiality that delimit parking areas, the movement of workers, vehicular circulation and the access to the janitor's apartment; all by means of variations in the level with reduced podiums, concrete tracks at street level or steps respectively. The sequence of pilotis on the ground floor is not homogeneous nor opened to the landscape on all sides. It is 'contaminated' by powerful planes that descend to the ground built with pink Vosges sandstone recovered from the bombardment of the city. Previously, Le Corbusier had proposed the use of material from demolitions, as in the Murondins Houses of 1940, but Enmanuel Rubio[15] detects in this reuse an 'aesthetic of ruin' born in Le Corbusier that would link with the post-warbound existentialist current. Gargiani and Rossellini[16] abound in the detail of its bonding and compare them to the wall of the *Pavillon Suisse* of the *Cité Universitaire* in Paris. But while maintaining the same materiality and careful bond, the role they play in the configuration of the ground floor space clearly distinguishes them. In the student residence the masonry wall conceals its receding support, giving to it an abstract quality as a canvas, while at the same time, through its curvature, it dynamically conducts the fluidity of movement beneath the building. The two gable walls of the Claude and Duval factory, on the other hand, start clearly from the ground, provide a load-bearing function and anchor the block and the space below it to the ground. They are walls that introduce the traditional construction "*reserved for the symbolic 'masonry diplomatic wall*' "[17] as an alliance with the place.

Le Corbusier also uses them to hide the formal casuistry of the surrounding buildings and lead the eye to the p.23 southern garden next to the Robache; an intention reinforced by the use of a sloping plane under the floor slab of the first floor, that acts as a visual frame (Figure 11). The entrance to the factory configures the third plane that visually constructs the space under the block as an outdoor communal anteroom. In it, Le Corbusier arranges some benches and a clock hanging from the ceiling to control rest time. The presence of the rear sequence of pre-existing warehouses is silenced in this space by the interposition of a wall built with sidewalk tiles also recovered from the bombing. As these are too made of the same pink Vosges stone, a material dialogue with the gables is clearly established. Together with the technical partition that unifies the ducts at the opposite end, this wall frames a large glass panel that reveals, from the space under the *pilotis*, the access hall to the factory with the attendance control. In keeping with the architect's concern for maintaining order and conveying civility in factory environments, the janitor's house operates as an urban façade that colonises the 'free' ground floor to delimit the rear space of the southeast product loading yard; making its potential disorder inaccessible to the gaze of passersby with the interposition of its mass (Figures 8 and 9).

In its desire to provide the workspace with sun and landscape perspectives, the block that houses the p.24 manufacturing cycle for garments is designed with its two longitudinal façades completely glazed. Not surprisingly, reconnection with the surrounding environment, as well as an awareness of the passage of time and the sequence of the solar cycle, were also necessary conditions according to Corbusier's cosmogonic vision. However, by these years the architect had already suffered the scorn[18] of the unmediated use of the *pan-de-verre*, and showed his reluctance to the indiscriminate use of huge expanses of glass and artificial light planes of many american factory buildings, reflecting that "*light from low ceilings or large windows, causes cold or hot temperatures depending on the season*"[19]. Consequently, the brise-soleil was an integral part of the southeast façade to Robache Street from the beginning, and the first trully designed and executed of his career. This 'architectural organ', as Le Corbusier liked to call it, achieved the objective of reaching an adequate light intensity, as constant as possible, and minimised excessive contrasts for the precise work of sewing; while at the same time, it mitigated the direct solar incidence therefore controlling the heat input[20].

In its aim to achieve the best thermal comfort for workers, this building incorporates another of the postulates defended as characteristic of the new mechanised era: the 'exact air machine'. An air conditioning system designed by NEU[21] thermally conditions the factory by supplying hot or cold air, depending on the season, and being the system divided into two groups, different temperatures are provided to various spaces independently. Following hygienic criteria, the air is constantly recirculated with external input[22] and the installation of heat exchangers allows heat recovery, so that the machined air remains renewed and filtered of possible harmful particles, guaranteeing the well-being of workers and minimising its cost. Natural ventilation is also allowed, through the selected opening of windows, and of course, through access to the anteroom under the *pilotis* or to the roof (Figure 12) to feel the climate and the contact with nature. On the roof terrace there are large planters and the rainwater that falls on it is collected through downspouts that cross the entire internal volume of the block and conduct its function of channelling water to the basement level to pour it into the stream that runs hidden.

The achievement of an *organised being*, efficient in its distribution, with a technically healthy environment, with adequate lighting and thermal comfort, and which also allows the vision of *cosmic influenc*es, is not enough to characterise the work environment where this 'period of life that occupies the largest part of it' takes place[23]. Le Corbusier asks rhetorically: "*Is it at all necessary, or even conduipossible, to bring into play, in the hard life of daily work, elements of distraction, if not the introduction into the relentless rigour of modern work, of factors of relaxation or, even* **p.25** *more, to introduce the joy of living by means of precise and premeditated provisions?*"[24].

The search for spatial variety and the intermediation of a plastic richness that qualifies the space and excites the eye, to distance it from the tedium of the mechanised and repetitive task, lead Le Corbusier to create a unique and elaborate configuration of each of the surfaces in this factory. The application of the Modulor to the structure, the brise-soleil and the façade partitions is carried out with three autonomous but synchronised numerical sequences to configure a perceptive symphony[25] (Figure 12). Klinhamer[26] finds in the application of primary and neutral pigments combined on various surfaces of this factory, the use of the same mathematical proportions to generate a 'fourth voice' **p.26** that interacts with the musicality of the other rhythms in perfect harmony. What is beyond doubt is the leading role given to colour in the Claude and Duval factory. To the fixed cadence of the three permanent elements that define the "*game of almost musical subtlety: a counterpoint and a fugue to the rhythm of the 'Modulor'*"[27], is added the variable vibration of the space through its qualification with bright and intense tonalities. Exposed conduits painted in bright shades complement a fragmented colour pattern superimposed on specific areas of walls and ceilings. The worker thus perceives transitions, different patterns and accentuated areas to avoid the monotony of the environment.

Le Corbusier spoke of the emotional role that the existing masonry wall in his studio, equivalent to the gables of this factory, represented for him: "*The stone speaks to us; it communicates with us through the wall. Its surface is rough but smooth to the touch. This wall has become a companion throughout my life*"[28]. The prominence given to these masonry frontispieces as structurally load-bearing elements that monolithically elevate the workshops, evoke with their heroic gesture the phoenix metaphor; the symbolism of the reconstruction of the new factory as a triumph over German barbarism.[29] (Figure 13). Sbriglio has detected an additional symbolic value in the Swiss architect's use of masonry, interpreting the wall of his Paris studio as an expression of the relationship between the architect-artist and the techniques and materials he uses[30]. The decision to expose the materiality of the gable walls and to use the power of their plasticity as backdrops in this longitudinal factory space denotes a distancing of Le Corbusier from **p.27** the aesthetics of the machine after the war. The synthesis expressed by the contrast between the *pan-de-verre* and the masonry wall represents a reconciliation between modern mechanised technology and the material and cultural building tradition.

The double-height space on the second floor of the new block, where the largest number of workers in the assembly line and the factory as a whole are located, acquires a representative and spatial status equivalent to that existing in Corbusier's residential examples. For this project, wood joinery is designed to be manufactured *ex profeso* and in a formal variety, instead of using identical metal windows in repetitive sequence. Thus, the standardised *pan-de-verre* executed for the collective residential blocks of the *Cité Refugé* or the *Pavillon Suisse*, with their smooth and continuous appearance, evolves here into a thick, multi-layered and rhythmically textured envelope. The curtains are additionally installed as a last façade filter that allows individual control of solar incidence. Being of various shades, their random manipulation introduces a dynamism of variable colour that contributes as material animation. With all this, a complex synthesis is articulated in the surfaces that contributes to a new environmental definition of this singular area within the factory. The tailoring space is perceived with a close and homely character, almost like a 'family domestic room' (Figure 14).

The office floor is connected directly with the landscaped roof terrace and with the production by means of a spiral staircase located in a lobby, that acts as a waiting room, where individual and reconfigurable furniture induces the informal and spontaneous use of the area. It receives light indirectly through a curved protuding through which light is forced to slide, causing a relaxing and intimate effect[31] (Figure 15). A domestic quality is also pursued here with the **p.28** placement of large black and white photographic reproductions of Le Corbusier's paintings as *modern tapestries* and through the profuse use of colour and wood in wall coverings that extend into the offices. The careful design of the offices and furnishings[32] adds a touch of quality and fantasy to the usually cold factory environments.

THE DOMESTICATION OF THE FACTORY

In conclusion, the Saint-Dié Plan reflects a turning point in Le Corbusier's industrial urban planning thinking. The 'industrial linear city' of up to 100km, isolated from the city of interchange, gives way to a joint approach of both units coordinated and in a situation of proximity, with the continuous plane of pedestrian transit also extending to the industrial area. Its factory buildings present a new formal characterisation with a flat roof and limited juxtaposed saw-toothed bays, partially advocating the solution adopted for the Claude and Duval factory.

P. DE DIEGO RUIZ. "La fábrica Claude et Duval de Le Corbusier en Saint-Dié. Una máquina para humanizar". Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 15-10-2024 / ACCEPTED 18-11-2024

P. DE DIEGO RUIZ, "La fábrica Claude et Duval de Le Corbusier en Saint-Dié. Una máquina para humanizar". Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 15-10-2024 / ACCEPTED 18-11-2024

If the Marseilles Unité d'Habitation realises the dream of the collective 'living machine', designed repeatedly until a first coherent achievement was get in 1952, the Saint-Dié factory departs from the formal model designed by Le Corbusier in 1940 for Aubusson as the prototype of *La Usine Verte*. A new compact factory archetype is developed to experiment, disruptively, with the linear vertical functional chain in its best adaptation to the urban context. With a reactivation of those 'deep structures'[33] that Curtis explains as latent in Le Corbusier's thinking and susceptible to being accommodated to different functions, the tripartite organism previously applied to housing and institutional building — building on *pilotis*, functional body and terrace-garden — is incorporated for the redefinition of the industrial model and its modern iconography[34]. The environmental notions and the guarantee of a good working environment p.29 of the generic 'green factory' ideal remain and are fundamental parameters in the conception of the renewed hosiery. The building generates greenery in an urban grid by maximising the surrounding space with its setbacks, landscaping the ground plane with the elevation of the volume to generate transparency and incorporate plant elements along the main street, and arranging a suspended garden on the roof with cutout and framing elements from which to view the peripheral landscape.

The effectiveness of the one-way linear organisation of garment production assumed in the project does not imply Le Corbusier's folding to the mere functionality that is usual in industrial architecture, and a renunciation of the exploration of its space as 'plastic fact'. In a continuous experimentation of his *recherche patiente*, in the Claude and Duval factory there is a clear new vocation to coordinate the vastness of the volume of the 'machine room' to the human scale through the dimensional control of the Modulor, and to establish a network of sensory relationships. These sensitive factors are enhanced by glazed façades that allow the solar cycle and distant perspectives to be monitored, as well as by the provision of living areas under the *pilotis* and on the roof as relaxation areas to ensure physical and moral well-being during the working period. Le Corbusier displaces to the world of the factory the use of colour as a spatial activator and the contrast of warm materials, neither synthetic nor industrialised, which distances him from his previous assimilation of factory architecture as a typified object, of repetitive nature and standardised mechanical materiality. In line with the 'dislocation of concepts' from his creative process pointed out by Colquhoun[35], in the Claude and Duval factory we find numerous 'domestic transfers' of elements used in previous residential areas, shared with the *Unité* de Marseille[36] which was executed in parallel, and especially from his apartment in Paris[37]. All of them act as devices that allow the construction of an almost familiar perception of the factory and stimulate a sense of appropriation of its space in the worker.

With this project Le Corbusier inaugurates a period of maturity where dogmatism becomes more flexible and shows its capacity to adapt to the specific climatic, cultural and post-war conditions. The irruption of an ecological proto-consciousness is evidenced in the use of material remains of the bombing and in the re-utilization of the basement; which beyond the consideration of saving, activate the poetic and symbolic reuse of the residue as a connection with the past. In the technical field, water collection and rechannelling, heat recovery in air conditioning, the use of natural light and passive controls reinforce this attitude. Le Corbusier thus transcends the objective of providing a healthy and well-lit environment, constructing a true 'machine to humanise' that aims to transmit the *joy of living* in the work environment, and in a way, domesticates the factory.

This building is a pioneer in industrial refurbishment and recycling strategies, and at the same time, it stands as an outstanding 'living' architectural heritage by surviving in its use as a clothing factory and fashion school[38]; making the p.30 city's textile production memory endure in the face of the generalised processes of deindustrialisation and relocation. The new archetype of the 'vertical factory' may, moreover, contribute to shape the thinking and sensibility of our time, and reveal itself as a convenient strategy for a possible compatible reindustrialisation within the urban environment in the coming era of industrialisation that is already approaching.

1 "*From all the effort at Saint-Dié, there remains but one small pure flame*". In: BOESINGER, W., ed. *Le Corbusier. Oeuvre complète. Volume 5: 1946-52.* Basel: Birkhäuser, 2013, p. 13. ISBN 978-3-7643-5507-4.

2 The book gathers the reflections carried out by the members of the Assembly of Builders for an Architectural Renovation "ASCORAL", which was chaired by Le Corbusier, but which actually synthesised the work developed by eleven work units.

3 "*Elle fut le prétexte de propositions pouvant entraîner d'importantes réformes dans la manière de construire les établissements industriels et dans l'art de doter le travail de condicitions favorables tant à l'exploitation techinique qu'au bien-être physique et moral des ouvries et du personnel*". In: BOESINGER, W., ed. *Le Corbusier. Oeuvre complète. Volume 4: 1938-1946,* Basel: Birkhäuser, 2013, p. 76. ISBN 978-3-7643-5506-7.

4 Le Corbusier freely handles this prevailing concept in the French sphere and adopts it to denominate the new ideal of factory that he proposes for modern times, as a distinction as opposed to the 'black factory' inherited from the First Industrial Revolution.

5 "*... que le travail s'effectue véritablement dans des conditions de nature. Il est tenu compte du siet, du soleil, des perspectives paysagistes et d'une masse de facteurs d'ordre sensible*". In: BOESINGER, W, op. cit. supra, nota 3.

6 The stream would be covered during the development phase of the mill reconstruction project.

7 Manasseh describes the previous operation of the factory, as well as the close relationship between Le Corbusier and Jean-Jacques Duval, son of the founder, who recommended him to design the Saint-Dié Plan and was particularly involved in the work of the factory, influencing the solution.

8 In charge of the task would be André Wogenscky, director of the architecture area within the *Ateliers de Batissement* (ATBAT) studio, who appears in the publication of the project as co-author; assisted by Francis Gardien for most of the site visits, and with technical support from the engineer Vladimir Vodiansky.

9 The layout was linear and one-way. See: MANASSEH, Thierry. *Etude d'une œuvre de Le Corbusier: La manufacture Claude et Duval*. Director: Franz Graf. Máster. Ecole Polytechnique Féderale de Lausannne, Yvan Delemontey Laboratoire des Techniques de Sauvegarde de l'Architecture Moderne, enero de 2014, p. 29. FLC 33630.

10 Ibid., p. 39. FLC 09728 y FLC 09734.

11 The Daily Express Building in London by Sir Owen Williams, inserted in a consolidated urban fabric, and the Fiat Lingotto factory in Turin, with its production cycle also complete but ascending, also visited by the architect and for which he confessed his admiration, could also be an inspiration. See thesis: RAMOS CARRANZA, Amadeo. *Dibujos y arquitectura: La Fiat-Ligotto 1916-1927.* Directores: Juan Luis Trillo de Leyva y Manuel Trillo de Leyva. Doctoral thesis. Universidad de Sevilla, ETSA, Departamento de Proyectos Arquitectónicos, 2005. Available at: https://docomomoiberico.com/tesis/dibujos-y-arquitectura-la-fiat-lingotto-1916-1927/.

12 The Van Nelle was also visited by Wogenscky in 1948 during the reconstruction process, and an appointment was arranged for Jean-Jacques Duval the following year. FLC Q3-13-389-001.

13 CORBUSIER, LE. *El urbanismo de los tres establecimientos urbanos.* Barcelona: Editorial Poseidón, 1981, p. 104. ISBN 9788485083190.

14 Ibid., p. 105.

15 RUBIO, Emmanuel. “Faire tenir debout des murs faits des pierres d’une ruine”. Le Corbusier face à la brutalité de l’histoire. In: SBRIGLIO, Jacques, dir. *Le Corbusier et la question du brutalisme*. Marseille: Parenthèses, 2013, p. 96. ISBN 978-2-86364-284-9.

16 GARGIANI, Roberto; ROSELLINI, Anna. *Le Corbusier, Béton Brut and Ineffable Space, 1940-1965, Surface Materials and Psychophysiology of Vision.* Lausanne; EPFL Press, 2011, p. 108. ISBN 9782940222506.

17 Like the stone party walls of the *Loucheur* houses, they materially characterise and delimit the space underneath them. See: DÍAZ SEGURA, Alfonso; MOCHOLÍ FERRÁNDIZ, Guillermo. Les Maisons Loucheur. “La máquina para habitar” se industrializa. In: *Proyecto, Progreso, Arquitectura* [on line]. Sevilla: Editorial Universidad de Sevilla, 2012, n.º 6, p. 44 [accessed: 30-09-2024]. ISSN-e 2173-1616. DOI: https://doi.org/10.12795/ppa.2012.i6.02.

18 Users of the *Cité de Refuge* and the *Pavillon Suisse* had serious problems with the use of pristine glazed façades to the south, and both buildings now have an overlapping *brise-soleil*. In the difficult reconciliation of the ideal with the pragmatic, the *brise-soleil* solution tried to maintain the modern principle of the conquered glass wall by making it compatible with the orientation and the singularity of the climate, by means of an appropriate environmental reflection.

19 LE CORBUSIER, op. cit. supra, nota 13, p. 102.

20 The *brise-soleil* was defended against the client’s misgivings, adjusted and extremely refined by consulting engineer André Salomon. This awareness of climatic suitability and the use of passive conditioning strategies would increasingly lead much of its future formal architectural conception, especially in India, orienting it to achieve ‘adiabatic atmospheres’. See COVA MORILLO-VELARDE, Miguel. El agua y el caracol. Atmósferas adiabáticas a través de las maquetas de las villas à la mode tropicale de Le Corbusier. En: *Proyecto, Progreso, Arquitectura*. Arquitecturas para tiempos cálidos [on line]. Sevilla: Editorial Universidad de Sevilla, 2021, n.º 26, pp. 48-65 [accessed: 30-09-2024]. ISSN-e 2173-1616. DOI: https://doi.org/10.12795/ppa.2022.i26.03.

21 This commercial firm is the same one that operates in the Marseille Habitation Unit, where there are great similarities in the solutions proposed for both projects and where they share the use of the ‘Vega’ turrets as air conditioning elements.

22 The intake is carried out through a powerful air hose with a naval resemblance located on the first floor and through various intakes located in different parts of the perimeter.

23 LE CORBUSIER, op. cit. supra, nota 13, p. 104.

24 Ibid., p. 95.

25 Ver *El Modulor* o BOESINGER, W, op. cit. supra, nota 1, p. 14 para profundizar en las dimensiones de los mismos.

26 KLINKHAMMER, B. Counterpoints and fugues: Le Corbusier’s idea of colour for the Factory Claude and Duval in St. Dié. In: *WIT Transactions on The Built Environment* [on line]. Southampton: WIT Press, 2005, vol. 83, p. 93 [consulta: 30-09-2024]. ISSN-e 1743-3509. Available at: https://www.witpress.com/elibrary/wit-transactions-on-the-built-environment/83/15294.

27 *“A l’ocassion de la construcción de cette usine, on a pu jouer un jeu d’une subtilité quasi musicale: un contre-point et fugue réglés sur le ‘Modulor’”*. In: BOESINGER, W, op. cit. supra, nota 1, p. 13.

28 *“Stone can speak to us; it speaks to us through the wall. Its covering is rough yet smooth to the touch. This wall has become my lifelong companion”*. In: SBRIGLIO, J. *Immeuble 24 N.C. et Appartement Le Corbusier*. Birkhäuser: Foundation Le Corbusier, 1996, p. 52. ISBN 3-7643-5432-1. Available at: https://dokumen.pub/download/immeuble-24-nc-et-appartement-le-corbusier-apartment-block-24-nc-and-le-corbusiers-home-9783035604122-9783764354329.html.

29 Le Corbusier was deeply impressed when he saw the remains of the bombing of Saint-Dié accumulated in an orderly fashion, reproducing the geometric layout of the city. Ver: *Le plan de reconstruction de Saint-Dié (1945)*. Disponible en: http://usine.duval.free.fr/reconstruction_grandidier.htm.

30 Ibid., p. 52.

31 This space of introspection is the seed and precursor of the solution later adopted by Le Corbusier for the rooms of The Hospital of Venice. See the explorations, progress and 1:1 scale tests of this light and environmental mechanism at DELGADO CÁMARA, Enrique. *La geometría del agua. Mecanismos arquitectónicos de manipulación espacial*. Directores: Alberto Campo Baeza y Rodrigo Pemjean Muñoz. Doctoral thesis. Universidad Politécnica de Madrid, ETSA, Departamento de Proyectos Arquitectónicos, 2015, pp. 372-379. DOI: https://doi.org/10.20868/UPM.thesis.40743.

32 The furniture is by Jean Prouvé, Le Corbusier and Charlote Perriand, the latter designing the *ad hoc* pieces of the main office, which also has a large pivoting partition window that integrates the view and use of the terrace almost in a particular way.

33 Deep structures. En: CURTIS, William J.R. *Le Corbusier. Ideas and Forms*. Nueva York: Phaidon, 2015, p. 426. ISBN 9780714868943.

34 This factory defines a turning point in Le Corbusier’s industrial projects and will influence later examples such as the Electronic Calculation Centre in Rho, Milan.

35 COLQUHOUN, Alan. Desplazamiento de conceptos. In: Le Corbusier. *Arquitectura moderna y cambio histórico*. Barcelona: Gustavo Gili, 1978. ISBN 84-252-1988-4.

36 For example, the rooftop body built with colourful tile mosaic, the air conditioning system, the use of bright colours, and other aspects that were not realised, such as the sculptural chimney.

37 The exposed masonry wall, the carpentry with mullions, colour as a spatial activator, the curved ceilings that allow the light to slide in, the door panels and the use of fabric curtains are elements found in Le Corbusier’s studio dwelling.

38 The Claude and Duval factory is now a clothing factory, albeit a luxury one, and its mixed programme brings it closer to Le Corbusier’s ideal of industry as a place of both ‘production’ and ‘training’. The boost received with its listing by being included in the World Heritage List in July 2016 has also generated a social awareness of its value, turning it into an architectural landmark of Saint-Dié, which represents a timeless value and has expanded its influence resulting in the improvement of the surroundings by the local authorities.

P. DE DIEGO RUIZ. “La fábrica Claude et Duval de Le Corbusier en Saint-Dié. Una máquina para humanizar”. Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 15-10-2024 / ACCEPTED 18-11-2024

USM HALLER: UN PARADIGMA DE SIMBIOSIS ENTRE ARQUITECTURA E INDUSTRIA

USM HALLER: A PARADIGM OF SYMBIOSIS BETWEEN ARCHITECTURE AND INDUSTRY

Angélica Fernández-Morales (0000-0002-5090-2331)
Miguel Sancho-Mir (0000-0003-2903-475X)
Marta Quintilla-Castán (0000-0002-2308-752X)

A. FERNÁNDEZ-MORALES ET AL. "USM Haller: un paradigma de simbiosis entre arquitectura e industria" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 31-03-2024 / ACCEPTED 12-09-2024
 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.02

p.33 INTRODUCTION

The Swiss architect Fritz Haller (Solothurn, 1924 - Berne, 2012) is recognised today for his contribution to the design of industrial buildings and for his collaboration with the industry to develop modular construction systems that can be applied to buildings of diverse uses. His involvement in industrial architecture started in 1961, with the commission for the headquarters of the steel profile manufacturing company USM in Münsingen (Switzerland). Haller designed a modular construction system in steel for that project, tailored to the company's production needs, which ultimately turned into a commercial product in itself (MAXI system). This was followed by two more, conceived for buildings with other uses (MINI and MIDI systems).

The article focuses on the analysis of the USM-Haller systems, with the following aims:

- Understand their origin in a specific historical and architectural context.
- Compile information with regard to the three construction systems to get to know them in detail.
- Identify their singularities in the context of industrial architecture.
- Evaluate, retrospectively, the importance of USM systems in the architect's career, as well as their contribution to subsequent architecture.

To do so, we have consulted mainly sources from the era, such as articles authored by Haller himself in the journal *Bauen+Wohnen*, as well as subsequent articles from other journals, monographic studies and academic publications. 3D models were created for to present the detailed description of the three construction systems, based on which explanatory axonometries have been generated.

BACKGROUND. INDUSTRIAL ARCHITECTURE AND MODULAR CONSTRUCTION SYSTEMS

Industrial architecture underwent a notable transformation in the decades of the 20th century before the creation of USM-Haller systems, driven by several pioneering figures. In the United States, the buildings of Albert Kahn for the automobile and aeronautics industries embodied the Ford principles of pragmatism and adaptability to the production
p.34 process, prioritising the utmost flexibility, to adapt to future requirements of the constantly changing industrial processes. In architectural terms, this was translated into the search for diaphanous horizontal space, the use of light, enveloping exostructures, the section as the defining technological element of the space, and the floor plan layout determined by the structure[1]. In Europe, Walter Gropius renewed the image of industrial architecture in his Fagus Factory, in 1913, with a glazed façade that would go on to become a characteristic feature of this kind of architecture.

The changing needs of industrial processes encouraged the exploration of prefabrication and the use of modular construction systems, and became more widespread in the post-war period, due to the need for fast construction. Germany was the first European country in which architects were actively involved in the development and use of new industrial construction systems[2]. Two prominent driving forces were Walter Gropius and Konrad Wachsmann.

Gropius was fundamental as an advocate of standardisation and prefabrication in architecture, promoting, both from the Bauhaus and the Deutscher Werkbund, the role of architects in the development of industrial products. In the United States, together with Wachsmann, he developed the *Packaged House*, considered a paradigmatic design of the prefabricated home.

For his part, Konrad Wachsmann, who specialised in wood construction and who created several prefabricated systems beginning in the 1920s, and his book *Wendepunkt im Bauen* (1959), were touchstones of construction with industrial components in the post-war period[3]. His designs for the US aeronautic industry laid the foundations for the standardisation of elements and the construction of spatial structures with wide spans. Wachsmann was the leading theorist for Haller, as well as a mentor. After they met in 1959 at a seminar on industrialisation in Lausanne[4], they kept in close contact over the years, exchanging knowledge and theoretical ideas.

In France, as well as Le Corbusier[5], Jean Prouvé is considered the great forerunner of industrialised architecture, with his early examples of prefabricated building in aluminium and steel in the 1930s, such as the flying club in Buc[6], the BLPS detachable house and the *Maison du Peuple* in Clichy. His 1954 aluminium Centenary Pavilion in Paris, with its long, modulated façade, was probably an aesthetic model for Haller in the design of the Münsingen factory (figure1).

FRITZ HALLER AND THE USM COMPANY: AN INNOVATIVE COLLABORATION

After a few years working in Holland, Fritz Haller set up in 1949 as an architect in Solothurn together with his father, Bruno Haller, and was the designer of several school buildings that had an impact on the national and international specialised media. Jürge Joedicke included it in what he called Solothurn Schule (Solothurn School), a scene with a
p.35 clear Miesian influence[7]. Mies van der Rohe's architecture is based on extreme formal simplicity, the predominant use of steel and glass, and the incorporation of innovative elements based on modular construction and prefabrication.

In 1961, the USM company, founded in Münsingen in 1885, passed into the hands of Paul Schärer, the founder's grandson, who decided to relocate the company's headquarters [8]. Attracted by Haller's buildings[9], he chose him for the design of the new headquarters: a flexible building that was to house the administration offices and production lines, and to be able to adapt in the future to the different manufacturing processes and changes in the industry. Under this premise, Haller designed, in collaboration with Schärer and based on his previous experience with prefabricated elements in school buildings[10], a flexible modular construction system with a steel structure.

In his description of the design for the Münsingen plant one can already identify the desire to conceive a "system" of more universal use:

"*The space had to be created solely from assembly parts, so that subsequent changes or extensions could be made simply and without the need for refurbishment work. Construction elements were sought that were as universal as possible, in order to be able to assemble different industrial buildings from basic units, housing the widest possible variety of uses. This effort to build a universal industrial hall could be the starting point for the industrial production of economical, flexible and fast-to-install building elements for industrial buildings.*

First, the common constructions of the day were examined, and their advantages and disadvantages were analysed. Next, we tried to define guidelines for the planning of manufacturing spaces based on trends in technological development. Different types of house lighting were compared, with measurements in concrete examples. The dimensions required in production were compared with the basic dimensions of the constructions"[11]. p.36

Following Haller's vision, the design of the Münsingen factory was the seed for the creation of the USM-Haller family of commercial building systems: MAXI (1961), MINI (1962) and MIDI (1972) (Figure 2).

The three systems, conceived as open,[12] were based on the same principle of reticular structure of steel profiles, but adapted to different scales, levels of complexity and programmes of use. Each system had elements and assembly systems that allowed the buildings to be adapted, expanded or reduced over time, both in terms of the general volumetry and the interior distribution.

THE "USM HALLER" SYSTEMS IN DETAIL

MAXI steel construction system

The MAXI system (developed from 1961, first used in a construction project in 1963)[13] is used for the construction of single-storey warehouses, with large distances between pillars. It is mainly designed to create industrial plants for any type of production, in which it is required to be able to make extensions or future additions. The system consists of a load-bearing structure, exterior façade and roof (figures 3 and 4).

The load-bearing structure is distributed in a reticular manner in plan, with spans of 9.6, 14.4 or 19.2 metres, and can function as a unidirectional or bidirectional structure. In the first case, it supports loads of up to 300 kg/m2 and, in the second, 350 kg/m2[14]. Within this modulation, the structure can be freely expanded. The pillars, made up of four L-shaped profiles joined by plates, have a floor plan dimension of 45 × 45 centimetres, and a variable height, always a multiple of 0.6 metres. The lattice beams, made of welded steel profiles, have a total depth of 1.2 metres. The composite shape of the pillars facilitates the meeting between them and the trusses, which are fitted between the two L's and supported by profiles welded to the pillars (Figure 5).

The façade is resolved with vertical T-profiles, between which removable pieces of 2.40 ×1.20 m are inserted, p.37 made either of glass or opaque insulating plates, as well as doors or other elements. Although the modulation in height is 1.2 meters, it is also possible to insert half-height bands (0.6 metres).

The roof consists of self-supporting reinforced aerated concrete slabs, 4.80 m long.[15] For natural lighting, p.38 2.40-metre-wide skylights are provided on the ceiling, with glass that darkens when the sun shines and remains transparent on cloudy days, ensuring optimal light output.[16]

MINI steel construction system

The MINI system (developed from1962, first used in a construction project in 1965)[17] allows the construction of one or two-storey buildings, with spans of up to 8.4 metres, such as single-family homes [18], workshops, school pavilions, laboratories, commercial establishments, exhibition halls, etc.

The system consists of a load-bearing structure with intermediate slabs, and an exterior envelope (figures 6 and 7). The structure, consisting of columns and beams made of cold-formed sheet metal profiles, allows unlimited horizontal extensions. For the joints between columns and beams, special triangular stiffening profiles are added

Marta Quintilla-Castán (0000-0002-2308-752X) "USM Haller: un paradigma de simbiosis entre arquitectura e industria" Proyecto, Progreso, Arquitectura. Noviembre 2024, E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 31-03-2024 / ACCEPTED 12-09-2024

Marta Quintilla-Castán (0000-0002-2308-752X) "USM Haller: un paradigma de simbiosis entre arquitectura e industria" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 31-03-2024 / ACCEPTED 12-09-2024

(Figure 8). As in the previous case, the external envelope allows, within the modular division, the quick replacement of windows, doors or other elements when required.

MIDI steel construction system

The MIDI system (developed from 1972, first used in a construction project in 1980)[19] it is designed for the construction of multi-storey buildings with a strong presence of facilities, such as schools, administrative buildings, laboratories or hospitals[20].

Its development, later than the other two systems, is based on the integration of all the components of the building as a systematic and geometrically coherent whole, including, in particular, the spatial arrangement of pipes and other p.41 installations, coordinated under a facility planning scheme. The ARMILLA installation model, developed by Haller in a research project at the University of Karlsruhe[21], is fully integrated into the overall MIDI system.

The load-bearing structure has a reticular distribution in plan with more variable spans, respecting a minimum module of 2.4 meters and reaching 16.80 meters [22]. It works as a unidirectional structure of gantries, which can alternate their direction. The pillars are circular steel tubes, also of variable height, always a multiple of 0.6 meters. The double trusses are 1.2 metres deep (Figure 9). The meeting between the two is made by means of a square frame or capital, welded to the pillar, to which the trusses are screwed by means of structural bolts (Figure 10)[23].

Common philosophy of the MAXI – MIDI – MINI systems

The USM-Haller family of construction systems is designed from the perspective of operability and interoperability. Although each of the subsystems tries to provide solutions to different architectural spaces, the common philosophy is p.42 totipotency[24]: to enable the widest possible spectrum of functions, over and above the typical determination of specific elements. The three systems complement each other and can be easily combined. To do this, they use a common module of 1.20 metres, both in plan and height (Figure 11).

On the other hand, in all three systems, design decisions can be seen that go beyond geometric and structural optimisation, even at the cost of an increase in the number of supports or the amount of material. For example, the aim is to unify the dimensions of the beams, even in different load situations. In the MINI and MIDI systems, the beams are designed in two pieces to be able to maintain the same construction criteria at special points, such as the edges, and their openings allow the integration of the technical installations in them.

USM Haller modular furnishing line

To the three architectural systems treated, we must add a fourth, intended for furniture, which is, in fact, the most popular and iconic of them all. It was created in 1963 with the approach of "*transferring the idea of modularity of the construction system of the factory from the macro-to the micro-space of furniture*"[25]. It is based on a three-dimensional grid of metal tubes, connected by a small sphere, and panels that make up walls and shelves.

The ball joint, a chrome-plated brass dial with a diameter of 25 mm, is the central element of the entire system. Six threaded holes allow the system's tubes, with a diameter of 19 mm, to be connected in the three dimensions of the space and in both directions, creating an orthogonal system with a variable modulus. The tubes, with lengths ranging from 100 to 750 mm, and the ball joints, are always visible from the outside, as a continuous line (Figure 12)[26].

The extreme flexibility of their configurations, together with their material robustness and the intact continuity of p.44 their design over the decades, gives these pieces of furniture great durability.

APPLICATION IN INDUSTRIAL ARCHITECTURE

Although they are designed for application in different types of buildings, it was in industrial architecture that Haller systems most clearly demonstrated their effectiveness and versatility[27]. The possibility of adapting to future changes and expansions evidenced a lucid vision of the needs of industrial architecture, while expressing a modern aesthetic consistent with this function.

The USM headquarters in Münsingen was the true test laboratory for the MAXI, MIDI and MINI systems. All three systems were used in some of the buildings and pavilions that are still part of the complex (Figure 13), and at the same time, a large part of the components were produced in the factory itself. The complex is currently considered heritage, as it is included in the inventory of cultural property of national and regional importance of Switzerland (KGS), in category A of national interest[28].

The main building, built in 1961 with the MAXI system, with a single height above ground of 6 metres, and a distance between supports of 14.40 metres, offers the flexibility required for the various manufacturing processes, as Haller and Schärer had carefully studied based on the needs of the company itself and the analysis of other industrial p.45 buildings[29]. The office pavilion, built in 1965 with the MINI system, is also an open-plan space with one floor above ground, which follows the open office model[30].

The constant modernisation of machines and changes in production processes led to a series of expansions over the decades, always using the USM-Haller steel construction system. Since 1998, the extensions were no longer planned or carried out by Haller, but by the company's architects, which is indicative of the true standardization and universality of the system.

Following the experience of the Münsingen construction site, both the MAXI and MINI systems and the modular furniture system became commercial products. Soon, other companies commissioned Haller to implement it in their new buildings. The flexibility of the system allowed variations to be made to the original design to adapt to the specific needs of the companies, generating buildings with spatial characteristics different from those of the Münsingen factory (Figure 14).

FROM A MODULAR CONSTRUCTION SYSTEM TO A THEORETICAL MODEL OF ARCHITECTURE AND THE CITY

Haller's systemic approach had its manifestation beyond professional practice, moving from his modular designs to his facet as a teacher, researcher and theorist.

As mentioned above, Haller's theoretical activity was closely linked to the ideas of Konrad Wachsmann[31]. In 1966, after five years of intense performance with industrial buildings, the then director of the Construction Research Institute of the University of Southern California, invited the Swiss architect as a visiting professor. There, Haller conducted research on mathematical-geometric models applicable to architecture; specifically, "*on the properties of salient points in regular geometric systems*"[32]. Its objective was to study "*the fundamental problems that every designer of complex modular systems constantly and repeatedly faces: the geometric coordination of the system components, the formation* **p.47**
of their connections, the safety of tolerances and the control of forces in the static system"[33].

In the research, Haller worked with cubes composed of equal cells connected by nodes. With the help of models, he established different relationships, analogies and geometric conditions for each node, depending on its location within the cube, and came to look for a universal mathematical description for these nodes that would be applicable to all systems.

Haller also explored the urban scale, although always with a purely theoretical approach. His utopian urban system, first published in 1968[34], it was based on the geometric organisation of post-industrial city space at various scales, from basic units to clusters of 61 million people, which were expanded in a second version in 1975[35] to a "total city" of more than a billion inhabitants. In them, different communication systems and adaptations were considered according to social, climatic and economic conditions. Transport infrastructures and technologies, based on rigorous prior studies of existing or developing technical systems, played an important role in the model.

In the *totale stadt* geometric order is more important than quantification or dimensioning. The model focuses on the "coordinated geometry" of the construction elements, the "knots" where the functions are located, and the "movements and flows" that occur in these systems.

At the time, the project was not widely recognised by the architectural community, it was even branded as totalitarian for its excessive rigidity and rationalisation[36]. However, in retrospect, its coherence within the architect's track record has been recognised and it is often mentioned as a part of the history of urban planning in Switzerland.

FRITZ HALLER'S ARCHITECTURAL LEGACY AND THE USM-HALLER SYSTEM

The USM-Haller system was one of the first Swiss prefabricated systems designed for industrial buildings. The earliest modular systems developed in the country, existing since the 1940s (Durisol, NILBO) were designed for single-family homes or small buildings[37]. In 1955, the first system designed for large spans was born, the Isler system, a closed system in a concrete structure[38]. It is followed chronologically by the MAXI system, with completely different characteristics: in a metal structure, adaptable to multiple reticular compositions in plan, and conceived as an open system, easily combinable with its own and non-system elements.

The contribution of the USM-Haller family of systems is not so much its early appearance as its level of versatility, flexibility, and interoperability, offering solutions to both the specific needs of the industry and other uses, and representing, as has been described, "*what is perhaps the paradigmatic example of systems integration architecture in Europe*"[39]. To do this, Haller worked from a systemic perspective, where the important thing "*is not so much the form generated as its morphogenesis*"[40].

With this focus, defined as structural[41] or mathematical[42], one recognises the philosophy of Konrad Wachsmann, **p.48**
which we can also find, for example, in Max Bill[43]. Some characteristics of the USM systems are present in the exposition pavilions of Expo 64, designed by the Zurich-based architect. The elaborate designs of the knots of its metal structure are reminiscent of both those of Wachsmann and the USM-Haller systems (figure 15).

The changes that occurred in subsequent decades - postmodernism, questioning of the technological paradigm, and a growing formal pluralism - did not facilitate the transmission of Haller's ideas, based on a vision of technical progress and the search for universal solutions. However, in Switzerland, from the 1980s onwards and unlike other countries, there was a trend towards reduction and minimalism[44], who found in Haller's buildings, and the Solothurn school in general, the appeal of minimalist architecture in steel and glass inspired by Mies van der Rohe, meticulous in details, finishes and modular proportions. A trend, developed mainly in the German-speaking part of the country, which was described as *Swissbox* or "Swiss essentialism".

However, Haller's influence is clearest among followers of industrialised architecture and the integration of prefabricated systems. A corroborated influence [45] in this vein are some buildings by Norman Foster, through the

Marta Quintilla-Castán (0000-0002-2308-752X) "USM Haller: un paradigma de simbiosis entre arquitectura e industria" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173-1616 – RECEIVED 31-03-2024 / ACCEPTED 12-09-2024

structural engineer Anthony Hunt, a collaborator of the British architect and an admirer of Haller's work. Team 4's Reliance Controls Electronics factory in Swindon (1965-1966)[46], has been compared to the USM factory built three years earlier[47], just as the Büchli house, designed by Haller with the MINI system, bears similarities to the structure of the Fosters' house in Hampstead.

CONCLUSIONS

Haller's interest in industrialised construction, which has been present since his professional beginnings, is the result of a favourable historical and architectural context, in the 1950s and within the School of Solothurn. A context of transformation and technological optimism, which, in Haller's case, was driven, especially, by his relationship with Konrad Wachsmann, in whom the Swiss architect found support for his work and theoretical support for his ideas.

Faced with the commission for USM's industrial equipment in 1961, with concrete requirements in terms of flexibility and transformation, Fritz Haller was forced to develop a rational and systemic approach as an architect. In the design process of the MAXI system, later complemented by the MINI and MIDI systems, Haller made design decisions not only based on geometric or static optimization, but also operational and interoperable, such as maintaining a constant 120 cm module in the three subsystems, the effort to reduce the number of different elements, and the careful design of the joints between pillars and beams.

p.49 Haller repeatedly focused on the question of "singular points," at different scales. In the case of MAXI-MINI-MIDI systems, it is identified, precisely, in the "nodes", joints between beams or between beams and columns; in the case of the iconic office furniture, it is the spherical connecting ball joints that provide a solution to the entire system; In their urban project of the *Totale Stadt*, they are the connection points of the transport systems. His theoretical research in Los Angeles also deals with "salient points" in mathematical terms. In this attention to nodes and salient points, the influence of Wachsmann is clearly identified, in whose spatial structures the points of connection are also a central theme.

Likewise, the desire, common with Wachsmann, to find solutions of general validity in architecture, taking it to the universal, prevails. The creation of a family of modular systems, linked together by means of compatible dimensions, which aim to jointly solve the widest possible spectrum of requirements, rather than independent systems to solve isolated needs, denotes an unusual system vision. Haller systems ultimately structured the architect's entire output over the decades, from the smallest scale to the largest, making each building fit into the overall system as a piece of the jigsaw. To this end, two necessary mechanisms are present: modulation and component standardisation.

From another perspective, USM-Haller systems are a successful example of teamwork and architect-industry collaboration. Although Haller is credited with creating the systems, the architect always recounts the design process using the plural, giving visibility to the collaboration with engineer Paul Schärer and the USM company. Both of them, designer and manufacturer, benefited from each other: for Haller, it was his most important and longest work in time, and defined him professionally as an architect, and later a teacher, specialising in industrialised construction. It also led him to develop a systemic approach and a constant search for universal solutions in all areas of architecture. In turn, for the USM firm, the building of its headquarters in Münsingen became its emblem, not only housing its industrial activity but also becoming a showcase of the products manufactured there. However, Haller's main legacy to the company was, undoubtedly, the design of the line of furniture that bears his name, and which is, sixty years later, its main product and its hallmark.

As well as being a leading figure in Swiss architecture of the 1960s and 1970s, Fritz Haller made an important contribution to industrialised architecture in the second half of the 20th century, in the design, the application and p.50 integration of prefabricated systems, and this has had an impact on the work of renowned architects also beyond the borders of Switzerland, such as Norman Foster and Richard Rogers.

In today's architecture, focused on sustainability and, as part of this, aware of the value of longevity and the importance of reducing waste, the characteristics of Haller's work, sixty years later, are rising values. Standardisation and adaptability facilitate reuse and help to achieve sustainability and waste minimisation objectives in a type of architecture, industrial architecture, which due to its use often undergoes changes over time.

Roles CRediT
Conceptualisation: AFM (50%); MSM (25%); MQC (25%).
Research, methodology and drafting: AFM 33%; MSM 33%; MQC 33%.
Visualisation: AFM (50%); MSM (25%); MQC (25%).

All of the authors declare that there is no conflict of interest with the results of the study.

Funding
GRAPHYC_Grupo de Representación Arquitectónica del Patrimonio Histórico y Contemporáneo (Group for the Architectural Representation of Historical and Contemporary Heritage. Government of Aragon (H32_23R).

Marta Quintilla-Castán (0000-0002-2308-752X) "USM Haller: un paradigma de simbiosis entre arquitectura e industria" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 31-03-2024 / ACCEPTED 12-09-2024

1 PANCORBO, Luis; MARTÍN, Inés. Architecture as technical object. Industrial architecture of Albert Kahn. In: *VLC arquitectura* [online]. Valencia: Polytechnic University of Valencia, 2014, vol. 1, no. 2, pp. 1-3 [retrieved: 30-09-2024]. ISSN-e 2341-2747. DOI: https://doi.org/10.4995/vlc.2014.2333.

2 Although British manufacturers led the world in new industrialised building techniques, architects played a negligible role in them. (HERBERT, Gilbert. *The Dream of the Factory-Made House*. Cambridge: MIT Press, 1984, pp. 29-30)

3 GRASER, Jürg Martin. *Die Schule von Solothurn: Der Beitrag von Alfons Barth, Hans Zaugg, Max Schlup, Franz Füeg und Fritz Haller zur Schweizer Architektur der zweiten Hälfte des 20. Jahrhunderts*. Doctoral thesis. Zurich: ETHZ, 2008, p. 60. Available at: https://www.research-collection.ethz.ch/handle/20.500.11850/150915.

4 Ibid, p. 267.

5 On Le Corbusier's prefabricated construction projects, see: DÍAZ SEGURA, Alfonso; MOCHOLÍ FERRÁNDIZ, Guillermo. Les Maisons Loucheur. La máquina para habitar se industrializa. In: *Proyecto, Progreso, Arquitectura* [online]. Seville: Editorial Universidad de Sevilla, 2012, no. 6, pp. 34-49 [retrieved: 30-09-2024]. ISSN 2173-1616. DOI: https://doi.org/10.12795/ppa.2012.i6.02.

6 For a detailed description of the construction system at the flying club in Buc, see: ARRIBAS BLANCO, Ruth. Jean Prouvé & Konrad Wachsmann. Dos formas de utilizar la maqueta como herramienta de proyecto. *Proyecto, Progreso, Arquitectura* [online]. Seville: Editorial Universidad de Sevilla, 2016, no. 15, pp. 56–69. [retrieved: 30-09-2024]. ISSN 2173-1616. DOI: https://doi.org/10.12795/ppa.2016.i15.04.

7 JOEDICKE, Jürgen. *Moderne Architektur: Strömungen und Tendenzen*. Stuttgart: Krämer, 1969, p. 104.

8 USM. *The history of a family business*. Corporate website. Available at: https://www.usm.com/en/office/about-usm/our-history-alt/.

9 SCHÄRER, Paul. Erlebnisse und Errungenschaften beim Aufbau der neuen USM. In: STALDER, Laurent; VRACHLIOTIS, Georg, eds. *Fritz Haller. Architekt und Forscher*. Zurich: GTA Verlag, 2016, p. 205. ISBN 978-3-85676-334-3.

10 The construction system of the cantonal school of Baden, designed by Haller in 1958 and built in 1962-1964, is considered the predecessor of the USM system (ICOMOS Suisse. *System & Serie. Systembau in der Schweiz – Geschichte und Erhaltung*. Zürich: GTA Verlag, 2022, p. 167. Available at: https://www.system-serie.ch/).

11 HALLER, Fritz. Allgemeine Lösungen in der Bautechnik. *Bauen + Wohnen* [online]. Zurich: Organ des Bundes Schweizer Architekten, 1962, no. 16, dossier 11: Planen und rationelles Bauen, p. 473 [retrieved: 30-09-2024]. Available at: https://www.e-periodica.ch/digbib/view?pid=buw-001%3A1962%3A16%3A%3A1404#1405.

12 Open systems are considered to be those that allow construction in combination with components of other construction systems, or with their own subsystems (for example, for facades or installations), due to their standardised dimensions, construction method or connections. Moreover, open systems are not necessarily tied to one manufacturer (ICOMOS Suisse, op. cit. supra, note 10, p. 181).

13 WICHMANN, Hans. *System Design: Fritz Haller Bauten – Möbel - Forschung*. Basle: Birkhäuser, 1989, p. 70. ISBN 978-3-7643-2325-7.

14 Ibid., p. 72.

15 HALLER, Fritz, op. cit. supra, note 11, p. 473.

16 Ibid.

17 WICHMANN, Hans, op. cit. supra, note 13, p. 138.

18 The best-known building constructed with the MINI system is the "Büchli house", private residence of the owner of the firm USM, Päul Schärer, built in 1968-1969 and currently listed as a building of heritage value.

19 WICHMANN, Hans, op. cit. supra, note 13, p. 102.

20 The most important commission built with the MIDI system is the training centre of the SBB (the Swiss state-owned rail company) in Loewenberg (1980-1983). The complex includes a training building, an engine room, a school building, canteen and two residential complexes.

21 From 1977, Haller was a professor with tenure in the University of Karlsruhe, and director of the Institute of Industrial Building Production, which until 1990 was called the Institute of Building Design (DRACH, Angelika; HOVESTADT, Ludger. Intelligente CAD-Systeme : Instrumente für die Planung und Verwaltung komplexer Gebäude. In: *Werk, Bauen + Wohnen* [online. Zurich: Organ des Bundes Schweizer Architekten, 1992, no. 79, dosssier 10: Fritz Haller, pp. 16-24) [retrieved: 30-09-2024]. Available at: https://www.e-periodica.ch/digbib/view?pid=wbw-004%3A1992%3A79%3A%3A883.

22 STADLER, Laurent; VRACHLIOTIS, Georg, op. cit. supra, note 9, p. 292.

23 Ibid.

24 SABATTO, Steeve. Zur Frage von Massstab und Ökonomie. Totipotenz und Automation bei Konrad Wachsmann und Fritz Haller. En: STALDER, Laurent; VRACHLIOTIS, Georg, op. cit. supra, nota 9, p. 140.

25 SCHÄRER, Paul, op. cit. supra, nota 9, p. 207

26 KLEMP, Klaus. *The USM Haller Furniture System. Design Classics Series*. Frankfurt: Verlag Form, 2002, p. 17. ISBN 9783931317430.

27 The MAXI system, the most widely used of the three, was employed almost exclusively for production sheds, with the exception of a single-family house. The MINI system was mainly used for office buildings linked to production plants, and for single-family homes. The MIDI system had a minor application, with a total of five works carried out, including several buildings for residential, administrative and educational use. The complete inventory of all projects, both executed and not executed, which included one of the three Haller systems, is included in: ICOMOS Suisse, op. cit. supra, note 10, pp. 167-169.

28 FEDERAL ADMINISTRATION OF SWITZERLAND. *Protection of cultural property inventory with objects of national importance (Federal Office for Civil Protection FOCP)*. Geographic Information Platform of the Swiss Confederation. Available at: https://api3.geo.admin.ch/rest/services/ech/MapServer/ch.babs.kulturgueter/9038/extendedHtmlPopup?lang=en.

29 HALLER, Fritz. Fabrikhalle in Münsingen = Halle de fabrication à Münsingen = Factory shed at Münsingen. In: *Bauen + Wohnen* [online]. Zurich: Organ des Bundes Schweizer Architekten, 1964, no. 18, dossier 10, p. 394 [retrieved: 30-09-2024]. Available at: https://www.e-periodica.ch/digbib/view?pid=buw-001%3A1964%3A18%3A%3A1290#1290.

30 Bürohaus Schärer›s Söhne, Münsingen = Immeuble des bureaux, Schärer et fils, Münsingen = Office building, Schärer›s & sons, Münsingen. in: *Bauen + Wohnen* [online]. Zúrich: Organ des Bundes Schweizer Architekten, 1965, no. 19, dossier 8, p. 323 [retrieved: 30-09-2024]. Available at: https://www.e-periodica.ch/digbib/view?pid=buw-001%3A1965%3A19%3A%3A1077#1077.

31 GRASER, Jürg Martin, op. cit. supra, note 3, p. 267.

32 HALLER, Fritz. Von Eigenschaften ausgezeichneter Punkte in regulären geometrischen Systemen. In: *Bauen + Wohnen* [online]. Zurich: Organ des Bundes Schweizer Architekten, 1967, no. 21, dossier 11: Bauforschung, pp. 425-438 [retrieved: 30-09-2024]. Available at: https://www.e-periodica.ch/digbib/view?pid=buw-001%3A1967%3A21%3A%3A1390#1390.

33 HALLER, Fritz. *Bauen und Forschen. Dokumentation der Ausstellung*. Solothurn: Kunstmuseum, 1988, no page (3.3.0)

34 HALLER, Fritz. *totale stadt. ein model*. Olten: Walter Verlag, 1968.

35 HALLER, Fritz. *totale stadt. ein globales model. zweite studie.* Olten: Walter Verlag, 1975.

36 STADLER, Laurent; VRACHLIOTIS, Georg, op. cit. supra, note 9, p. 299.

Marta Quintilla-Castán (0000-0002-2308-752X) "USM Haller: un paradigma de simbiosis entre arquitectura e industria" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 31-03-2024 / ACCEPTED 12-09-2024

Marta Quintilla-Castán (0000-0002-2308-752X) "USM Haller: un paradigma de simbiosis entre arquitectura e industria" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173-1616 – RECEIVED 31-03-2024 / ACCEPTED 12-09-2024
Con licencia CC BY-NC-SA 4.0 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.02

37 ICOMOS Suisse, op. cit. supra, note 10, p. 40-43; 103-107.

38 Designed by the engineer Heinz Isler, it consisted of concrete structures with a square base, with a cupular "shell"-type roofs. It was a closed system and was marketed and sold as an end product (ICOMOS Suisse, op. cit. supra, note 10, p. 81-83).

39 SOLÉ BRAVO, Carlos. *La casa de Norman y Wendy Foster en Hampstead. Tecnología y domesticidad entre los años 1960 y 1980*. Doctoral thesis. UPM, 2017, p. 153. Available at: https://oa.upm.es/45408/1/CARLOS_SOLE_BRAVO.pdf.

40 SABATTO, Steeve, op. cit. supra, note 24, p. 143.

41 MEDINA WARMBURG, Joaquín; LEOPOLD, Cornelie. *Strukturelle Architektur: Zur Aktualität eines Denkens zwischen Technik und Ästhetik*. Bielefeld: Transcript Verlag, 2012. ISBN 978-3-8376-1817-4.

42 FREI, Hans. Freiheit im Korsett. Die mathematische Denkweise in der Architektur von Fritz Haller. In: STADLER, Laurent; VRACHLIOTIS, Georg, op. cit. supra, note 9, pp. 124-139.

43 Wachsman was a teacher in the school of Ulm between 1954 and 1957, specialising in industrial architecture and teamwork, hence Max Bill's relationship with the German architect was a close one.

44 HIMMELREICH, Jørg. Alles bleibt anders? Beobachtungen zu zwei Jahrzehnten Schweizer Architektur. In: ANGÉLIL, Marc; HIMMELREICH, Jørg, eds. *Architekturdialoge : Positionen, Konzepte, Visionen*. Salenstein: Niggli, 2011, p. 120. ISBN 978-3-7212-0801-6.

45 Carlos Solé's doctoral thesis on the work of Norman Foster refers to "the influence that the work of the Swiss architect and industrial designer Fritz Haller exerted on the integration of systems in the "well-served building", through the structural engineer Anthony Hunt." (SOLÉ BRAVO, Carlos, op. cit. supra, note 39, p. 152.

46 A team of architects of which Norman Foster and Richard Rogers were members, which broke up in 1967.

47 SOLÉ BRAVO, Carlos, op. cit. supra, note 39, p. 369.

Marta Quintilla-Castán (0000-0002-2308-752X) "USM Haller: un paradigma de simbiosis entre arquitectura e industria" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 31-03-2024 / ACCEPTED 12-09-2024
 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.02

Alfonso Díaz Segura (0000-0002-1424-3068) "Arquitectura industrial en las publicaciones de posguerra de los Estados Unidos de América" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 14-03-2024 / ACCEPTED 04-11-2024
Con licencia CC BY-NC-SA 4.0 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.03

ARQUITECTURA INDUSTRIAL EN LAS PUBLICACIONES DE POSGUERRA DE LOS ESTADOS UNIDOS DE AMÉRICA

INDUSTRIAL ARCHITECTURE IN POST-WAR PUBLICATIONS IN THE UNITED STATES OF AMERICA

Ricardo Manuel Merí de la Maza (0000-0002-6462-8847)
Bartolomé Serra Soriano (0000-0003-3491-5615)
Alfonso Díaz Segura (0000-0002-1424-3068)

p.53 FORGOTTEN ARCHITECTURES: POST-WAR AMERICAN PUBLICATIONS

Over the last century, architectural journals have been a fundamental source of information and dissemination of the international architectural panorama. However, their temporal and idiosyncratic nature means that the works published can be forgotten as quickly as they were published. On the other hand, industrial architecture has now been reduced to a testimonial presence in architectural magazines.

This was not always the case. In the United States of America after the Second World War, industrial architecture had a considerable specific weight in architectural journals, in accordance with the reality of professional practice and the demands of a society aware of the importance of industrial development. Architectural publications, affected by the mobilization of their contributors and wartime rationing, resumed their activity with greater intensity at the end of the conflict. The Second World War and the intensification of industry facilitated the transformation of magazines into architectural handbooks[1].

Evidence of the social importance of industrial architecture in those years can be found in the MoMA exhibition Built in USA: Post-War Architecture catalogue, in which four of the 43 works selected were of an industrial nature. The selection was made by a committee of independent experts supervised by Henry-Russell Hitchcock, according to the "*quality and significance of the* moment"[2] method. In his preface, Hitchcock notes: "*Industrial work remains on a high level comparatively and yet, as always, individual factories of particular distinction are hard to find*"[3]. A comment
p.54 he would endorse a few years later: "*It is hard to single out particular factories for mention, if only because their design, whether it is by engineers or by specialist architectural firms like Albert Kahn, Inc., has arrived at a largely anonymous standardization - the fate, incidentally, towards which some critics see all twentieth-century architecture as inevitably moving*"[4]. It is noteworthy that, of the four industrial works referenced, two are buildings by Mies and Wright, the *Boiler plant* at IIT and the research tower for the Johnson Wax Co. Another example is Saarinen's *General Motors Technical Center*, which Hitchcock himself described as "*more comparable in scale and complexity to a university city than to a factory*"[5]. The last example, Frank L. Whitney's *Bluebonnet Plant* for processing corn products, is the only genuinely industrial one.

The most important historiographies of modern architecture have tended to forget the existence of these works of architecture. In the compilations by Frampton, Colquhom, Curtis, Benevolo or Zevi, the industrial architecture of the period is not present[6]. An exception is J. Buschard and A. Bush-Brown's controversial book on the social and cultural influence of American architecture, which devotes fragments to industrial architecture, its influence and the firms that developed it, but gives an incomplete picture[7]. Therefore, to recover a specific vision of what these architectures contributed and what can still be useful today, the periodicals of the time are an indispensable source of information.

To have as complete an overview as possible, we have gone through and compiled nearly 200 articles related to American industrial architecture during the ten years after the Second World War, from 1945 to 1954. There was a peak of publications in 1951 with a certain delay in the execution of the works. Subsequently, we have focused on the first five years, limiting the research to the post-war transition period that facilitated the subsequent expansion (Figure 1).

The journals selected for analysis and compilation are *The Architectural Forum*, *Architectural Record*, *Progressive Architecture*, *AIA Journal*, *Arts & Architecture*, *Interiors* and *American Builder.* The selection was made based on their importance and circulation at the time, as well as the existence of databases containing digitized copies. The first three are the most relevant, as they include the most significant number of articles and examples related to industrial architecture. In others, their presence is testimonial, if not non-existent, but they provide relevant data on the profession's state and construction during the post-war period (figure 2).

THE HISTORICAL, SOCIAL, ECONOMIC AND PROFESSIONAL CONTEXT

The end of the Second World War came much sooner than American society expected. The United States was unprepared to transform the war economy and resume economic activities immediately, and it took six months to "*get over the* shock *of* peace"[8]. Many graduate architects returned to their jobs or took up new activities independently. At the end of the conflict, the deficit of buildings was significant, and the delay imposed by the war allowed a generational change in the industry that facilitated the acceptance of a new architecture[9].

p.55 In January 1945, *American Builder* published an article by Herman Byer on the volume of construction in 1944 and 1945. It includes a table on public and private construction by sector over the previous 30 years, showing that the total construction volume almost doubled in the early war years and fell to just over a third afterwards. The initial increase was achieved at the expense of private construction, which was reduced to figures similar to those of the Great Depression years, thanks exclusively to public investment in military, shipbuilding and industrial construction. Byer explains that "*a large number of companies want to expand or remodel their factories as soon as possible in preparation for the turnaround, and other companies have specific plans for expansion*"[10]. Some industrial plants dedicated to war production were sold to private firms immediately after the war, under the condition that they would remain available in case of emergency. And the growth of the domestic market allowed many corporations to convert and utilize their expanded factories during the conflict[11].

The most pressing problem for the construction industry in 1946 was the bottleneck of the lack of materials on **p.57**
the market, which led to a considerable increase in construction times[12] . This problem was essentially caused by mismatches in the distribution of raw materials and by the maximum price regulations set by the OPA[13] . Despite this, although "*the familiar sound of the riveter was still missing from city streets, the rasp of the carpenter's saw was loud in the suburbs. Outlying plots were turning over almost as fast as they had in the twenties*"[14].

The big question in 1946 was which buildings were considered essential to prioritize in the use of materials. The *Wyatt program*[15] strongly emphasized low-cost housing for veterans, and there was also a consensus to include schools and hospitals among the primary needs[16]. Although almost all types of housing were now permitted, some construction still had restrictions. The overall situation led to a further escalation of prices, with general post-war inflation particularly pronounced in construction.

Meanwhile, in 1946, the automobile industry was gearing up for unstoppable expansion, and applications for industrial building permits were coming in at a rate of almost 150 per day. The CPA[17] in Detroit approved $12 million in its first weeks of existence, as many of the materials planned for plant expansions were already in the manufacturing process and could not be reused. In late 1946, President Truman began lifting some of the construction restrictions. Some measures would remain in place as an after-effect of wartime controls, especially on steel stocks, which inevitably meant some government control over all industrial production[18].

That was also the year of *Republic Steel*'s announcement that "*the century-old dream of steel makers had become a reality*"[19]: steel could be melted in a continuous one-step process. Consequently, steel processing plants could be built at significantly lower cost and in a decentralized manner. The decision of the U.S. Supreme Court to prohibit the price-fixing system established for the steel, cement and other materials industries gave the final push to industrial development. This was coupled with the recommendation of the *National Security Resources Board* that a geographic distribution of industrial power was vital to national security[20]. The policy of strategic relocation of industry during the war would continue into the following decade, favouring private industrial expansion in many parts of the country.

Industrial construction in the post-war years began to decelerate slightly until 1949. A graph published by *The* **p.58**
Architectural Forum in July 1949[21] shows the drop from 5% to 2.5% of total non-residential construction by sector. The numbers are confirmed by the end of 1949 with a forecast of a 25% drop in the industrial building sector by 1950[22]; although this may also partly reflect the immense growth of private residential construction in those years.

In 1949, the president of the *Dodge Corporation* gave a very clear and concise overview of the three phases of post-war recovery[23]:

- Phase 1. Shortages and hoarding (from *V-day* to August 1948): Reconversion of industry; expansion and modernization of factories; shortages and inflation; order delivery problems; creation of many new enterprises.
- Phase 2. Market adjustment (September 1948 to 1949): adjustment of demand, supplies and prices; industry expansion programmes cut back or postponed; construction costs stabilized; brief period of deflation and recession.
- Phase 3. Economic expansion (1950s onwards): new products and new industries; rapid expansion of private industries; new equipment and higher standards; new building and engineering infrastructure.

The early 1950s brought a huge economic expansion and a period of optimism, slightly conditioned by the enormous doubts generated by the threat of the atomic bomb, which also affected industrial architecture.

LARGE FIRMS AND THE REPERCUSSIONS OF WAR FACILITIES

In the early post-war years, there were still no new industrial buildings to be shown, only projects under development. On the other hand, it was already possible to publicize the advances in wartime industrial architecture of the previous years without wartime censorship. These constructions were carried out by several large professional firms with an innovative methodology that was interesting to show to the rest of the profession. Prominent among them were *The Austin Company* and *Albert Kahn Associates*[24], which extended their predominant position over the following years.

The Architectural Forum devoted part of its January and February 1945 issues to an article on *The Austin Company* describing the modern wartime industrial organizations carried out with the '*Austin Method*' following their slogan of '*undivided responsibility*'. The article also presents their material and technical research programme and how they prepared for the post-war period. It also highlights the rupture between professional boundaries since the war:

"Although the professional standards of the American Institute of Architects still forbid participation in construction work, more and more large architectural firms now subscribe to the idea that some relaxation of this rule to permit more direct control over the building process might be advantageous to both architect and client. Especially since the war, former distinctions between purely architectural and purely engineering services have broken down almost entirely"[25].

The essential developments can be summarized as follows: speed and economy through standardization of the **p.59**
structural system; application of rigid frame principles to concrete and timber structures to save on steel; prestressed slabs and beams in reinforced concrete to save time and labour; glulam arches for long spans; beams for 300 ft spans; double insulated exterior walls with acoustic block inside; insulated acoustic ceilings; *breathing walls* to save

Alfonso Díaz Segura (0000-0002-1424-3068) "Arquitectura industrial en las publicaciones de posguerra de los Estados Unidos de América" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 14-03-2024 / ACCEPTED 04-11-2024

on air conditioning; new, more efficient industrial lighting systems using new fluorescent lamps; windowless buildings with innovations in heating and ventilation; study of flow diagrams and three-dimensional functional layout; study of human flows in addition to production flows (figure 3).

The Austin Company's works were recurrently featured in the three major American architectural magazines: a plant for the *American Paper Goods Company* as a measure of modern efficiency[26]; an industrial plant for the *Boeing Aircraft Company*[27]; the dust and germ control design for the *Winthrop Chemical Co.*[28]; or a new plant for the *Bayer Company*[29].

The other firm with a strong presence in the publications of those years was *Albert Kahn, Associates Architects & Engineers*, first with its war work for the *United Aircraft Corporation*[30] or the *U.S. Navy*[31], and later with various p.60 commissions in peacetime: a clothing factory in Rochester[32] or various projects for Chevrolet[33][34] (figure 4).

In January 1946, *Progressive Architecture* subtitled its cover story "*Since you went away*", seeking to update returning architects. The article by Thomas H. Creighton of the *American Institute of Architects* covered a wide range of issues affecting the profession. Architectural publications had evolved from presenting basic information to detailed materials and construction methods analyses. Regarding industrial architecture, he notes: "*the word 'factory' had come to mean a building which worked well but had no good looks. Several designers, notably* Albert Kahn *organization and* the Austin Company*, had self-consciously tried to remove this stigma*"[35].

In the same year, *The Architectural Forum* published a compilation of the most important buildings built by the U.S. p.61 Navy during the war[36]. The varied typologies featured include hangars, shipyards, warehouses, factories and other industrial buildings, with innovative technical solutions and materials (Figure 5).

DEVELOPMENTS AND TRENDS IN INDUSTRIAL ARCHITECTURE

A. Kahn Associates' presence extended to other types of articles on current industrial trends and needs, such as "*The Design of Factories Today*". The article is based on the findings of a survey of 23 industrial plants in which the personnel responsible for the various areas were consulted on the suitability of their facilities and the changes they might recommend. It begins with a desideratum: "*The last twenty years saw industrial buildings brought into the realm of architecture by clean decency of handling; in the next twenty years perhaps these buildings will come out of their seclusion and seek to share the agreeableness of the rest of life*"[37].

The key issues raised can be summarised as: increased efficiency and pleasant workplaces without the need for artistic embellishment; well-organized, well-lit and fully equipped buildings; location outside the cities taking into account the treatment of the external landscape and possible future extensions; the need for flexible plants both new and adapting existing ones; taking care of the circulation and facilities of employees by studying their actual behaviour (figure 6).

In December 1946, the president of *A. Kahn Associates* wrote about new trends in industrial plant design[38]. The topics covered encompass all the fundamental aspects of design for industry: the impact of personal relationships on building design; new building materials; changes in structural design; the influence of production layout on building design; roofs and enclosures; spacing between supports; heating, ventilation and air conditioning; windowless versus daylight construction; interior painting and use of colour; canteens; sanitary facilities; recreational facilities; outdoor facilities; parking; landscaping; acoustics.

p.63 Other articles in the same issue focused on industrial plants as workplaces; on the design of small industrial plants; on the need for standardization to lower costs; and on rising construction costs and the danger of economizing in the factory execution process at the cost of future efficiency loss.

Another particularly interesting article from that year presents the '*Mobilar structures*'[39] invented by Konrad Wachsmann using tubular structural elements and movable walls. Given the lack of materials, searching for more economical construction methods became essential. The system has two parts: standardized frame elements consisting of steel tubes of constant outer diameter with simple connectors welded at both ends; and movable wall panels that can be detached from the structure or attached to it at will (figure 7).

In August 1947, Roland A. Wank wrote in *Architectural Record* about the opportunities for architects in factory design. These were mainly related to the small industries that comprised most of the American industrial fabric and were an important source of commissions for the small professional firms. It highlighted the dichotomy between the needs of these industries to grow and the difficulties of doing so in their facilities, while simultaneously making it difficult to relocate them. He also commented on the difficulties of renovating facilities given spatial and environmental needs that the old factories found difficult to cope with: "*An observant architect should be able to make a fair guess as to the degree to which plants in his vicinity have been affected by such trends (...) His life-long preoccupation with the reactions of people to their physical surroundings will probably qualify him to make valid remarks on matters of employee relations, working efficiency, effect upon the public*"[40].

The same issue included several recent works of industrial architecture, a study on economic details for steel structures[41] by the *American Institute of Steel Construction for Small Industrial Buildings*, and a summary of a research p.64 project carried out by Harvard students on the construction of industrial buildings under the direction of Professor of Architecture Walter F. Bogner[42] (figure 8).

p.65 In August 1948, *Architectural Record* published the article "*An Enlightened Look at a Factory*"[43] with General Robert Johnson's vision of the ideals of industrial buildings according to his high standards and his conception of industrial

Alfonso Díaz Segura (0000-0002-1424-3068) "Arquitectura industrial en las publicaciones de posguerra de los Estados Unidos de América" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171-6897 / ISSNe 2173-1616 – RECEIVED 14-03-2024 / ACCEPTED 04-11-2024

management. One of his fundamental precepts was that a factory should be small, and if the enterprise is large, production should be divided into smaller units. This stemmed from the principle that workers should be regarded as human beings and not just as production units, just as plant managers were human beings and should spend time with the workers. The place for this encounter is the small factory. According to Johnson, there are six basic principles of industrial management: "*(1) good housekeeping; (2) simplicity and beauty of plant and facilities; (3) human engineering; (4) decentralization; (5) emphasis on youth; (6) cost consciousness*"[44]. These principles explained why the Johnson & Johnson plants differed so much from each other. Subsequently, the article recorded the company's design modus operandi as codified by its director of plant construction, F.N. Manley.

In the same issue, we find another article by Julian Ellsworth Garnsey dedicated to colour as a functional element in industrial buildings[45], which highlights its importance in any building where tasks requiring visual concentration are carried out. Among other topics, the text deals with: simultaneous contrast in visual perception; the memory effect of colour; the influence of cool and warm colours; physiological associations; and aesthetic considerations.

THE NEW INDUSTRIAL BUILDINGS

In August 1947, *The Architectural Forum* published the new forging and tooling factory for H.K. Porter Inc. designed by Walter F. Bogner[46]. The company, in the midst of a boom in war orders, asked the architect to study the cost of expansion compared to a new one. Bogner designed a completely modern plant with an initial cost twice that of an expansion, but he also helped select a new site that reduced operating costs by 10%. After numerous studies, a highly efficient solution integrated the two factories and facilitated future expansions. And in December of the same year, *The Architectural Forum* published a cleaning products factory for the B.T. Babbitt Co. in Chicago's Clearing industrial district[47]. The architect, Henry L. Blatner, convinced the company of the advantages of a single-storey layout with uninterrupted flow of materials and interior loading. In addition, to ensure healthy working conditions, a special dust collection system and heating and lighting systems were installed (figure 9).

The same magazine included in its August 1948 issue an article on new industrial buildings[48]. The first is a carton folding plant designed by The Ballinger Co. together with Walter Gropius, whose fundamental requirement was to facilitate continuous production and the work of supervisors, for which they extended the usual spans to a 50 × 20 feet layout in the manufacturing area. The second building was a warehouse designed to sell sections of heavy steel bars '*over the counter*' - according to its engineers, the only fully mechanized warehouse in the steel industry at the time. And the third building featured is a pharmaceutical plant for Abbot Lab. designed by Harper Richards and H.J. Doran. In this case, the study focused on optimizing operations and reducing costs, for which a two-level solution was arrived at where manufacturing tasks were grouped, taking into account the massive periodic movement of personnel **p.66** and materials between departments (figure 10).

The August 1948 issue of *Progressive Architecture* devoted its architectural criticism section to four examples of industrial buildings with comments by Roland Wank, former chief architect of the *Tennessee Valley Authority*. The introduction to the study elevates the industrial building to the status of the most organic architecture of the time: "*The function may be stated with almost mathematical exactness. Since efficiency is the watchword, the plan may be developed as logically as the designer's ability permits. Because of the need for good working conditions, the architect may call on the latest technical developments to produce the ideal environment for the work at hand. Since gluey architectural sentiment is usually lacking, he is free to work out genuine harmony between form and function*"[49] . The examples included range from a simple paper mill in Maine built entirely of wood, a nylon production plant in precise atmospheric conditions with a gleaming aluminium finish, to an elegant warehouse in Illinois for the *J.A. Roebling Corp.* designed by Skidmore, Owings & Merrill (figure 11).

Progressive Architecture magazine's 1948 architectural awards were announced in the June 1949 issue, and the **p.68** top prize in the non-residential category went to the U.S. Navy Department's Ordnance and Optics Building at the San Francisco Navy Yard. The Jury praised the work of architect Ernest J. Kump and structural engineer Mark Falk as one of the most imaginative and well-designed industrial buildings in the world: "*The concept, the handling of materials, the lighting, have all been perfectly integrated. Because it is so direct an approach, so skilfully carried out, the Jury felt* **p.69** *that it represents definite progress in the humanization of industrial plants*"[50] (figure 12).

Architectural Record devoted a good part of its November 1949 issue to a number of small-scale factories in the United States. The main case study was a refinery in Texas designed by H.K. Ferguson Co. with Frank L. Whitney as the architect in charge[51]. In addition, an article by Eric L. Bird, editor of the *Journal of the Royal Institute of British Architects*, looked at some post-war industrial buildings in England[52] . And the analysis article was written by Kenneth K. Stowell, architect of the firm *Giffels & Vallet, Inc. Eng., L. Rossetti Arch*[53]. **p.70**

LARGE CORPORATE PROJECTS

During the early post-war years, some large-scale projects in the pipeline were also published as novelties, which were to make up many pages in the publications of the 1950s.

The first were reported in the November 1945 issue of *Architectural Record*. The firm of *Giffels & Vallet, Inc. L. Rossetti, Associated Engineers and Architects* designed for the *General Electric Co.* in Syracuse, New York, a new

Alfonso Díaz Segura (0000-0002-1424-3068) "Arquitectura industrial en las publicaciones de posguerra de los Estados Unidos de América" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 14-03-2024 / ACCEPTED 04-11-2024
 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.03

Alfonso Díaz Segura (0000-0002-1424-3068) "Arquitectura industrial en las publicaciones de posguerra de los Estados Unidos de América" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171-6897 / ISSNe 2173-1616 – RECEIVED 14-03-2024 / ACCEPTED 04-11-2024
Con licencia CC BY-NC-SA 4.0 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.03

'*Electronics Park*'[54] destined to become the new electronics capital of the world. It was a complex of factories and research buildings comprising nine buildings in total: Administration, Reception, Laboratory, Radio Reception, Radio Transmission, Specialties, Restaurant, Maintenance and Boilers. Each was to function as a self-contained unit. And in addition to the extensive research facilities, classrooms, auditorium and other educational facilities were foreseen.

The same issue published *Saarinen & Swanson*'s project for the new General Motors Technical Centre in Detroit[55], one of the interventions that received the most media attention. The vast investment envisaged brought together a group of buildings on a 350-acre site to achieve a more rapid exchange of ideas and closer contact between pure science and practical application. In addition to the administration buildings, the complex included research laboratories, advanced engineering, design and process development sections. The buildings were grouped around a large central esplanade with a seven-acre lake that was envisaged as a feeder for the cooling system for the air conditioning (figure 13).

Another important project was the refurbishment and extension of the Heinz factory in Pittsburgh[56], carried out by Gordon Bunshaft as a partner of *SOM.* The Heinz industrial complex consisted of 19 main buildings, the oldest of which was over 50 years old. Faced with production bottlenecks and space saturation, they decided to bring order to the complex through a new master plan. The first of their problems was the major flooding of the Allegheny and Monongahela rivers, which reached the first floor in the last major flood of 1936. SOM's solution was to build the new buildings on piles or with the provision of no major machinery below the level of the last flood. The second problem was the occupation of 60% of the floor space by material stocks, which was to be solved with a new centralized warehouse on three levels for finished products. The third problem was related to parking and accessibility for lorries for loading and unloading, which was solved with new facilities. And the fourth problem was the obsolete buildings, seven of which were demolished to make room for a new large vinegar factory, the new company headquarters, and the new research and quality control building (figure 14).

SOME CONCLUDING REMARKS

The five years after the war prepared society for the tremendous economic development of the following decade. It saw a strong revival of private industrial activities, and a major renewal and growth of enterprises was necessary
p.71 after years of stagnation. A report published by *The Architectural Forum* in its December 1950 issue[57]notes that out of 231 architectural offices studied, 74% had designed industrial buildings in the previous years, second only to commercial typologies. Although the large technical firms continued to have a considerable presence in the market, the significant number of industrial commissions brought work to many architectural practices of various sizes. Their specific characteristics and generational change also facilitated the spread of modern precepts.

These circumstances were reflected in the journals of the time, which published many articles devoted to architecture for industry. After the wartime restrictions, the publications were able to show in detail the advances made during the war and also their new possibilities of application in later industrial architecture. During these years, the magazines did not focus on aesthetic aspects but rather on organizational, technical and technological advances; they became technical manuals with a clear role of transmitting to the collective. Many of the advances that took place in that post-war decade are still in force in terms of industrial architecture: planning, spatial flexibility, flow of materials and people, construction and structural techniques, and the importance of spaces for people.

p.72 This research provides an exhaustive analysis of post-war industrial architecture in the USA, recovering architectures forgotten in established historiographies and facilitating future research on the subject. It also provides an in-depth understanding of this period's specific technical, functional and social developments. And it highlights the importance that industrial architecture had for the discipline both in the professional development of architects and in the acceptance and expansion of modern architecture.

Roles CRediT:
Ricardo Meri de la Maza (RMM); Bartolomé Serra Soriano (BSS); Alfonso Díaz Segura (ADS). Conceptualization, methodology, analysis and preparation of the paper (RMM 33.3% - BSS 33.3% - ADS 33.3%). Authorship (MMR 33.3% - BSS 33.3% - ADS 33.3%).

All of the authors declare that there is no conflict of interest with the results of the study

Acknowledgements:
Photographs in figure 5 courtesy of the Naval History & Heritage Command Archive; figure 7 courtesy of Ray Wachsmann; photographs in figures 4 and 11 top © *The Chicago History Museum Collection*; photograph in figure 14 © *Photographer/Esto. Licensing agreement as per email correspondence with Esto sales agent*.

1 PANIGYRAKIS, Phoebus Ilias. *Architectural record 1942-1967: chapters from the history of an architectural magazine*. Delft: TU Delft, 2020, p. 55. ISBN 9789463663014.

2 JOHNSON, P. C. Preface. In: HITCHCOCK, HR. and A. DREXLER. *Built in USA: Post-war Architecture*. New York: Museum of Modern Art, 1952, p. 9.

3 Ibid., p. 16.

4 HITCHCOCK, Henry-Russell. *Architecture. Nineteenth and Twentieth Centuries*. Baltimore: Penguin Books, 1958, pp. 417-418.

5 Ibid., p. 418.

6 Except for indirect references to SOM, Saarinen and Albert Kahn, or some works by the '*masters*'.

7 BURCHARD, John; BUSH-BROWN, Albert. *Architecture in the United States. Its social and cultural influence*. Mexico City: Editorial de Letras, 1963, pp. 546, 598.

8 The Building Outlook -1946 a Crucial Year- A Review and a Forecast. In: *American Builder* [online]. Chicago: Simmons-Boardman Pub. Corp., January 1946, vol. 68, n. 1, pp. 60-63 [accessed: 30-09-2024]. Available at: https://usmodernist.org/AB/AB-1946-01.pdf.

9 BURCHARD, John; BUSH-BROWN, Albert. *Architecture in the United States. Its social and cultural influence*. Mexico City: Editorial de Letras, 1963, p. 517.

10 BAYER, Herman B. The Construction Picture, 1944 and 1945. In: *American Builder* [online]. Chicago: Simmons-Boardman Pub. Corp, January 1945, vol. 67, n. 1, pp. 112-113 [accessed: 30-09-2024]. Available at: https://usmodernist.org/AB/AB-1945-01.pdf.

11 DAVIDSON, Joel. Building for War, Preparing for Peace: World War II and the Military-Industrial Complex. In: ALBRETCH, Donald, ed. *World War II and the American dream: How Wartime Building Changed a Nation*. Washington D.C.: National Building Museum & MIT Press, 1995, p. 218.

12 Shortage of Major Building Materials Was 1946 Construction Bottleneck. In: *American Builder* [online]. Chicago: Simmons-Boardman Pub. Corp. January 1947, vol. 69 n. 1, pp. 64-65 [accessed: 30-09-2024]. Available at: https://usmodernist.org/AB/AB-1947-01.pdf.

13 The Office of Price Administration (OPA) was established by Executive Order 8875 of 28 August 1941. Its functions were to control prices and rents after the outbreak of the Second World War.

14 Building Month. In: *The Architectural Forum* [online]. New York: Time Inc, May 1946, vol. 84, n. 5, p. 5. [accessed: 30-09-2024]. Available at: https://usmodernist.org/AF/AF-1946-05.pdf.

15 The name by which the *Veterans Emergency Housing Program* (VEHP) promoted by Wilson Wyatt and put into operation in December 1945 was known.

16 What are essential buildings? In: *Architectural Record* [online]. New York: F. W. Dodge Corp, June 1946, vol. 99, n. 6, p. 71 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1946-06.pdf.

17 The *Civilian Production Administration* was a state agency created in October 1945 to replace the *War Production Board*. Its function was to promote the transition from wartime industrial production to peacetime production free of government controls.

18 Building Month. In: *The Architectural Forum* [online]. New York: Time Inc, April 1948, vol. 88, n. 4, p. 9 [accessed: 30-09-2024]. Available at: https://usmodernist.org/AF/AF-1948-04.pdf.

19 Building Month. In: *The Architectural Forum* [online]. New York: Time Inc, September 1948, vol. 89, n. 3, p. 11 [accessed: 30-09-2024]. Available at: https://usmodernist.org/AF/AF-1948-03.pdf.

20 Idem.

21 News. In: *The Architectural Forum* [online]. New York: Time Inc, July 1949, vol. 91, n. 1, p. 9 [accessed: 30-09-2024]. Available at: https://usmodernist.org/AF/AF-1949-01.pdf.

22 News. In: *The Architectural Forum* [online]. New York: Time Inc, December 1949, vol. 91, n. 6, p. 7 [accessed: 30-09-2024]. Available at: https://usmodernist.org/AF/AF-1949-06.pdf.

23 HOLDEN, Thomas S. The Three Phases of Postwar Recovery. In: *Architectural Record* [online]. New York: F.W. Dodge Corp. Dodge Corp, August 1949, vol. 106, n. 2, pp. 94-97 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1949-08.pdf.

24 For more information see: COHEN, Jean-Louis. *Architecture in Uniform. Designing and Building for the Second World War*. Montreal: CCA, 2011, pp. 86-99. ISBN 978-2-75410-530-9.

25 Building in One Package. Part 1. In: *The Architectural Forum* [online]. New York: Time Inc, January 1945, vol. 82, n. 1, pp. 93-112 [accessed: 30-09-2024]. Available at: https://usmodernist.org/AF/AF-1945-01.pdf. Building in One Package. Part 2. In: *The Architectural Forum* [online]. New York: Time Inc, February 1945, vol. 82, n. 2, pp. 113-128 [accessed: 30-09-2024]. Available at: https://usmodernist.org/AF/AF-1945-02.pdf.

26 A measure of modern efficiency. In: *Architectural Record* [online]. New York: F. W. Dodge Corp., December 1946, vol. 100, n. 6, pp. 102-105 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1946-12.pdf.

27 Industrial Plant. In: *Progressive Architecture* [online]. New York: Reinhold Pub. Corp., December 1946, vol. 27, n. 12, pp. 40-49 [accessed: 30-09-2024]. Available at: https://usmodernist.org/PA/PA-1946-12.pdf.

28 Designed for dust and germ control. In: *Architectural Record* [online]. New York: F. W. Dodge Corp., August 1947, vol. 102, n. 2, pp. 100-102 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1947-08.pdf.

29 New plant to relieve a nation's headaches. In: *Architectural Record* [online]. New York: F. W. Dodge Corp., August 1948, vol. 104, n. 2, pp. 124-127 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1948-08.pdf.

30 Fast Construction for Fast Production. In: *Architectural Record* [online]. New York: F. W. Dodge Corp, February 1945, vol. 97, n. 2, pp. 66-73 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1945-02.pdf.

31 Diesel engine plant. In: *Progressive Architecture* [online]. New York: Reinhold Pub. Corp., March 1945, vol. 26, n. 3, pp. 79-84 [accessed: 30-09-2024]. Available at: https://usmodernist.org/PA/PA-1945-3.pdf.

32 Clothing Plant. In: *The Architectural Forum* [online]. New York: Time Inc, April 1947, vol. 86, n. 4, pp. 118-119 [accessed: 30-09-2024]. Available at: https://usmodernist.org/AF/AF-1947-04.pdf.

33 Mammoth Automobile Factory. In: *Architectural Record* [online]. New York: F. W. Dodge Corp., August 1948, vol. 104, n. 2, pp. 112-117 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1948-08.pdf.

34 Assembly plant. In: *Progressive Architecture* [online]. New York: Reinhold Pub. Corp, August 1948, vol. 31, n. 2, pp. 52-56 [accessed: 30-09-2024]. Available at: https://usmodernist.org/PA/PA-1948-02.pdf.

35 CREIGHTON, Thomas A. Pearl Harbour to Nagasaki. A review of Architectural progress during the war years. In: *Progressive Architecture Architecture* [online]. New York: Reinhold Pub. Corp, January 1946, vol. 27, n. 1, pp. 42-93 [accessed: 30-09-2024]. Available at: https://usmodernist.org/PA/PA-1946-01.pdf.

36 The Navy builds. In: *The Architectural Forum* [online]. New York: Time Inc, March 1946, vol. 84, n. 3, pp. 121-135 [accessed: 30-09-2024]. Available at: https://usmodernist.org/AF/AF-1946-03.pdf.

37 ALBERT KAHN, Ass. Arch. & Eng. The Design of Factories Today. In: *Architectural Record* [online]. New York: F. W. Dodge Corp., November 1945, vol. 98, n. 5, pp. 120-138 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1945-11.pdf.

Alfonso Díaz Segura (0000-0002-1424-3068) "Arquitectura industrial en las publicaciones de posguerra de los Estados Unidos de América" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 14-03-2024 / ACCEPTED 04-11-2024

38 MIEHLS, George H. Trends in industrial plat design. In: *Architectural Record* [online]. New York: F. W. Dodge Corp., December 1946, vol. 100, n. 6, pp. 96-101 Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1946-12.pdf.

39 WACHSMANN, Konrad. Mobilar structures. In: *Progressive Architecture* [online]. New York: Reinhold Pub. Corp., March 1946, vol. 27, n. 3, pp. 87-99 [accessed: 30-09-2024]. Available at: https://usmodernist.org/PA/PA-1946-03.pdf.

40 WANK, Roland A. The Architect's opportunities in factory design. In: *Architectural Record* [online]. New York: F. W. Dodge Corp., August 1947, vol. 102, n. 2, pp. 86-90 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1947-08.pdf.

41 Economical steel framing details. In: *Architectural Record* [online]. New York: F. W. Dodge Corp., August 1947, vol. 102, n. 2, pp. 115-121 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1947-08.pdf.

42 BOGNER, Walter F. Industrial plants - A Harvard research Project. In: *Architectural Record* [online]. New York: F. W. Dodge Corp., August 1947, vol. 102, n. 2, pp. 103-114 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1947-08.pdf.

43 An Enlightened look at a factory. In: *Architectural Record* [online]. New York: F. W. Dodge Corp., August 1948, vol. 104 n. 2, pp. 108-111 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1948-08.pdf.

44 Idem.

45 ELLSWORTH, Julian. Functional Colour in Industrial Buildings. In: *Architectural Record* [online]. New York: F.W. Dodge Corp, August 1948, vol. 104, n. 2, pp. 118-123 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1948-08.pdf.

46 Forge and Tool Factory. In: *The Architectural Forum* [online]. New York: Time Inc, August 1948, vol. 87, n. 2, pp. 121-135 [accessed: 30-09-2024]. Available at: https://usmodernist.org/AF/AF-1948-02.pdf.

47 Midwest Bab-O Plant. In: *The Architectural Forum* [online]. New York: Time Inc, December 1947, vol. 87, n. 6, pp. 61-66 [accessed: 30-09-2024]. Available at: https://usmodernist.org/AF/AF-1947-06.pdf.

48 Industrial Buildings. In: *The Architectural Forum* [online]. New York: Time Inc, August 1948, vol. 89, n. 2, pp. 90-100 [accessed: 30-09-2024]. Available at: https://usmodernist.org/AF/AF-1948-02.pdf.

49 Industrial Buildings. In: *Progressive Architecture* [online]. New York: Reinhold Pub. Corp, August 1948, vol. 29, n. 3, pp. 47-66 [accessed: 30-09-2024]. Available at: https://usmodernist.org/PA/PA-1948-03.pdf.

50 Annual Progressive Architecture Awards. In: *Progressive Architecture* [online]. New York: Reinhold Pub. Corp, June 1949, vol. 30, n. 6, pp. 43-49 [accessed: 30-09-2024]. Available at: https://usmodernist.org/PA/PA-1949-06.pdf.

51 Architecture meets machinery and likes it. In: *Architectural Record* [online]. New York: F. W. Dodge Corp., November 1949, vol. 106, n. 5, pp. 91-108 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1949-11.pdf.

52 BIRD, Eric L. Postwar factory construction in England. In: *Architectural Record* [online]. New York: F. W. Dodge Corp., November 1949, vol. 106, n. 5, pp. 120-121 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1949-11.pdf.

53 STOWELL, Kenneth K. The designing of industrial buildings. In: *Architectural Record* [online]. New York: F. W. Dodge Corp., November 1949, vol. 106, n. 5, pp. 109-116 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1949-11.pdf.

54 Industrial group on the campus plan. In: *Architectural Record* [online]. New York: F. W. Dodge Corp., November 1945, vol. 98, n. 5, pp. 116-117 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1945-11.pdf.

55 General Motors Technical Center to unite science with its application. In: *Architectural Record* [online]. New York: F. W. Dodge Corp., November 1945, vol. 98, n. 5, pp. 98-103 [accessed: 30-09-2024]. Available at: https://www.architecturalrecord.com/ext/resources/archives/backissues/1945-11.pdf.

56 Flood-free Industrial Buildings. In: *The Architectural Forum* [online]. New York: Time Inc, May 1949, vol. 90, n. 5, pp. 102-105 [accessed: 30-09-2024]. Available at: https://usmodernist.org/AF/AF-1949-05.pdf.

57 What is a Typical Architectural Organization? In: *Progressive Architecture* [online]. New York: Reinhold Pub. Corp., December 1950, vol. 31, n. 12, pp. 49-50 [accessed: 30-09-2024]. Available at: https://usmodernist.org/PA/PA-1950-12.pdf.

Alfonso Díaz Segura (0000-0002-1424-3068) "Arquitectura industrial en las publicaciones de posguerra de los Estados Unidos de América" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 14-03-2024 / ACCEPTED 04-11-2024
Con licencia CC BY-NC-SA 4.0 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.03

Alfonso Díaz Segura (0000-0002-1424-3068) "Arquitectura industrial en las publicaciones de posguerra de los Estados Unidos de América" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 14-03-2024 / ACCEPTED 04-11-2024
 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.03

EL TEMPLO DE LA *HOUILLE BLANCHE* DE LAGARDE EN LA PRESA DE RICOBAYO

THE TEMPLE OF *HOUILLE BLANCHE* BY LAGARDE AT THE RICOBAYO DAM

José Ramón Sola Alonso (0000-0001-9560-9043)
Cristina Pérez Valdés (0000-0002-5344-2529)

p.77 EL SALTO DEL ESLA IN ZAMORA

In 1940, the company *Saltos del Duero* commissioned engineer and member of the Board of Directors Vicente Machimbarrena to write a monograph on José Orbegozo Goróstegui, founder and first general manager of the company, who died in January 1939 in Kreuzlingen (Switzerland). Orbegozo was the engineer responsible for the development of the *Saltos del Duero*, whose energy resources played a leading role in the Spanish electricity system until the last quarter of the 20th century.

The initiative began in 1903 with studies on the Duero and its tributaries Esla, Tormes and Huebra. Fifteen years later, the *Sociedad Hispano-Portuguesa de Transportes Eléctricos* was constituted and on the same day the *Consorcio Saltos del Duero* was created, lending its name to the group of hydroelectric projects of its basin in the Spanish section and bordering Zamora and Salamanca with Portugal, located in the natural parks of the Arribes del Duero (Spain) and Douro Internacional (Portugal). The Esla flows to the right of the Duero before reaching the Portuguese border and its seasonal ferocity carves a spectacular V-shaped canyon with vertical walls that fits between igneous rocks on the right bank and Paleozoic metamorphic rocks on the left, heralding the extraordinary landscape of the Arribes downstream.

From 1918 Orbegozo directed the technical, administrative and economic actions on the Douro. In 1926, they obtained the administrative concession for use of water "*of the Esla river, with reservoir and power plant at the foot of the dam, in Ricobayo*"[1].

The Salto del Esla, called the Ricobayo Dam or Waterfall, is the first of the five that make up the "*set*" of the *Saltos del Duero* hydrological project, a name used by Orbegozo when he presented it internationally at the First World Power Conference in London in 1924[2].

p.78 In 1927 he drafted the *Esla River Water Usage Project (Zamora)* and a subsequent modification in 1931[3]. The works began in 1929 and were completed at the end of 1934, with the collaboration of engineers Machimbarrena, Rubio, Martínez Artola, De Nó and Ríos, among others[4]. Ricobayo is a gravity dam with a 240m long concrete crest wall, 90m high and a *powerhouse* at its base. A sheet of water of almost 6000 ha, 100km long and 350km of coastline, made the dam the largest volume of water dammed in Europe in 1934 with approximately 1150 hm^3 and one of *"the largest hydraulic works in the world: perhaps unique in its characteristics*"[5].

The Ricobayo Dam concession and construction predates the major *Boulder Canyon Project* (1931-1936), renamed the Hoover Dam in 1947. Located on the Colorado River between the states of Nevada and Arizona and with the difference in its scale, the formal, technical and equipment similarities are notable. To this circumstance we must add the later participation, with the technical project developed by the engineers, of the British architect Gordon B. Kaufmann in 1931, who redesigned the exteriors and interiors, applying a qualified Art Deco style[6].

The place could not be more indicative (Figure 1) of a human intelligence that since the beginning of the 20th century has placed its trust in the progress of industry as an engine of social development. In this context, electricity and its cheapness as an energy resource is the guarantee of a successful future. The search for social well-being is synonymous with modernity and the overwhelming empiricism that seeks it, overshadowing the creative dimension that does not exclude the rational, but is responsible for its artistic expression. It is the time of scientific progress and electricity that seeks its profitability in hydroelectric power, the French *Houille Blanche*[7] ("white coal"), as opposed to the black mineral fuel coal.

LAGARDE AND HIS TIME

Eduardo de Lagarde Aramburu[8] was born in Toledo in 1883, and after beginning his military career he became an architect in 1910. His different destinations allowed him to travel in 1920 and 1921 in France, Belgium and England, linked to the studies of Physical Education, attending the Antwerp Olympics.

Retiring from his military activity in 1926 and settling permanently in San Sebastian, he found a city in full progress. Turned into a spa town, La Concha beach is the specialised recreation and summer resort of kings, aristocrats and the high bourgeoisie. This elite social scenario demanded new recreational spaces, the origin of a rich cultural activity. With
p.79 the strong international influence came a speculative and recreational architecture of a different scale[9] with an ideologized language of dual response to functionality and representativeness[10]. The eclectic Frenchified formulations with Second Empire and Beaux Arts styles began to be questioned in the face of the new stimuli of the Modern Movement. Two buildings symbolise this architecture, spread over half a century. The Gran Casino (1882) by Aladrén y Morales de los Ríos begins the path of a city that finds in gambling, leisure and health the ideal scenario for cultural and aesthetic freedom; and the Club Náutico (1929) by Aizpurua y Labayen, *quintessential*[11] of Spanish rationalism and expression of the incipient Modern Movement that seeks the transformation of the system of relations between man and his environment.

p.80 Lagarde exemplifies the "*change of era [...], an amalgamating work in the sum of architecture, applied arts and new media*".[12]. Incorporated into social life, he displayed a multifaceted ability as an architect, painter, poster artist, draughtsman, illustrator and cartoonist, beginning to stand out in a city where social and cultural life is the priority. He

J. R. SOLA ALONSO, C. PÉREZ VALDÉS "El templo de la *Houille Blanche* de Lagarde en la presa de Ricobayo" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171-6897 / ISSNe 2173-1616 – RECEIVED 29-04-2024 / ACCEPTED 12-09-2024
 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.04

actively participated in publications, exhibitions and informative actions as a poster designer, and in social events, decorating public spaces in theatres, dance halls or even in the bullring, all with artists such as Zuloaga, Martiarena, Kaperotxipi, Olasagasti, Artia, Arrue, TxiKI, Martín and the architect Alday Uranga.

His architectural activity maintained the same intensity. The urban scenario represents an exhausted poetic manual of formal registers of the international eclectic language, but also new attitudes of modernity that encourage the visits of Le Corbusier or Gropius, feeding the open debate between the popular and the traditional. Lagarde is part of this "*generation of rupture*".[13] or "*dispersed generation*".[14] that Carlos Flores mentions when referring to that of 25 that would immediately lead to the vanguard of GATEPAC, being part of the North or Basque Group in 1931 and being editor of its magazine *AC Documentos de Actividad Contemporánea* in 1934.

Tradition and modernity that translates into its architectural activity[15], contrasting his eclectic regionalism with the competitions he developed in collaboration with members of GATEPAC. In 1932 he participated with two proposals in the Tomás Meaba School Group in Bilbao; 1933 with Aizpurúa, Labayen and Sánchez Arcas in the San Sebastián Hospital; 1934 with Aizpurúa in the Hogar Escuela de Huérfanos de Correos in Madrid and the building he designed with him in 1935 for rental housing in Fuenterrabía[16].

His architectural and painting studio became an exhibition hall, becoming an important artistic centre of the city, as evidenced by the visit of the Queen Mother to an exhibition of Kaperotxipi in 1928.

In 1934 he founded and directed the Gastronomic-Cultural Society *GU* together with Aizpurúa, Olasagasti, Ribera, Tellaeche and Cabanas. It was a unique meeting place and the forefront of the cultural society of San Sebastian, regardless of ideological positions, where, among many others, Picasso, Giménez Caballero, Víctor d'Ors, Virginia Collis, Rezola, Sacha, Sánchez Mazas, García Lorca, Giménez Caballero, J. Antonio Primo de Rivera, Benjamín Jarnés, Max Aub, Sáinz de la Maza, Tellería, and Celaya, etc. were present.

After the Civil War, he became involved in the recovery of Toledo's heritage when he was appointed head of the Military Service of Artistic Recovery, curator of the Alcazar and representative of the General Directorate of Devastated Regions. In 1950 he died after a traffic accident.

In 1940 Lagarde carried out the *Decoration Project for the Esla hydroelectric power plant*[17]. It is an unpublished document consisting exclusively of 7 plans and 5 views, but without a report, so it is possible that it was an intervention proposal. However, it reveals for the first time the participation of an architect in the Ricobayo Dam, developed until p.81 then exclusively by the engineers mentioned above.

Prior to Ricobayo, the collaboration of architects with engineers in Spain since 1900 was limited to the projects of Vicente Lampérez, Manuel Ruiz Senén, Antonio Palacios and his student Casto Fernández Shaw[18]. Lampérez participated with Sociedad Hidráulica Santillana, S.A. and Mengemor[19] in the Santillana dam (1906-1908, Madrid), intervening in the crown and water intake tower with a marked regionalist character. Ruiz Senén cooperated with the engineer Luis de la Peña in the Bolarque Hydroelectric Power Plant (1907-1910, Guadalajara). Palacios collaborated with Mengemor in Andalusia and Galicia, participating in the Mengíbar Hydroelectric Power Plant (1913-1916, Jaén) together with Joaquín Otamendi Machimbarrena[20] and engineer Mendoza. With an industrial language, it articulates the architectural composition of the facades by means of large vertical openings, the power of pilasters and corners and a cornice that hides the roof, resolved with stone ashlars and masonry panels. Subsequently, he contributed with the mercantile company Sociedad Gallega de Electricidad in the Tambre Hydroelectric Power Plant and the engineer Luciano Yordi (1924-1927, A Coruña). A free-standing power plant interprets the vernacular architecture of the area, sustaining a regionalist historicism with the granite material of the site.

Fernández Shaw continues the path opened by his master with Mengemor in two clear periods. Firstly, the El Salto dam and hydroelectric plant in the municipalities of El Carpio and Pedro Abad (1920-1922, Córdoba), with the engineers Carlos Mendoza and Antonio del Águila and the sculptor Juan Cristóbal. Built with historicist formulations, it shows a clear Andalusian and Mudejar influence. According to Sobrino, the engineer Mendoza recognised Fernández Shaw as "*an architect who designed dams*"[21] after seeing his winning project for the Monument to the Triumph of Civilization (1918) at the National Exhibition of Fine Arts in 1920, which was the origin of his participation in the hydraulic projects. The work was awarded the Gold Medal in the Architecture Section of the International Exhibition of Modern Decorative and Industrial Arts in Paris in 1925 and was declared an Asset of Cultural Interest in 2003[22]. Secondly, the waterfalls of La Lancha, Encinarejo and Alcalá del Río. The first is known as the Salto del Jándula in Andújar (1927-1930, Jaén). It is a concrete gravity dam lined with granite ashlars, with a curved plan and a central part at the foot incorporated in the wall construction, reaching an intense expressionism of organic and dynamic shapes[23]. El p.82 Encinarejo (1928-1930, Jaén) with powerhouse attached to the dam, next to the right abutment. Alcalá del Río (1928-1930, Seville) is a mobile dam with eight gates supported on piles and a hydroelectric power plant with a balanced historicist rationalism.

After these first experiences, from 1940 onwards, a greater conciliation between architecture and engineering arose. Science and art at the service of the hydroelectric industry in the run-up to Spanish developmentalism, already announced by Casto Fernández Shaw in the face of the "*new forms of architectural engineering*"[24]. In 1930 it brought a different attitude towards the emotion of the vernacular, regional localisms or the satisfaction of monumental formalism, represented by Rucabado or Palacios as an expression of authentic national architecture[25]. With a yearning spirit of modernity, it tries to rediscover, from the architectural debate, the reconciliation between the values of the "*white and horizontal stain of the farmhouse and the blackened verticality of the skyscraper*"[26]. A balance between the "*treasure*

J. R. SOLA ALONSO, C. PÉREZ VALDÉS "El templo de la *Houille Blanche* de Lagarde en la presa de Ricobayo" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 29-04-2024 / ACCEPTED 12-09-2024
 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.04

of our popular architecture... (and) *the new forms of Architecture*[27] which stimulated the breakthrough of the Modern Movement in Spanish architecture. New forms that Luis de Landecho already announced in 1905 because the search for "*new forms*" of this "*New Architecture*" "*is heard everywhere*"[28] or that Anasagasti wonders in 1914 what could be
p.83 the manifestations of the "*new forms*", of the "*modern architecture*"[29] advocating collaboration between architects and engineers. In spite of these impulses, it was not until 1951 that the National Journal of Architecture declared, with a French technician, the recognition of industrial architecture[30].

The year of Lagarde's project, 1940, was significant, since it marked the beginning of a new dictatorship that sought to exalt him, the dam being in full operation and Machimbarrena, a close friend of Orbegozo's, paying homage to him with his monograph. All three were from San Sebastian, the first by adoption, although his mother was from Guipuzcoa, in a territory that practices a technocracy immersed in the endogamy typical of Spanish underdevelopment, feeding mainly from its own financial, technical and cultural scenarios (Figure 2).

Machimbarrena is an exception in engineering and defended the necessary "*collaboration of the architect and the engineer, in such intimate and close conjunction that they appear as fused in a single ideal personality*". After reflecting on the architectural profession by making it responsible for "*decoration and embellishment*", he addresses the need for professional interdisciplinarity. To support the opinion, he refers to the bridge competitions of Bilbao in 1902 and San Sebastian in 1903, first and second prize respectively, with a team formed by the engineer Miguel Otamendi and the architects Palacios and Joaquín Otamendi. The second won 2nd prize at the General Exhibition of Fine Arts and Artistic Industries of 1904. However, there was also his indirect participation in the railroad station projects of the engineer Ruiz y López y Zuazo[31].

This engineer belonged to a family of the Basque technocratic elite, with a strong presence in San Sebastian despite living in Madrid. It is reasonable to think that he was familiar with Lagarde's work both in Donostia and Toledo, since in 1940 he gave the lecture "*Historias y leyendas toledanas: el milagro del Alcázar*" (Toledo stories and legends: the miracle of the Alcazar).[32] in Madrid, when the architect was its curator. Given this speculation, it is plausible to suppose that Machimbarrena encouraged the commissioning of the *Decoration Project,* especially given his declared attitude towards interdisciplinary collaboration, although this research has not been able to prove it with documents (Figure 3).

THE TEMPLE OF HOUILLE BLANCHE BY LAGARDE AT THE RICOBAYO DAM

The main parts of the Ricobayo Dam are the gravity wall, the spillway and the *powerhouse,* a genuine name adopted by Orbegozo to define the centre of hydroelectric power generation, being the most significant building of the complex.
p.84 Originally installed autonomously downstream on the left bank of the Esla in 1927, once construction began in 1929, it was modified in 1931 by eliminating two of the six Francis turbines and placing it parallel to the dam wall and on the riverbed. (Figure 4).

The *Powerhouse* is a free-standing L-shaped volume built in reinforced concrete, with a light metal roof and access from the southeast, sheltered by the long shadow of the imposing 90m high concrete wall to the northeast. The long side is called "Casa de Turbinas" (Turbine House) as an open space with a single height and the short side is called "Casa de Administración" (Administration House), divided into three interior floors of different heights.

The *Decoration Project of the Esla de Lagarde hydroelectric power plant* is mainly focused on the interior of the "Turbine House", externally reaching the whole of the *Powerhouse.* The documentation of Orbegozo's 1931 project underwent slight modifications during its execution, so we focus the description on the one actually completed in 1934 (figure 5, 6 and 7)[33].

The floor plan of the "Turbine House" is almost symmetrical on its longitudinal axis, illuminating the interior through a series of openings, twelve to the southwest and fourteen to the northeast. The space is symmetrically closed to the southeast with three openings, the central one for carriages and two lateral ones for lighting, and to the northwest almost blindly with a single pedestrian access. The "Administration House" is attached to the previous one with three openings in each of the released orientations.

The facades of the "Turbine House" show all the lighting openings in the floor plan in the form of vertical and identical windows starting from the ground (module A). To the southwest they are framed in a different L-shaped plane, like the floor plan of the complex, composed of a frieze that runs along the entire length hiding the sloping roof and a vertical blind plane to the northwest. To the northeast this frame is perfectly symmetrical. The southeast elevation is symmetrical, and the passage opening is framed in a setback and lintelled plane with the height of the side windows that have the same width as the longitudinal ones (module A), while the northwest is almost blind with the door indicated.

The "Administration House" has three façades pierced by three windows equivalent to the previous ones, narrower (module B), but with the same height. To the southwest, the openings are equal to each other, crowned at the top by a single horizontal recess that covers the full width of the windows.
p.86 These three windows have the same width (module B), while to the southeast there is a central span equal to the "Turbine House" (module A) and the narrower sidewalls (module A), marked at the top by three horizontally proportioned openings, marking a firm compositional symmetry.

The cross section of the "Turbine House" allows us to identify the industrial nature of the existing space. Thus, it is possible to recognise the gable roof skirts, trusses that support the roof, pillars attached to the interior of the

J. R. SOLA ALONSO, C. PÉREZ VALDÉS "El templo de la *Houille Blanche* de Lagarde en la presa de Ricobayo" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 29-04-2024 / ACCEPTED 12-09-2024

longitudinal façades that support the bridge crane brackets, turbines and a double-height space to the southwest that **p.87** allows their maintenance.

As a whole, the *Powerhouse* volumetrically distinguishes the two activities with different heights, enhancing their functional and architectural autonomy by assigning autonomous compositional symmetries to each of them. The building designed by an engineer like Orbegozo, who was familiar with the world industrial experiences of the time, proposes a powerful composition sensitive to the European rationalist currents of industrial architecture. The documentary research carried out has not allowed us to identify the possible participation of architects in the definition of the *Powerhouse*, but its architectural personality could well have been ascribed to any member of GATEPAC, or even Lagarde himself, who was a member of it.

There are four general characteristics of the scenario Lagarde encounters at the Ricobayo Dam. First, the spectacle of a place qualified by the whims of nature and the deep granite trench carved by the Esla, which overwhelms before the contrast of man's attempt to control it. Second, the presence and solidity of the wall containing the water, proportional to the immense hydroelectric power that it draws from it and of which there is only awareness in the interior space of the "Turbine House" that houses the machines. Third, the extraordinary architectural quality of the *Powerhouse,* which is indebted to an avant-garde Modern Movement. Finally, its location at the base of the dam, on the Esla and with **p.88** access from the southeast on the left bank of the river, whose reality and functionality hinders any action in relation to the immediate environment.

Lagarde interpreted these conditions by proposing an intervention that praises hydroelectric industrial activity. For this purpose, it uses the architectural element of light as intangible matter[34] in its double condition of natural and artificial. The first is the light of the place, thanks to the geographic orientation and the solar power that qualifies the built forms of its architecture. The second, light generated by the hydroelectric energy worked both in the generation of a new interior space as a symbolic form, as well as in the exterior of the building, valuing the composition of its architecture. In both cases he interpreted the relationship between man and the world, the new techniques and their transcendence, proposing the creation of a Temple of *Houille Blanche.*

In the "Turbine House" he transforms the system of existing relationships between construction and form by that of coherence between contents and parts, understanding them as almost purely interior. The building represents a rationalist industrial architecture that perfectly identifies a functional language of balanced composition, clear volumetry and extraordinary spatial flexibility. In its interior he planned the most important intervention, with an attitude that goes beyond the term *decoration* used by Machimbarrena and his mere action of masking the surface of the elements. Lagarde did not propose to embellish the forms of the built architecture, but to structure its tectonics by exploring the expressiveness of its structural and material solutions.

The cross section develops a staging stimulated by the tripartite order of its main facade, recreating a new spatiality that evokes the analogy of temples. For this purpose, it develops three main actions on the space. The first one directs and focuses it towards the northeast through the implementation of a large mural. With this resounding pictorial resource, he visually constructed both the dominant horizontal axis of the space and its meaning, clarifying the orientation of a viewer moving through its interior, but also preserving the functional coherence of the access in the industrial activity. The second replaces the presence of the roof skirts and its flat metal latticework with an apparent lowered vault. In reality, it is a "*ceiling made of thin brick board*" hanging from the trusses. Finally, it introduces granite as the main material of the interior, paying homage to the geology of the place (Figures 8 and 9). **p.89**

These actions, together with the architectural element of natural and artificial light, end up defining a complex system of material, formal and symbolic relationships, building the new space of the Temple of *Houille Blanche.*

The longitudinal section participates in the new spatiality by purifying the system of relationships without concessions to adornment. The only decoration is purely architectural: pilasters, cornice and texture, formalising a qualified double order in granite, which relates the concepts of space, time and light.

The pilasters, almost gigantic, evoke both the notion of time in the architectural space, and give rhythm to its depth, through the movement of the shadows generated by the natural southwest light coming through the windows (Figure 10).

The series of fourteen openings to the northeast, in semi-darkness due to the orientation, orography and projection of the dam, organises a system of artificially illuminated displays (Figure 11).

Lagarde's experience in the organisation of exhibitions and informative actions is enriched with the use of light, finding in this project the precursor of the illumination of the night tourist route of the Historic Centre of Toledo, which he carried out in 1943, with the aim of highlighting the city's heritage[35].

The showcases have the dual function of display experience and illumination. The first formalises a tour of the **p.90** exhibition whose content would be linked to information on the development and execution of the dam itself and the importance of hydroelectric energy in human activity. The second proposes a direct illumination of the space on a human scale, linked to the dark northeast facade that Lagarde himself represents in black (Figures 12 and 13).

The granite dresses the complete canvases from the floor to the top of the cornice, enhancing the double interior order. Only the intrados of the main facade breaks this criterion when the stone rises in all its development reaching the vault and arranging two statues in the lighting openings, reinforcing the symmetry of the elevation.

The floor continues with the presence of this material, but polished, generating specular surfaces that contrast with both the roughness of the granite in the canvases and the smoothness of the vault. This flooring has its own order,

J. R. SOLA ALONSO, C. PÉREZ VALDÉS "El templo de la *Houille Blanche* de Lagarde en la presa de Ricobayo" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 29-04-2024 / ACCEPTED 12-09-2024

J. R. SOLA ALONSO, C. PÉREZ VALDÉS "El templo de la *Houille Blanche* de Lagarde en la presa de Ricobayo" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 29-04-2024 / ACCEPTED 12-09-2024
Con licencia CC BY-NC-SA 4.0 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.04

entrusted to two taping systems that enhance the presence of the turbines. Firstly, on the access level, it arranges four borders that frame the machines from the axes of the northeast windows. Secondly, it qualifies the double-height space by inverting the upper sequence when looking for the axes of the southwest pilasters (see figure 5).

The showcases are recessed as niches between the pilasters, defining a perceptive L-shaped plinth that extends along the interior of the facade towards the focus of the mural, framing it in the intrados of the northwest facade (Figure 14).

At the top of the pilasters a volume is formalised that prevents its development, but not the windows that continue above it with smooth plaster. It is the masking of the system of brackets supporting the beam-bridge in the form of a large interior cornice that runs along the longitudinal elevations, characterising the space and supporting an apparent movable walkway that floats above the space. Inside, artificial light is reintroduced, bathing the vaulted shape of the space. These decisions point to the perceptual quality of the dual order. Above, the vaulted space is plastered and smooth, and the lower one is composed of the cornice, pilasters and windows textured with "*granite 0.05cm thick*".

On the outside, artificial light enhances the architectural composition of the *powerhouse* by illuminating the series of windows in its buttresses and from below, embedded in a plinth attached to the facades, accentuating its rhythm.

p.91 The analogy of the temple is perfected externally by recreating on the main facade a new architectural discourse of intense coherence that reinforces the character of the building's main access, exterior volumetric autonomy and functional independence from the interior space of the "Turbine House". It partially doubles the southeast factory incorporating a new volume that emphasises the main condition of the tripartite order. A small cornice ends in a projection, indicating on it the year of its future renovation, MCMXL, the date of the project.

These decisions make it possible to appreciate the two functions on the southeast facade of the building, the "Administration House" and "Turbine House", as hierarchical and symmetrical parts in themselves, only broken by two flagpoles on the corner that turns to the southwest, now responding to their immediate surroundings. The place is polarised, giving priority to the complete perception of the *Powerhouse* over the river, lessening the individual symmetry of each part and building a full understanding of a whole that floats on the Esla as the main element of the Ricobayo Dam (Figure 15).

CONCLUSIONS

Lagarde captures and places prominence on the cultural intensity of San Sebastian before the civil war, becoming a social figure through an amalgamating vision of all his activities as an architect, painter, poster artist, draughtsman and illustrator, exemplifying the "*change of era".*

p.92 His architectural activity shows that "*generation of rupture*" that participates in the play of contradictions between historicist attitudes and the transition to new formal expressions in response to modern times, whose greatest exponent in Europe is industrial architecture.

In this context, scientific progress has made it possible to look for energy sources that seek their profitability in hydroelectric developments, the *Houille Blanche* versus mineral fuel.

In Spain, these large industrial companies are mainly entrusted to the engineering discipline. The Salto del Esla dam was the largest in Europe in 1934, exemplifying the lack of architecture in the face of the exclusive development of civil engineering.

However, in 1940 Lagarde carried out the *Decoration Project for the Esla hydroelectric power plant,* an unprecedented circumstance that reveals for the first time the presence of an architect at the Ricobayo Dam.

His approach aimed to humanise this industrial architecture. As a member of GATEPAC he developed his knowledge of the Modern Movement, pursuing the modification of the system of relations between man and his environment in a clearly avant-garde attitude. He interpreted functionalism much more broadly than purely technical, bringing irony to the ability of science to supplant nature by transforming the space of the "Turbine House" with a new architectural content and language.

Lagarde did not propose to embellish the constructed forms of the existing industrial building, but instead to structure its tectonics by using the expressiveness of its structural and material solutions, humanising its mechanical nature. With the prominence of light as an architectural element, the natural light of the place and the light generated by
p.93 hydroelectric power, it builds a complex system of material, formal and symbolic relationships, incorporating emotion into the spatial experience of the interior and exterior.

Its new industrial architecture is able to synthesise the hydroelectric activity by recreating a new sensitive spatiality that evokes the analogy of temples, a new Temple of *Houille Blanch*e.

Roles CRediT:

José Ramón Sola Alonso (JRSA); Cristina Pérez Valdés (CPV). Conceptualization, methodology, analysis and preparation of the paper (JRSA 50,00% - CPV 50,00%). Authorship (JRSA 50,00% - CPV 50,00%).

All of the authors declare that there is no conflict of interest with the results of the study

Funding

This article deals with an architectural aspect of the Ricobayo Dam that originated the 'Florián de Ocampo' Research Award 2021, with the project *La Construcción del Embalse de Ricobayo. Expedientes de Expropiación y poblaciones desaparecidas: La Pueblica, Palacios del Pan and San Pedro de la Nave*, financed by the "Florián de Ocampo" Institute of Studies of Zamora. Iberdrola has also collaborated with the company to provide access and authorisation for the publication of historical documentation.

1 Real decreto de Concesión de los aprovechamientos del Duero. In: *Gaceta de Madrid*, de 24 agosto de 1926, n.º 236, p. 1156. Available at: https://www.boe.es/gazeta/dias/1926/08/24/pdfs/GMD-1926-236.pdf.

2 ORBEGOZO, José. Characteristics and brief description of the scheme for developing hydraulic power from two important groups of waterfalls in the basin of the river Duero, en VVAA. *The transactions of the first World power conference.* London: Percy Lund Humphries & CO LTD, 1925, vol. II, pp. 289-294.

3 *Archivo Histórico Iberdrola "Salto de Ricobayo"*.

4 There are many publications about the Ricobayo project, due to its historical and technical relevance. For this article, all those published in the Revista de Obras Públicas between 1925-1942 have been reviewed, which includes the engineers who participated in its execution, directed by Orbegozo. Equally, the texts correspond to AMIGO ROMÁN, Pedro; BUENO HERNÁNDEZ, Francisco; CALLIS FREIXAS, Eduard; CHAPA IMAZ, Álvaro and DÍAZ MORLÁN, Pablo.

5 MACHIMBARRENA, Vicente. *Orbegozo. Historia de un ingeniero*. Madrid: Saltos del Duero, 1941, p. 188.

6 SOLA ALONSO, José Ramón. Ponencia invitada: Cemento, agua y piedra. Materiales de la memoria de Ricobayo. In: *II Jornadas Interdisciplinares Náyade. La memoria del agua. Patrimonio y obras públicas en la España del siglo XX*. Santiago de Compostela, 18-20 de abril de 2023. Universidad de Santiago de Compostela. Available at: https://cispac.gal/es/posts-actualidade/ii-jornadas-interdisciplinares-nayade-la-memoria-del-agua-patrimonio-y-obras-publicas-en-na-espana-del-s-xx/.

7 *Houille Blanche* describes to the new hydroelectric energy, popularized in the last quarter of the 19th century apparently by Camillo de Cavour, although the author is probably the engineer Aristide Bergès. CAVAILLÈS, Henri. *La Houille blanch.* Paris: Colin, 1922, pp. 3-4. Available at: https://www.persee.fr/doc/geoca_1164-6268_1930_num_6_2_6910. La primera vez que se publica esta expresión en España es en 1897. *Madrid Científico. Revista de ciencias, ingeniería y electricidad*. Madrid, 1897, n.º 157, p.1109.

8 Biographical data from MARTÍN-CALERO, Manuel; PAGOLA LAGARDE, Eduardo. Eduardo Lagarde. Arquitecto, pintor y promotor del Arte Guipuzcoano. In: *Donostia eta gipuzkoari buruzko azterketa historikoen buletina*. Astigarraga: Kutxa Fundazioa, 2023, n.º 57, pp. 113-153. ISSN 2794-0497, excepto cuando se especifique expresamente otra procedencia. Available at: https://kutxafundazioa.eus/sites/default/files/57_Azterketa-Historikoen-buletina_Boletin-de-Estudios-Historicos.pdf

9 NAVASCUÉS PALACIO, Pedro. El Hotel María Cristina y su arquitectura. In: *Rehabilitación del Hotel María Cristina. San Sebastián* [online]. Madrid: Dragados, 1989, p. 8. [accessed: 05-03-2024]. Available at: https://oa.upm.es/7939/.

10 SOLÁ MORALES, Ignasi. *Eclecticismo y vanguardia. El caso de la Arquitectura Moderna en Catalunya*. Barcelona: Gustavo Gili, 1980, pp. 25-26. ISBN 978-84-252-1949-8

11 FULLAONDO, Juan Daniel; MUÑOZ, María Teresa. *Historia de la arquitectura contemporánea española, T-I Mirando hacia atrás con cierta ira (a veces).* Madrid: Munillalería, 1995, p. 378. ISBN 84-89150-04-4.

12 AGUIRRE, Peio. Relato de una modernidad singular. In: *Una modernidad singular: "arte nuevo" alrededor de San Sebastián, 1925-1936* [online]. Madrid: Editorial La Fábrica, 2016, p. 8 [accessed: 25-03-2024]. ISBN 978-84-16248-79-7. Available at: https://www.academia.edu/36822332/.

13 SANZ ESQUIDE, José Ángel (1988-05-30). *La tradición de lo nuevo en el País Vasco. La arquitectura de los años treinta* [en línea]. Tesis Doctoral. Director: Josep María Rovira Gimeno. Universitat Politècnica de Catalunya: Escola Tècnica Superior d'Arquitectura de Barcelona, 2008, p. 139. ISBN 978-84-691-3448-1 [accessed: 10-03-2024]. Available at: http://hdl.handle.net/10803/5860.

14 FULLAONDO, Juan Daniel; MUÑOZ, María Teresa. *Historia de la arquitectura contemporánea española, T-II Los grandes olvidados*. Madrid: Munillalería, 1995, p. 172. ISBN 84-89150-04-4.

15 LAINEZ ALCALÁ, Rafael. Arquitectura y poesía en la Exposición de Eduardo Lagarde. In: *Revista Nacional de Arquitectura*. Madrid: Colegio oficial de Arquitectos de Madrid, julio de 1944, n.º 31, pp. 240-248. Available at: https://www.coam.org/media/Default%20Files/fundacion/biblioteca/revista-arquitectura-100/1941-1946/docs/revista-completa/revista-nacional-arquitectura-1944-n31.pdf.

16 AIZPURUA, José Manuel. In: *Nueva forma: arquitectura, urbanismo, diseño, ambiente, arte.* Dedicado a Jose Manuel Aizpurua, 1904-1936. Madrid: Nueva Forma, 1969, n.º 40, pp. 30-34. ISSN 0029-5825.

17 LAGARDE, Eduardo. Proyecto de Decoración de la central hidroeléctrica del Esla. In: *Archivo Histórico Iberdrola "Salto de Ricobayo de Muelas del Pan"*.

18 The collaborations have been reviewed on piece of information by CALLIS FREIXAS, Eduard. *Arquitectura de los Pantanos en España*. Sevilla: Universidad de Sevilla, 2021; CARBAJAL-BALLELL, Nicolás. *El Salto del Jándula. Andújar*, 1927. Archivos de arquitectura España siglo XX. Almería: Colegio Oficial de Arquitectos de Almería, 2014; MOLINA SÁNCHEZ, Javier. *Patrimonio industrial hidráulico. Paisaje, arquitectura y construcción en las presas y centrales hidroeléctricas españolas del siglo XX* [online]. Director: Fernando Vela Cossio. Tesis Doctoral. Universidad Politécnica de Madrid, ETS de Arquitectura, Dpto. de Composición Arquitectónica, 2015 [accessed: 20-09-2023]. Available at: https://doi.org/10.20868/UPM.thesis.42851: and PÉREZ MARREO, Jenny. *Catálogo de presas españolas anteriores a 1926 asociadas a procesos industriales. Tomo II* [online]. Madrid: Instituto del Patrimonio Cultural de España, 2017, p. 582 [accessed: 23-11-2023]. Available at: https://www.culturaydeporte.gob.es/planes-nacionales/dam/jcr:3be674a7-fa63-4b9b-8e8f-567bc321b3ee/tomo-1-1-comprimido.pdf.

19 Mengemor is the acronym of the founding civil engineers in 1904, Carlos Mendoza, Antonio González Echarte and Alfredo Moreno Osorio with the family Crespi de Valldaura and Otamendi. BERNAL RODRÍGUEZ, Antonio-Miguel Ingenieros-empresarios en el desarrollo del sector eléctrico español Mengemor, 1904-1951. In: *Revista de historia industrial* [online]. Barcelona: Universidad de Barcelona, 1993, n.º 3, p. 95 [accessed: 30-09-2024]. ISSN-e 2385-3247. DOI: https://doi.org/10.1344/rhi.v0i3.18207. Orbegozo coincide con González Echarte en clase de electricidad en la Escuela de Minas. MACHIMBARRENA, Vicente, op. cit. supra, note 1, p. 39.

20 Vicente Machimbarrena Gogorza is María Juana Machimbarrena Echave´s nephew, who is engineers Miguel and José María´s mother and architects Joaquín and Julián Otamendi.

21 SOBRINO SIMAL, Julián. Casto Fernández-Shaw: ¡Un arquitecto que proyecta presas! In: GARCÍA PÉREZ, María Cristina; CABRERO GARRIDO, Félix, ed. *Casto Fernández-Shaw: arquitecto sin fronteras: 1896-1978*. Catálogo de exposición. Madrid: Ministerio de Fomento; Junta de Andalucía; Electa, 1999, p. 37. NIPO 161-99-060-X.

22 Ibíd., p. 4. the Salto del Esla is declared BIC categorized Monumento (BOE n.º 234 de 30 septiembre de 2003). MOSQUERA ADELL, Eduardo. *La cultura del agua en la imagen patrimonial de Andalucía*. Sevilla: Universidad de Sevilla, 2015, p. 66. ISBN-e 978-84-472-1669-7. Available at: https://editorial.us.es/es/descarga/719243?f=pdf.

23 CARBAJAL-BALLELL, Nicolás. Evolución del proyecto del Salto del Jándula. Proceso de integración de la central hidroeléctrica en el cuerpo de presa. In: *Informes de la Construcción* [online]. Madrid: CSIC, 2019, vol. 71, n.º 554, e294.. ISSN-L: 0020-0883. https://doi.org/10.3989/ic.63725.

24 GARCÍA PÉREZ, María Cristina, op. cit. supra, note 21, p. 17.

25 GARCÍA PÉREZ, María Cristina, op. cit. supra, note 21, p. 17.

26 Editorial of the first issue of the review FERNÁNDEZ SHAW, Casto. Nuestro propósito. In: *Cortijos y rascacielos: arquitectura, casas de campo y decoración*. Madrid: [s.n.], verano de 1930, n.º 1, p. 1.

27 Saltos del Duero y la economía española. Un avance gigantesco en la producción de energía eléctrica. In: *El Castellano, Diario católico de información,* 4 de octubre de 1932, n.º 7304. Available at: https://descargasarchivo.toledo.es/high.raw?id=0000020323&name=00000001.original.pdf&attachment=El+Castellano.+4%2F10%2F1932%2C+n.%C2%BA+7.304..pdf.

28 LANDECHO Y URRIES, Luis de. In: *Discursos leídos ante La Real Academia de Bellas Artes de San Fernando*. Madrid: Real Academia de la Historia, 18 de junio de 1905, p. 12. Available at: https://www.realacademiabellasartessanfernando.com/assets/docs/discursos_ingreso/Landecho_y_Urries_Luis_1905.pdf.

29 ANASAGASTI, Teodoro de. El arte en las construcciones industriales. In: *Arquitectura y construcción* [online]. Barcelona: Universidad Politécnica de Cataluña, julio de 1914, n.º 264, p. 151 [accessed: 30-09-2024]. ISSN 1887-5351. Available at: https://dialnet.unirioja.es/descarga/articulo/4018994.pdf.

Cristina Pérez Valdés (0000-0002-5344-2529) "Arquitectura industrial en las publicaciones de posguerra de los Estados Unidos de América" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 29-04-2024 / ACCEPTED 12-09-2024
 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.04

30 LAPRADE, M. Arquitectura Industrial. *Revista Nacional de Arquitectura*. Madrid: Colegio oficial de Arquitectos de Madrid, febrero-marzo de 1951, n.º 110-111, pp. 9-15. Available at: https://www.coam.org/media/Default%20Files/fundacion/biblioteca/revista-arquitectura-100/1946-1958/docs/revista-articulos/revista-nacional-arquitectura-1951-n110-111-pag09-15.pdf.

31 MACHIMBARRENA, Vicente. Arquitectura e Ingeniería. In: *Revista de Obras Públicas*. Madrid: Colegio de Ingenieros de caminos canales y puertos, 1924, n.º 2397, pp. 17-21. Available at: https://quickclick.es/rop/pdf/publico/1924/1924_tomol_2397_01.pdf.

32 Conference at the Instituto de Ingenieros Civiles el 26 de noviembre de 1940. *La Voz de España-diario tradicionalista.* San Sebastián, 27 de noviembre de 1940, n.º 1299.

33 In the historical graphic documentation, the absence of the core of vertical communications of the "Casa de Administración" is guessed, but for documentary fidelity, the three temporary situations are represented without providing new elements.

34 VALERO RAMOS, Elisa. *La Materia Intangible. La luz en arquitectura*. Valencia: Ediciones Generales de la Construcción, 2004. ISBN 84-933540-1-5.

35 FERNÁNDEZ SHAW, Guillermo. Toledo de noche. In: *Cortijos y rascacielos: arquitectura, casas de campo y decoración*. Madrid: [s.n.], julio-agosto de 1944, n.º 24, pp. 2-3.

J. R. SOLA ALONSO, C. PÉREZ VALDÉS "El templo de la *Houille Blanche* de Lagarde en la presa de Ricobayo" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 29-04-2024 / ACCEPTED 12-09-2024

– DOI http://dx.doi.org/10.12795/ppa.2024.i31.04

J. R. SOLA ALONSO, C. PÉREZ VALDÉS "El templo de la *Houille Blanche* de Lagarde en la presa de Ricobayo" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 29-04-2024 / ACCEPTED 12-09-2024
 DOI http://dx.doi.org/10.12795/ppa.2024.i31.04

Ó. FUERTES DOPICO ET AL. "Arquitectura industrial en las publicaciones de posguerra de los Estados Unidos de América" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 01-04-2024 / ACCEPTED 14-09-2024
Con licencia CC BY-NC-SA 4.0 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.05

ANÁLISIS DEL PATRIMONIO MARÍTIMO INDUSTRIAL GALLEGO

ANALYSING GALICIAN MARITIME INDUSTRIAL HERITAGE

Óscar Fuertes Dopico (0000-0003-0411-7444)
Iago Fernández Penedo (0009-0005-7974-1219)
Carmen Fabregat-Nodar (0009-0001-1626-9675)

p.97 INTRODUCTION

After the failure, because of a variety of political and economic reasons, of the first industrialization of Galicia, which was based on the working of linen and iron, the single most important industrial vestige of the last third of the 19th century are tanneries (usually on rivers) and sardine salting factories on the coast[1]. The true Galician industrial development, however, did not occur until the first third of the 20th century with the fish canning industry[2], which relied on a fabric of sea trades that had been developing since ancient times and with which it had coexisted: fishing and shell fishing, timber production and shipbuilding.

The Spanish National Plan for Industrial Heritage defines industrial heritage as '*the suite of movable and immovable assets and sociability systems associated with the working culture generated by the extraction, transformation, transport,*
p.98 *distribution and management activities of the economic system that emerged from the 'industrial revolution'*[3]. In the case of Galicia, therefore, the activities prior to the first third of the 20th century may be considered protoindustrial as they were linked to traditional trades and meet the two characteristics that, according to González Enciso[4], define Spanish protoindustrialization: it is a rural industry and, in its production, people associated with agriculture are also involved. In Galicia, however, there is the particularity that these two protoindustrial characteristics have remained true to this day. First, because a direct dependence on the sea means that factories in the sector need to be located on the coastline, thus preventing their concentration on urban areas as it is the case with other industrial sectors[5]. And secondly, because the structure of property and small land holding are at the heart of the idiosyncrasy of Galician families where subsistence agriculture coexists with working in other sectors, even in the 21st century[6].

The definition of industrial heritage continues: '*These assets have to be understood as an integral whole comprised of the landscape in which they stand, the industrial relations that structure them, the architectures that characterise them, the techniques used in their procedures, the archives generated during the activity and their symbolic practices'*[7]. On the other hand, the maritime heritage comprises, according to Dionisio Pereira[8], the small premises of the sea industries, along with the objects and immaterial creations associated to their activities. Therefore, in this study, all the buildings arising from or associated with the production of sea trades in Galicia as part of the maritime industrial heritage were considered. Also, architectures are linked to the landscape in which they stand and the memory they bear witness to. By linking and studying them together, we underscore the singularity of a heritage that preserves the atmosphere of the activity it houses and the identity of the territory where it stands: the Galician coastline, a complex line that stretches some 2500 km[9] washed by the Atlantic Ocean and the Cantabrian Sea.

In this geographic, economic and social context, marine industries erected essential buildings free from aesthetic prejudices where form is the efficient result of the function and the adaptation to context[10]. These buildings change the environment. They appropriate it. Thanks to a knowledge of the terrain, a respect for tradition and the use of local raw materials, buildings are erected with a system closely linked to the territory with the precision and efficiency of industrial techniques, leaving a clear mark of human activity. Both the buildings and the settlements of coastal population are commensurate to the scale of their location and share common patterns of growth on the basis of their placement on the coastal line, their insertion within the terrain, the sea-industry connection they establish and the business model prevailing at the time they were built.

CASE STUDY

In the catalogue of industrial buildings of the Galician coast, some common characteristics can be seen which, according to Carmona[11], are: dependence on the sea and a link with natural resources that means that these two elements determine their location; moderate dimensions and ambitions; current status as disused constructions with the associated risk of disappearance; and the typological value and uniqueness of the buildings. It is not, however,
p.99 a homogeneous whole as these architectures correspond to different industrial activities, which is reflected in their typological features.

In this context, the need arises to conduct a study that underscores the specificities of each typology and the common characteristics of the whole from the perspective of industrial architecture. The main objective of this article, therefore, is to study and comparatively analyse different, representative instances of the maritime industrial heritage of Galicia in order to have a broad overview and be able to make a global reflection and a critical analysis of the current situation and the future prospects. The following are the specific objectives: understanding the heritage value of the assets studied and the value of the landscape in which they stand; and understanding their state of conservation both as individual pieces and as part of a cultural ensemble.

A qualitative methodology of descriptive and comparative analysis of all seven cases was used. The aim is to encompass the representativity of the different typologies, times, geographical contexts and current use and conservation status. The Plan for Galician Maritime Heritage (PCUMA)[12] lists nine types of industrial architecture under the categories of immovable properties. The criterion for the selection of cases for this study relies on the selection of instances across different areas of the Galician coast, all of them catalogued in the Regional Basic Plan[13], which are representative of the six building types of industrial architecture in the PCUMA (Figure 1): shipyards and shipwrighting, canning factories, salting factories, whaling stations, tide mills and timber mills; and by way of example of the types which do not require a building for their industrial activity: mussel rafts, fisheries, and spaces for aquaculture and **p.100** shellfish farms.

An analysis of the location and the link between architecture and the coastline is made for each individual case as well as of its definition as maritime industrial heritage and of its current use and conservation status.

1. A Insua Shellfish Farm, in Rinlo (Ribadeo, Lugo)

Location. *A Insua* shellfish farm, also known as *de Penacín*, is located at a natural cove with cliff walls between 8 and 10 metres, close to the village of Rinlo. This village flourished in the early decades of the 20th century as it was used as a whaling port[14]. In the vicinity there are two smaller shellfish farms[15].

Maritime Industrial Heritage. Shellfish farms are hatcheries, usually of shellfish, located in places where the physical conditions make it possible to create protected enclosures[16]. In this case (Figure 2), two stone walls with organic shapes were built in the first decade of the 20th century. They blend in with the environment, face the force of the sea while allowing water to enter in a controlled way by using sluices. As a result, a pool was created. It was protected by a roof supported by a structure of pillars and stone beams. A staircase allows access to land from the **p.101** sea. There is an ancillary building housing offices in the property[17] and a perimeter wall closes the compound. Special mention deserves the efficiency of the small intervention in the landscape, which results in a most fruitful use of the resources available.

Current state. The shellfish farm remained active until the 1990s. Currently (Figure 3) abandonment and the pounding of the waves have gradually deteriorated the compound. The meadows and the crop fields around remain unchanged, though. The walls enclosing the pool as well as some pillars and beams, part of the staircase, the ancillary building and the perimetral wall as a whole are preserved. The property is publicly owned, and it is the intention of the authorities, according to the catalogue of municipal planning[18] to restore the shellfish farm for touristic, educational and recreational purposes. In 2010 a project was passed that included the adaptation of this and two other nearby shellfish farms (one of them had been restored in 2001) and the construction of a connecting trail with the village[19], as **p.102** part of a project seeking to promote an appreciation of these heritage elements by giving them new uses. This project, however, never came to fruition and the abandonment of the shellfish farm puts its integrity at risk.

2. Whaling station at Caneliñas (Cee, A Coruña)

Location. Caneliñas is a sandy area at the bottom of a small inlet on the southern end of *Costa da Morte*. It is a strategic location: a protected inlet in a transit area for whales and sperm whales, away from any urban area. There used to be a salting factory there, and locals were familiar with seafaring trades.

Maritime Industrial Heritage. Whaling factories are located at a maximum distance of 22 hours by ship from the area where the whales are captured. They have a ramp directly connected to the *plaza*, a large area where whales are cut. Other, more compartmentalised rooms house the boilers for oil generation, grinding areas for the preparation of flours, warehouses, reservoirs, and ancillary services. In its early days, in 1924, all there was in Caneliñas for this activity was a quay and a ramp at one end of the beach with several stone buildings. Later, (Figure 4) the main building, which is connected to the ramp, was erected. It has large open spaces thanks to its structure of concrete. In its time, this compound was one of the largest whaling stations in the Iberian Peninsula[20], and was the last one to close in Europe in 1985.

Current state. Since it closed down, there has been no intervention on the compound. Its surrounding area has not changed since then, either. The factory enclosure is fenced and inside dereliction and vegetation threaten the stability of the huge, dismantled warehouses and the oil tanks (Figure 5). On one side of the sandy area, the stone ramps that received the freshly captured animals can still be seen, also in a process of decay. The factory is privately owned. Its owners have expressed their intention to use it for touristic purposes while the authorities are working on enhancing its significance as heritage.

3. Salting factory at Casais, in Quilmas (Carnota, A Coruña)

Location. On a stretch of the Galician coastline that is very exposed, there are two adjacent sandy areas in a small natural bay that provide shelter to sardine fishing boats. This led to the formation of the townlet of Quilmas, where there is documental evidence of the existence of six salting factories and other ancillary buildings.

Maritime Industrial Heritage. Salting factories are ground-floor rectangular buildings with a central patio that organises spaces and processes, built with outer stone walls and inner pillars, also of stone that support wooden

Ó. FUERTES DOPICO ET AL. "Arquitectura industrial en las publicaciones de posguerra de los Estados Unidos de América" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 01-04-2024 / ACCEPTED 14-09-2024
 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.05

roof structures, generally gable roofs. The dwelling of the *fomentador* or enterpriser controls the industrial processes from one of the short sides of the rectangle, and in some cases, it consists of two floors. On the opposite side, there are warehouses and workshops. The long sides of the rectangle house, at one side, the tanks for salting sardines, *píos*: granite vessels some 2.5 m long and 1.8 m deep, fitted on the ground and with wooden lid and on the other side, the *muerto*, where the already salted fish is pressed and packed[21]. The salting factory of Casais (Figure 6) is a paradigmatic example of this type of construction that dates back to mid-19th century.

Current state. In the second decade of the twentieth century this factory was no longer in operation. It was used as
p.104 a warehouse for fishing materials[22]. Nowadays, the dwelling and the warehouses have been restored and are privately owned. The dwellings of other three factories in the townlet of Quilmas, which had fallen into disuse also at that time (Figure 7), have been restored too. The outer walls of the enclosure, some of the stone pillars that demarcated the patio, the *píos* and the bases of the pressing mechanism remain in a state of consolidated ruin. In other of the four factories part or all the *píos* and outer walls have survived, which makes it possible to perfectly convey the essence of the whole compound that remained unchanged since the time of the construction of the factories.

4. O POZO DE CHACÓN TIDE MILL, AT SERRES (MUROS, A CORUÑA)

Location. At the bottom of the inlet of Muros, at the mouth of River Valdexería, there is a cove with a wide intertidal area where a number of sea-related activities thrived.

Maritime Industrial Heritage. Tide mills are usually constructed in inlets so that they can store water when the tide rises and release it when the tide falls. This way the milling mechanism can be operated at any time of the year, regardless of seasonal fluctuations in river flows. The first drawings for the construction of the Muros tide mill date
p.105 back to 1815, but it the first documental references of its existence and operation are from the 1830s[23]. A stone dam some 230 m long closes the bottom of the inlet, thus allowing the passage of water through the manually actuated wooden sluices and through the stone arches on which the mill is erected. It is a building in the shape of an elongated rectangle (Figure 8) with two floors, stone loadbearing walls and a wooden interior structure. The building is divided into two sections: one is the milling area and the other is the storage area. Its distinctive characteristic is its two large stone chimneys, which show that it was also an oven.

Current state. *Pozo do Chacón*, after a succession of owners, was abandoned in the 1920s when electric mills were installed in the municipality, thus falling into decay and ruin. Currently, (Figure 9) it is owned by the town council of Muros, which in 1990, began restoration works of both the building and the dam that gives access to it and its surrounding area. In 2005, its restoration was completed and it underwent a musealization process[24], which turned it into an ethnographic museum and cultural centre in a much more urbanised environment than a century ago.

5. O Engano Timber Mill, at Punta do Engano (Outes, A Coruña)

Location. The Inlet of O Engano, in Outes, at the bottom of the Estuary of Muros-Noia, is a sheltered spot, away
p.106 from populated areas, half-way between timber resources areas and areas where shipbuilding and fish-processing industries were located. These circumstances led to the establishment of other timber mills also in this same area.

Maritime Industrial Heritage. Traditional timber mills are located close to water courses, which they used as motive power for the saws. They usually include outdoor spaces for drying and storing timber, open-plan warehouses for cutting and processing, partitioned ancillary spaces and tall chimneys. At the timber mill of O Engano (Figure 10), with the construction of a seawall, a platform for the storage of raw material was created as well as an anchorage area and a loading dock. The two adjoining open-plan warehouses consist of a brick load-bearing structure and a gable wooden roof truss structure and another, smaller transverse warehouse with the same structural system that houses the boilers and other ancillary rooms. The brick chimney rises on the side of the compound becoming a landmark in the local landscape.

Current state. Nowadays, the timber mill remains privately operated under concession and with very low workload and premises in poor condition (Figure 11). Over the course of its operating history, it has undergone alterations to the external appearance of enclosures and roofs. Both the main warehouses and the chimney are still standing in a state of advanced deterioration, but the transverse warehouse and the sheds on the coastal front are in a state of ruin. The surrounding area has suffered a significant degradation win the construction in 2010 of the AC-554 Viaduct, the pillars of which stand on the edge of the plot where the timber mill is located.

6. Acuña traditional shipyard, in Cobres (Vilaboa, Pontevedra)

Location. At the parish of San Adrián de Cobres, on the inlet of San Simón, at the end of the estuary of Vigo, there is an anchorage with a wide intertidal area which is optimal for sea-based activities. There is evidence of activity of several shipwrights in the area, although not all of them built their shops there.

Maritime Industrial Heritage. The construction and reparation of ships, the trade of shipwrights, was an itinerant occupation in sheltered spots across the coast. When the demand for the construction of ships rose, some artisans opted for a fixed location to work and constructed shipyards. The essential characteristics of this type of constructions
p.108 are[25]: they are located on land where the coastline has been modified by the construction of walls or ramps; they consist of a *tinglado* – a platform or large space – where ships are built. This is a wooden structure which may or may not have fences, also of wood; and other buildings or annexes that are used for ancillary functions. The shipyard of

Ó. FUERTES DOPICO ET AL. "Arquitectura industrial en las publicaciones de posguerra de los Estados Unidos de América" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173-1616 – RECEIVED 01-04-2024 / ACCEPTED 14-09-2024

Acuña (Figure 12) began to operate in 1914 with the *tinglado*, a high, diaphanous space with a gable roof. By mid-20th century, one of the gables was stretched thus creating a space with a lower ceiling that houses the saws, the workshop and the offices. The only side that is closed, the southern side, originally consisted of wooden collapsible enclosures for ventilation. The property also has a small warehouse, a wood yard, a seawall that delimits the work platform, and the slipway or sloping platform for working on and launching boats. The slipway was initially made of stone but in 1945 it was replaced by one of concrete and metal rails.

Current state. The shipyard (Figure 13) remains inactive. Some repair work, however, is conducted sporadically as the bearing structure is in good state of preservation. In fact, although part of the original fencing has been replaced by more modern elements, this is the only facility of its kind that is still standing in the area. Other heritage elements have been obliterated by the major changes that the coastline has undergone and the urban pressure in the area with reclaimed land and marinas.

7. Massó Canning Factory, at O Salgueirón (Cangas, Pontevedra)

Location. O Salgueirón is on a small inlet very close to the Estuary of Vigo, where there used to be a salting factory. It is very near the village of Cangas, an area with strong links to the fishing and canning industry and relatively close to the original Massó factory in Bueu.

Maritime Industrial Heritage. By late 19th century, the traditional canning industry underwent a profound transformation. Its production levels increased, thus becoming a modern industrial sector. Small traditional canning factories needed to transform themselves into factories adapted to the new demands. They remained linked to the coastline to ensure access to goods, but they added large diaphanous spaces thanks to the use of construction systems, techniques and materials that are used in engineering. Besides, these new factories sought to symbolically reflect the value of the company in the building. This results in buildings that are comparable to the great works of industrial heritage found in the rest of Europe. The Massó factory in Cangas (Figure 14) was designed in 1935 by engineer Tomás Bolíbar Sequeiros and architect Jacobo Stens Romero and was completed in 1941[26]. Its main building, with modernist and rationalist influences, stands out for its geometrical abstraction, its corner tower that rises p.109 some 20 m and the large glass areas on the facades. Built with a structure of reinforced concrete and trusses of riveted steel, it is divided inside into four, two-storey longitudinal units with gabled roofs. The industrial compound includes everything that is required for developing its activity: docks, boatyard, cold stores, packaging factory, changing rooms, kitchen canteen, company shop, dwellings for workers and even a crèche. At the time of its opening in 1941, the compound was one of the largest canning factories in the world.

Current state. In 1996 the canning factory definitively closed down marking the beginning of a long period of abandonment that has continued to this day. The major changes to the coastline as a consequence of building of the p.110 factory (construction of dams, reclaimed land, ramps, etc.) contrast with the few changes seen ever since. Currently (Figure 15) the state of conservation of the units is very deficient. Their advanced, general state of deterioration endangers the stability of the whole ensemble.

DISCUSSION

Following the analysis of the seven case studies as individualised and significant elements, a cross analysis of the interrelation between them as part of the maritime industrial heritage of Galicia was made. To this end, a comparison was made of their landscape, heritage dimension as well as of their use, valorisation and conservation.

With regard to the relation of the examples studied with the place where they were built, it should be noted that, unlike other industrial activities, in this case, proximity to urban centres is not a priority. In some cases, this is deliberately avoided. This is the case of the whaling station (2) which was built away from any human settlement that could oppose the establishment of a noisy, polluting plant in their vicinity. Indeed, all the instances studied are located in areas that optimize the use of resources and proximity to raw materials. Resorting to this efficiency criterion explains the sprouting of settlements like Quilmas (3), where a number of factories specialising in the same sector were established or the reuse of some locations for similar activities, like the case of the Massó factory at Salgueirón (7).

All the cases studied made changes to the coastline whether by building retaining walls as in the case of the mill (4) or the shellfish farm (1) or by building platforms delimited by a seawall like the timber mill (5) or the shipyard (6) which also used ramps and docks. This is also true of the whaling station (2) and the canning factory (7). The only exception might be the salting factory (3) as no change to the coastline was made, but it used the proximity of the beach to utilise it as anchorage.

Architect Bernard Rudofsky coined the term *Architecture without Architects*[27] to refer to indigenous building traditions. If we analyse the buildings in the light of this notion, with the exception of the canning factory (7), which has known authors, we can see that it strips them of the past, of the traces of the generations to which this architecture mut be attributed. These instances of maritime industrial heritage 'without architects' are buildings that stem from a rational p.121 commitment with function and technique, escaping from intellectualism in their design and free from the unconscious projection of the personality of the author. These buildings, and the landscape associated with them, treasure the customs, techniques and needs of the maritime industry sector.

Of the cases studied, the factories that began to operate in the 19th century were the salting factory (3) and the mill (4), which fell into disuse in early 20th century when techniques were modernized, and electricity was introduced. The

Ó. FUERTES DOPICO ET AL. "Arquitectura industrial en las publicaciones de posguerra de los Estados Unidos de América" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 01-04-2024 / ACCEPTED 14-09-2024

Ó. FUERTES DOPICO ET AL. "Arquitectura industrial en las publicaciones de posguerra de los Estados Unidos de América" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173-1616 – RECEIVED 01-04-2024 / ACCEPTED 14-09-2024

factories which began to operate at a later time, however, had the opportunity to adapt and continued to operate. As a result, they underwent changes in their external appearance and spatiality to adapt to the changes in production and labour conditions. In any case, all these traditional factories are nowadays in a state of disuse and abandonment. Also abandoned are the trades they housed, with the danger this entails for the preservation of a maritime heritage rooted in the places where they are located and the societies that inhabit them. For instance, the factory of Caneliñas (2) is currently the only testimony remaining of the whaling industry in Galicia. Its advanced level of deterioration, therefore, is a cause for concern for the preservation of an activity that no longer exists.

It should be borne in mind, as Dionisio Pereira[28] points out, that the Galician maritime industrial heritage, besides its symbolic and identity value, is a strategic resource that may be developed to generate an economy that contributes to the improvement of the areas where it is located. This situation prompts the debate on the need to protect buildings and the restoration and rehabilitation options. Of all the cases studied, all of them catalogued, only the timber mill (5) has comprehensive protection under the current planning in force, but this protection is limited to its chimney. As to the management of the industrial heritage, according to the case study, public administrations in some cases develop rehabilitation projects and plans for public use and valorisation of heritage. Often these projects do not come to fruition for a variety of vicissitudes, though. When they are actually undertaken, they may become icons that represent the architectonic history of the maritime industrial heritage in Galicia and safeguards of local memory, like the tide mill Serres (4). In other cases, their private management results in the buildings, or at least part of them, being restored for private uses, like the salting factory at Quilmas (3), thus preventing their abandonment and preserving their pristine essence.

CONCLUSIONS

The case study sought to contextualise, extract the values and thoroughly analyse the current state of the Galician maritime industrial heritage. We are, however, aware that each of the buildings and typologies has its peculiar characteristics and therefore a more in-depth study would be required to draw conclusions that could be generalized.

From the analysis conducted, we drew evidence, on the one hand, of the potential of a worthy heritage as legacy and identity of the trades and industries associated with the sea, and, on the other hand, of the existence of a set of buildings that must be conserved and used as a resource with characteristic spaces and shapes which provide an opportunity to house activities with a clear social mission and bring about an intergenerational dialogue on the culture of the sea.

The study and dissemination of the maritime industrial heritage seeks to pave the way so that Galician society, from its political representatives to its youngest citizens, develop a greater interest in these buildings and their landscape. This would give rise to a social demand for their conservation, with the possibility of introducing new uses.

Historical heritage research is an indispensable tool for knowledge. But the fact of demanding a prior historical artistic report should have a direct result when it comes to valorising the buildings, their landscape and the proposal for their rehabilitation. Taking full advantage of post-industrial landscapes makes sense if we approach them with a philosophy that valorises ruins and abandoned objects as part of the landscape, without losing the memory of them, thus reinforcing the identity of the place.

Roles CRediT:

Óscar Fuertes Dopico (OFD); Iago Fernández Penedo (IFP); Carmen Fabregat-Nodar (CFN). Conceptualization, methodology, analysis and preparation of the manuscript (OFD 45% - IFP 30% - CFN 25%). Authorship (OFD 45% - IFP 30% - CFN 25%).

All of the authors declare that there is no conflict of interest with the results of the study.

Financing: This article arises from the results of European Project DORNA, cofinanced by the European Regional Development Fund (ERDF) and the Interreg Atlantic Area 2007-2013 (first call) of the European union; and research project *Valorización e estudo do patrimonio marítimo pre-industrial vinculado ós oficios do mar do bordo litoral da provincia da Coruña,* by Óscar Fuertes Dopico (Universidade da Coruña), financed by the Diputación Provincial de A Coruña by virtue of Research Grants BINV-EA / 2019 -field of engineering and architecture- Decision no 27189/2019.

1 CARMONA BADÍA, Xan. La industria en Galicia: un repaso historiográfico. In: *Storiografia d'industria e d'impresa in Italia e Spagna in Età Moderna e Contemporanea.* Padova: Coop. Libraria Editrice Università di Padova, 2004, pp. 375-397. ISBN 9788871788128.

2 CARMONA BADÍA, Xan. Lo material y lo inmaterial en el Patrimonio Industrial de Galicia. Notas sobre su situación y características. In: Miguel Ángel ÁLVAREZ ARECES, coord. *Patrimonio industrial y paisaje: V congreso sobre patrimonio industrial y la obra pública en España*. Gijón: CICEES, 2010, pp. 533-540. ISBN 978-84-936996-9-7.

3 Definition of Industrial Heritage, MINISTERIO DE EDUCACIÓN, CULTURA Y DEPORTE. *Plan Nacional de Patrimonio Industrial.* Madrid: Secretaría General Técnica, Subdirección General de Documentación y Publicaciones, 2015 pp. 11. Available at: https://www.cultura.gob.es/planes-nacionales/dam/jcr:88a504bd-a083-4bb4-8292-5a2012274a8c/04-maquetado-patrimonio-industrial.pdf.

4 GONZÁLEZ ENCISO, Agustín. La protoindustrializacion en España. In: *Revista de Historia Económica / Journal of Iberian and Latin American Economic History* [online]. Cambridge: Cambridge University Press, March 1984, volumen 2, n.º 1, pp. 11-44 [consultedd: 30-09-2024]. ISSN 0212-6109. DOI: http://dx.doi.org/10.1017/S021261090001288X.

5 FUERTES DOPICO, Óscar; Iago FERNÁNDEZ PENEDO, Francisco VARELA LOJO. Las arquitecturas de los oficios del mar: sus construcciones y estructuras arquitectónicas como objeto a regenerar. In: Miguel Ángel ÁLVAREZ ARECES, Silvia BLANCO AGÜEIRA & Antonio Santiago RÍO VÁZQUEZ, eds. *Patrimonio industrial en el contexto de la sostenibilidad: repercusiones medioambientales, paisajes de la industrialización, estrategias de regeneración y turismo industrial.* Gijón: TICCH España, 2017, pp. 273-289. ISBN 978-84-945966-5-0.

6 CARMONA BADÍA, Xan, op. cit. supra, note 2.

7 MINISTERIO DE EDUCACIÓN, CULTURA Y DEPORTE, op. cit. supra, note 3, p. 11.

8 PEREIRA GONZÁLEZ, Dionisio. *O patrimonio marítimo de Galicia*. ISBN 978-92-0-286060-5. Cambados: Federación Galega pola Cultura Marítima, 2000, pp. 10

9 Exactly 2555 kilometers, considering not just the 1659 km of continental coastal perimeter but also the 432 km around the hundreds of islands and islets and the 464 km of marshes and sandy aeras in accordance with ACT 4/2023, of 6 July on the integrated planning and management of Galicia's coastal line. Available at: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2023-19356.

10 CALO LOURIDO, Francisco. *Vida e traballo no mar dos galegos*. Santiago de Compostela: Museo do Pobo Galego, 2019, p. 49. ISBN 978-84-88508-63-8.

11 CARMONA BADÍA, Xan, op. cit. supra, note 2.

12 XUNTA DE GALICIA. *PCUMA. Plan da cultura marítima de Galicia. Horizonte 2030.* Santiago de Compostela: Consellería do Mar, 2023, p. 79. Available at: https://www.udc.es/export/sites/udc/planculturamaritima/_galeria_down/PCUMA_Documento_Marco_Anexos.pdf_2063069294.pdf.

13 CONSELLERÍA DE VIVIENDA Y PLANIFICACIÓN DE INFRAESTRUCTURAS. Decision of 17 June 2024, by the Directorate General for Urban Planning whereby the sixth updated version of the Regional Basic Plan of Galicia is approved, IN: *DOG,* 28 June 2024, n,º 125, p. 39785. Available at : https://www.xunta.gal/dog/Publicados/2024/20240628/AnuncioG0765-180624-0001_es.html.

14 CALO LOURIDO, Francisco, op. cit. supra, note 10., p. 88.

15 LLANO CABADO, Pedro de; BAS LÓPEZ, Begoña; FUERTES DOPICO, Óscar. *Arquitecturas del mar*. A Coruña: Fundación Universidade da Coruña, 2014. ISBN 978-84-697-0797-5.

16 GARCÍA-LOUZAO ARAUJO, David. Arquitecturas Batientes. In: *BAc Boletín Académico. Revista De investigación y Arquitectura contemporánea* [online]. A Coruña: Universidad de A Coruña, diciembre 2023, volumen 13, pp. 64-73 [consulted: 30-09-2024]. ISSN 0213-3474. DOI: https://doi.org/10.17979/bac.2023.13.0.10193.

17 Ídem.

18 CONSELLERÍA DE MEDIO AMBIENTE, TERRITORIO E INFRAESTRUCTURAS. Orden de 14 de noviembre de 2014 de aprobación definitiva del Plan general de ordenación municipal de Ribadeo (Lugo). In: *DOG*, 1 December 2014, n.º 230, p. 49113. Available at: https://www.xunta.gal/dog/Publicados/2014/20141201/AnuncioCA02-211114-0006_es.html.

19 Green paper 161/001910 submitted by the Grupo Parlamentario Mixto, with regard to the Project of the so-called Rinlo¡s Shellfish Farms Trail in Ribadeo (Lugo) to the Environment, Agriculture and Fishing Committee. BOE 5 October 2010, serie D, n.º 453.

20 AGUILAR, Álex. *Chimán. La pesca ballenera moderna en la península ibérica*. Barcelona: Publicancions i edicions de la Universitat de Barcelona, 2013. pp. 97-124; pp. 227-305. ISBN 978-84-475-3763-1.

21 LLOVO TABOADA, Santiago. *As salgaduras de Carnota*. Santiago de Compostela: Meubook, SL. 2017. ISBN 978-84-946537-8-0.

22 LLOVO TABOADA, Santiago. op. cit. supra, note 20.

23 BAS LÓPEZ, Begoña. Las primeras menciones de molinos de mareas de Galicia. In*: Llull: Revista de la Sociedad Española de Historia de las Ciencias y de las Técnicas* [on line]. Madrid: Sociedad Española de Historia de las Ciencias y de las Técnicas, 1990, vol. 13, n.º 24, pp. 43-56 [consulted: 30-09-2024]. ISSN 0210-8615. Disponible en: https://dialnet.unirioja.es/servlet/articulo?codigo=62069.

24 ANAYA DÍAZ, Jesús; VOLPINI, Pilar. Rehabilitación dos muíños de Maré do Pozo do Chacón. In: *Obradoiro: revista de arquitectura y urbanismo* [on line]. Santiago de Compostela (A Coruña): Colexio Oficial de Arquitectos de Galicia, 1994, n.º 23, pp. 64-77 [consulted: 30-09-2024]. ISSN 0211-6065. Available at: http://obradoirodixital.gal/index.php/anteriores/numeros-anteriores/obradoiro-23.

25 FUERTES DOPICO, Óscar. *Las carpinterías de ribera en Galicia: la recuperación de sus arquitecturas*. Thesis supervisor: Joaquín Fernández Madrid. Doctoral Thesis. Universidad de A Coruña, Departamento de Construcións Arquitectónicas, 2015. Available at: https://ruc.udc.es/dspace/handle/2183/15768.

26 SOBRINO FAGILDE, Iria. Arquitectura industrial en Vigo. En: *Arquitectura industrial en la provincia de Pontevedra*. Vigo: COAG Vigo, 2008, p. 75. Available at: https://noncommon.wordpress.com/wp-content/uploads/2012/04/00-a-indyarq_1-393_low.pdf.

27 RUDOFSKY, Bernard. *Architecture without architects, an introduction to non-pedigreed architecture*. New York: The Museum of Modern Art, Distributed by Doubleday Garden City, 1964. ISBN 9780826310040.

28 PEREIRA GONZÁLEZ, Dionisio; Una visión estratégica del patrimonio marítimo: comparativa entre Catalunya, Euskadi y Galicia. In: *Itsas Memoria. Revista de Estudios Marítimos del País Vasco* [on line]. Donostia-San Sebastián: Diputación Foral de Guipúzcoa y Museo Naval, 2009, n.º 6, p. 24 [consulted: 30-09-2024]. ISSN 1136-4963. Avaliable at: https://dialnet.unirioja.es/servlet/articulo?codigo=3295324.

Ó. FUERTES DOPICO ET AL. "Arquitectura industrial en las publicaciones de posguerra de los Estados Unidos de América" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 01-04-2024 / ACCEPTED 14-09-2024

ARQUITECTURAS INDUSTRIALES Y TRANSFORMACIÓN CREATIVA. TRES CASOS DE ESTUDIO EUROPEOS

INDUSTRIAL ARCHITECTURES AND CREATIVE TRANSFORMATION. THREE EUROPEAN CASE STUDIES

Safiya Tabali (0000-0001-9515-7243)
José Manuel Romero Ojeda (0000-0002-7026-1324)
María F. Carrascal Pérez (0000-0001-8194-9995)

S. TABALI ET AL. "Arquitecturas industriales y transformación creativa. Tres casos de estudio europeos" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024

p.115 INTRODUCTION: SPACES OF PRODUCTION, SPACES OF OPPORTUNITY

The built fabric of many European cities is supported and modified by architecture with a productive component, as is evident from industrial, transport, supply, and marketing structures forming the list of the industrial heritage[1] mentioned above. Deindustrialisation led to the abandonment of a large number of industrial buildings[2] with important architectural and social attributes, as well as to the disappearance of professional sectors and ways of life that were deeply rooted in the neighbourhoods, environments and communities where these architectures were located[3]. In addition to material value, this confers intangible value to these enclaves, which serve as places of memory of now-defunct production processes, as well as of the workers and their daily lives. Some studies associate industrial heritage with a timeless value that is to be respected and maintained, interacting positively with the environment[4].

In the late 1990s, the disappearance of major industrial architectural works such as Les Halles in Paris —designed by Victor Baltard—, was met with a global trend which pushed for the protection and conservation of these buildings. The reasons for this were not just practical: efforts were already underway to adapt these architectures to other industrial
p.116 functions. This was also seen as a solution to the abandonment and underuse of this emerging heritage[5]. This shift in perspective and the consequent valorisation of these architectures in international charters was consolidated by the creation of the International Committee for the Conservation and Defence of Industrial Heritage (TICCIH) —an advisory body to the International Council on Monuments and Sites (ICOMOS)—, which in 2003 promoted the Nizhny Tagil Charter for Industrial Heritage[6]. This key document set out the principles for the conservation and protection of the heritage values of industrial sites worldwide, underlining the importance of preserving not only the buildings, but also the memory, social affection and productive skills of each particular place. Alongside this pioneering document, it is also worth mentioning their subsequent approval of the "Joint ICOMOS-TICCIH Criteria for the Conservation of Industrial Heritage Sites, Buildings, Areas and Landscapes"[7], known as the Dublin Principles, in 2011. These principles have become an indispensable point of reference for the conservation of industrial heritage worldwide and have been applied in paradigmatic cases such as the Van Nelle Fabriek in Rotterdam, designated a World Heritage Site by UNESCO[8]. The preservation and conservation of these buildings involves finding a function and a purpose compatible with their typological and spatial forms[9], usually through interventions which suitably conserve their cultural value and memory. This approach is fundamental in what is known as rehabilitation or adaptive reuse, a strategy which seeks not only to rehabilitate these spaces, but also to reprogramme them to serve new purposes without losing their historical essence[10]. This concept differs from traditional interventions, which often radically transform industrial buildings into museums or commercial spaces, stripping them of their original context and using a design strategy where the building becomes a mere container. Notable examples of this can be found in the Tate Modern in London and its Turbine Hall[11], the Gasometers in Vienna[12], and CaixaForum Madrid[13], all interventions which have chosen to empty and demolish interior infrastructures and installations, as well as annexed auxiliary buildings, creating a blank canvas for new cultural and residential uses. In contrast, adaptive reuse respects the memory of the site while adapting it to new uses, favouring the continuity of its industrial legacy[14]. Notable examples of this strategy can be seen in
p.117 projects such as the Palais de Tokyo in Paris, France[15], and C-Mine in Genk, Belgium[16].

The rehabilitation of industrial buildings faces significant challenges, due mostly to the limitations of their owners to undertake the necessary investments and to overcome the administrative and technical difficulties imposed by heritage protection conditions. These barriers often lead to projects being delayed, prolonging the abandonment of these buildings[17]. In some cases, this abandonment leads social groups to find temporary uses for these spaces, sometimes for extended periods of time.

The classification by Álvarez Areces[18] established three types of industrial architectural assets: isolated elements which, due to their historical, architectural or technological value, are typical of an industrial activity; industrial ensembles which preserve all the material and functional components of a specific industrial activity; and industrial landscapes which maintain all the essential components of the production processes, also bringing about landscape alterations. This study focuses on obsolete industrial sites or assemblages that represent an emerging heritage, ready for effective architectural preservation.

In a way, this research is a continuation of a larger study, developed through the research project "CREAfab. Methodologies for a creative reindustrialisation of historic centres"[19]. This aims to promote a creative reindustrialisation of historic centres as a local development strategy, facilitating the implementation of Creative Industries in the context of Andalusia's industrial heritage.

The link between obsolescent factory or production spaces and local creative communities as alternative places for living and working and their significance as heritage can be traced back to at least the 1990s. In the history of the contemporary European and North American city, particularly from the 1950s onwards, artistic and countercultural collectives played a pioneering role in the unveiling and valorisation of these architectures. Therefore this approach to the adaptive rehabilitation of industrial heritage from the creative and cultural sector is, to some degree, a continuation of the recent past. However, the sophistication and complexity acquired by these processes in the last decade, within the regulatory framework mentioned above, make it necessary to study them in depth and understand them as a possible key to the future.

In the research conducted, the 142 reference cases, both national and international, have been identified and stand out in terms of management, conservation and intervention, driven by Creative Industries[20]. This paper analyses three specific cases: Tabačka Kulturfabrik in Košice (Slovakia); The Cable Factory in Helsinki (Finland); and Manifattura Tabacchi in Florence (Italy). These projects have been selected because they share a process of reprogramming driven by partnership and creative management, adapting the buildings to the needs of the community while preserving their industrial characteristics and demonstrating these strategies on three different scales. Interventions that can well be p.118 gathered under the concepts of *de-cluttering architecture, liberating spaces* and *expanding concepts.*[21]

Ultimately, the study of these three cases reveals a correlation between industrial architecture, production spaces and creative communities. The environments of these complexes are conducive to cultural activities, allowing innovative professions and social relations to be preserved in a sustainable and heritage-friendly framework. The Creative Industries, with their focus on sustainability and positive impact, help to preserve the memory of work in industrial spaces which might otherwise be seen as mere cultural vessels.

CREATIVITY AS A DRIVER OF URBAN DEVELOPMENT

According to the United Nations Conference on Trade and Development 2022, Creative Industries are "*creative sectors as the cycles of creation, production and distribution of goods and services that use creativity and intellectual capital as primary inputs. They comprise a set of knowledge-based activities that produce tangible goods and intangible intellectual or artistic services with creative content, economic value and* market *objectives*"[22]. They encompass a productive fabric made up of 'creators' and 'producers' integrating all creative sectors: arts, architecture, cinema, music, design, fashion, performing arts, crafts, advertising, television and radio, software and video game design, while also intersecting with the prolific artificial intelligence scene.

The argument that identifies the Creative Industries as a potentially beneficial sector for the regeneration of heritage urban spaces and environments is identified within the context of the ambitious "Creative City" theory developed at the turn of the century, as well as in the most current strategic approaches put forward in European Union reports and plans[23,24,25,26,27,28,29]. These reports and plans highlight the potential of the Creative Industries, not only as an economic sector[30], but also as a motivator of resilient processes for city transformation[31], and are especially synergistic in historic urban contexts where they act as a resource to reverse the intense processes of over-tourism to which they are p.119 currently subjected[32]. Thus, the convergence between the specific needs of the Creative Industries and the updating of spaces with a productive past remains a paradigm of adaptive rehabilitation of industrial heritage.

A clear example of this trend is the investment that numerous European cities have made to transform former industrial environments into districts which foster the Creative Industries. Through the 22@ project Barcelona has transformed the former industrial district of the Poblenou neighbourhood into a technological and creative hub housing digital media companies and innovative start-ups. Similarly, Milan has developed Fashion City and the World Jewellery Centre, merging traditional sectors such as fashion and jewellery with an environment which combines industrial heritage and cutting-edge technology. In Copenhagen, the development of Orestad has resulted in a modern urban district that mixes residential, commercial and technological uses within a former industrial space. Germany proposes an ambitious project for the Rhur region as an ecosystem where Cultural and Creative Industries converge, with museums, creative districts and centres set up for the promotion of local culture in its historical productive landscape.

There are also numerous examples on an architectural scale, such as the interventions in Barcelona's rich industrial heritage, many of them grouped under the municipal initiative *Fábricas de Creación*, which includes projects such as Fabra i Coats and Hangar[33]. Other key examples include the ambitious Matadero project in Madrid[34], Tabakalera in San Sebastián[35], and La Térmica in Málaga[36]. These projects, which have been extensively documented, not only revitalise the urban fabric, but also reinforce the role of the Creative Industries as driving forces for innovation and social transformation, demonstrating their potential in the context of industrial heritage[37].

TOWARDS THE LOCAL. THREE EUROPEAN CASE STUDIES OF CREATIVE ADAPTIVE REHABILITATION AND HERITAGE CONSERVATION

The three case studies selected —Tabačka Kulturfabrik in Košice, The Cable Factory in Helsinki and Manifattura Tabacchi in Florence —have been chosen for their capacity to illustrate a process of adaptive rehabilitation of former industrial facilities through the promotion of Creative Industries. These cases stand out for their relevance at European level, a pioneering territory in the reprogramming and conservation of industrial heritage[38]; their heritage protection status; their focus on contemporary creative production; their effective strategy for urban conservation and

S. TABALI ET AL. "Arquitecturas industriales y transformación creativa. Tres casos de estudio europeos" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024
Con licencia CC BY-NC-SA 4.0 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.06

revitalisation; their active involvement of local collectives; and their pedagogical capacity or potential for replicability on different scales.

Search, selection and analysis methodology

p.120 As was stated in the Introduction, the three case studies analysed are found among the results of the preliminary phase of the *CREAfab* research project. This phase included the creation of a spatial database to map the promotion of Creative Industries as regards heritage, distinguishing between two levels of analysis (General Cases and Paradigmatic Cases), five categories (Planning, Agencies, Programmes, Creative Centres and Districts), and two scopes (Global and National). A total of 142 cases were registered in 26 countries (figure 1), three of which from the category of Centres have been selected for this analysis[39].

The methodology used to create this spatial database[40] consisted of four phases: bibliographical search for case studies; design and standardisation of the database for individual categories; selection of paradigmatic cases; and finally, the analysis of case studies at both levels of analysis. In this study, the last two phases of this methodology are applied.

The quantitative and qualitative analysis of the case studies which make up this database is based on the identification of the five categories of elements seen in figure 2.

p.122 The preliminary results of this analysis of case studies within the framework of the "CREAfab" research project[41] show that the Creative Industries demand spaces that allow them to develop their activities effectively and efficiently and, despite the specificity of individual jobs, some shared aspects can be identified in many cases. Generally, they require spaces that offer both privacy— to protect intellectual property— and public accessibility for dissemination events, while also valuing architectural uniqueness and central location in distinctive neighbourhoods. Large, versatile spaces are sought to facilitate collaborative work, interaction with the public and the development of educational activities. The interventions aim to provide adequate ventilation, soundproofing, lighting control, high connectivity and efficient waste management, together with good transport connections. Reused industrial spaces are well suited to these needs, combining flexibility, existing infrastructures and unique environments reminiscent of the work culture and innovation of earlier times. Their initial easy appropriation often leads to greater commitment to building conservation and heritage preservation, social cohesion and an improvement in the quality of life in the area. In addition, the communities that inhabit these centres have been found to generate a sustainable ecosystem that extends beyond their perimeter, fostering an eco-social conscience and a civic economy.

For this paper, European cases have been selected in which the adaptive rehabilitation project stands out for its capacity to transform the environment. These three unique protected industrial buildings are all located in historic centres or remarkably close to them, and have been safeguarded by the association of creatives and citizens, leading to a positive socio-economic and urban impact. Other criteria for their selection were the innovation components in management and the possession of a multifunctional and multi-scale programme, capable of accommodating the spatial demands of the different sectors of the Creative Industries. Finally, centres located in countries that do not necessarily have a legislative framework to support the promotion of the Creative Industries in these buildings were chosen, discarding countries considered pioneers in these practices, such as the United Kingdom and Germany. The three cases are analysed below.

Tabačka Kulturfabrik: a rehabilitation project under the umbrella of a citizens' association

Tabačka Kulturfabrik is a cultural centre in Košice, Slovakia, located in a former tobacco factory built between 1851 and 1854. The factory was used to produce cigars during the Austro-Hungarian monarchy until the end of World War II and was closed in 1951. In 1953, the building was partially reconstructed to house a vocational school, a function p.123 it retained until September 2007. In 2009, the architect Peter Radkoff and the civic association Bona Fide initiated a project to revitalise the abandoned space, transforming it into an alternative cultural centre (figure 3). In May 2015, Bona Fide implemented a new operating model in cooperation with the autonomous region of Košice, aiming to foster the development of creative economies in the area.

This case, together with Manifattura Tabacchi in Florence, represents an already consolidated trend of conversion of tobacco factories and drying sheds into cultural and creative centres in several European cities[42]. This phenomenon seems to be a response to the dismantling of these activities, motivated by the spatial attractiveness and location of these buildings, which offer large, adaptable and well-connected spaces in strategic urban areas.

Tabačka Kulturfabrik's management model is bottom-up and independent, meaning that it is driven by engaged citizens and funded through multiple sources, including its own economic activity, grants, and financial partners. The centre serves as a creative incubator for new talent in the Creative Industries sector, providing start-up support and workspaces for emerging artists and producers.

The Tabačka building is located in a block in the centre of Košice, on Gorkého Street, parallel to the uncovered section of the Hornad River, in the Žižkov district, a former industrial area near the historic city centre. Tabačka stands out in its urban context as one of the few buildings with no more than two storeys. It is surrounded by other industrial architecture converted to administrative or residential use and is close to the most important monuments in Košice. It is also easily accessible by public transport. Its two L-shaped floors are surrounded by a large central courtyard and a single-storey warehouse.

S. TABALI ET AL. "Arquitecturas industriales y transformación creativa. Tres casos de estudio europeos" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024

The façade, a characteristic architectural attribute of this building, features a main entrance connecting the large central open space for the spaces for cultural relations and dissemination, making this the heart of the project (figure 4). The first floor houses the creative production programme with workspaces and workshops. The former tobacco factory now offers 2500 m^2 for activities related to these industries. Its programme provides a multipurpose hall with a capacity for 600 people standing and 200 seats; a *black box* for 60 people; a cinema for 77 spectators; a creative zone with six office spaces; a coworking centre for 30 creators and producers; a creative print studio; a recording studio; a music lab; a video studio/workshop for 15 people; a bistro bar for 130 people; a contemporary art gallery and a shop for artistic material (figure 4).

The Tabačka Kulturfabrik renovation project, led by architects Peter Radkoff and Pavol Pirovits, together with designer Dávid Hutira, was carried out between 2014 and 2015, respecting its status as a National Technical and Cultural Monument. The intervention meticulously preserved the building's materials and structure, highlighting the different historical layers visible on the façades, which combine exposed brick and plastered sections, without altering the original industrial atmosphere (figure 5). The intervention focused on creating large spaces for community activities, relegating individual production areas to the first floor, thus encouraging active citizen participation in programming activities.

The impact of this project has been significant. Tabačka Kulturfabrik has functioned as a cultural catalyst in Košice, encouraging new rehabilitation interventions in its surroundings and revitalising the previously declining Žižkov neighbourhood. In addition, Tabačka played a key role in the designation of Košice as European Capital of Culture in 2013, which led to the adoption of the Košice Creative Strategy 2014-2018[43]. Today, it is the second most important **p.124**
cultural and creative centre in Slovakia, attracting large daily audiences and hosting more than 80 professionals from the creative sector, thus contributing to an active cultural life and a renewed sense of community[44].

The Cable Factory: hybridisation of uses as a strategy for revitalisation

The Cable Factory (Kaapelitehdas) (figure 6), in the Ruoholahti district of Helsinki, Finland, has been an official cultural and creative arts centre since 1991[45]. The building housing it was built for the manufacture of marine cables. **p.125**
Later, Finland's first supercomputer was installed here. When the manufacturing and data communication activities ended in the late 1980s, creators and producers of the Creative Industries found a place to settle in the vacant spaces of The Cable Factory.

The building, Salmisaari, was built in the 1930sas a cable factory, designed by architect Wäinö G. Palmqvist. When the construction of the complex was completed in 1954, The Cable Factory was the largest building in Finland. The building is listed as a cultural heritage site by the Ministry of the Environment, under the designation "Factory of Culture", because of its cultural and creative values. **p.126**

In 1987, a group of artists and creatives moved into the vacant factory and converted the premises into workspaces, initiating a bottom-up process of renovation to transform the building into a centre of culture and art for Helsinki. Subsequently, this project would be supported by the local municipality. This led to it receiving national protection in the late 1990s as a complex with Cultural and Creative values, categorised as a "Factory of Culture". The Cable Factory, part of the international network Trans Europe Halles (Creative Europe), has established itself as one of the largest cultural centres in Finland and attracts a large number of visitors each year by hosting major social events such as film festivals and contemporary art exhibitions. Today, it is home to a mixture of organisations, art studios, galleries, theatres, music and dance venues and creative technology companies.

The Cable Factory is a 62,000 m^2 complex consisting of three-, five- and seven-storey blocks on a five-hectare site on the shores of the Salmisaari sector of the Ruoholahti district, facing the island of Lauttasaari. This area is largely made up of administrative and office uses bordering the main area of Helsinki. The characteristic image of this location is that of brick buildings facing the water, highlighting the scale of the building. The building, which was once a landmark due to its size, is now surrounded by numerous contemporary buildings with metal structures and glass enclosures of similar or greater height, emphasising the mass scale of its enclosure despite its reduced presence in the cityscape. As for the interior configuration (figure 7), a U-shaped volume generates an imposing central hall, an empty double-height space with a glazed roof separating the two large wings of the complex.

The architectural rehabilitation project followed the "non-intervention" technique: low-cost actions aiming to obtain the maximum operational space. A *raw space* method, an option widely developed by the North American counterculture of the 1970s in its post-industrial spaces, was applied. This invited the creative appropriation of spaces and encourages their dynamism, allowing for different combinations depending on the needs of the creators and producers (figures 8 and 9). A series of techniques were used to recover the original materials, while preserving the spatial configuration, creating indeterminate spaces with no specific use.

Under the management of the public company Kaapeli, the management is based on a process of self-organisation and participation of a community committed to the spatial operability of the building achieved by the *raw* **p.127**
space phenomenon*, the* main concept of the project. The permanent programme of the complex includes work areas, a concert hall, three museums, and living and accommodation areas, together with other smaller spaces (figure 7).

The reactivation of this complex for creative and cultural uses, encouraged by local interest, has been key to the transformation of the Salmisaari sector. This intervention and its subsequent use by many professionals in the creative sector has led to an exemplary urban regeneration, not just in terms of the number of people it attracts — it has more than 750,000 annual visitors, is home to more than 300 companies and professionals, and has generated more than

S. TABALI ET AL. "Arquitecturas industriales y transformación creativa. Tres casos de estudio europeos" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024
Con licencia CC BY-NC-SA 4.0 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.06

S. TABALI ET AL. "Arquitecturas industriales y transformación creativa. Tres casos de estudio europeos" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024
Con licencia CC BY-NC-SA 4.0 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.06

600 jobs — but also thanks to recent extensions such as the construction of the Dance School annex in 2022[46] or the acquisition of other outdoor spaces that host festivals and large international events[47] .

Manifattura Tabacchi: rationality and creativity in a Renaissance setting
The Manifattura Tabacchi project[48] (figure 10) in Florence, Italy, is an outstanding example of the reuse of a former industrial complex as a multifunctional, ambitious and monumental-scale space. A project that reclaims and transforms the pre-existing industrial heritage into a centre for contemporary arts, fashion and counterculture. With a careful adaptation of the historic buildings, architectural elements are preserved (figure 11) and interventions p.128 compartmentalise the spaces, fundamentally redesigning the auxiliary spaces such as the wet areas and circulation to guarantee accessibility. It also includes an interesting and important green urban regeneration project placing the intervention at the forefront of sustainability.

The complex of the former tobacco factory of Florence, protected as a historic monument, was designed by the engineers Giovanni Bartoli and Pier Luigi Nervi. Together with the recreational building (now the Puccini Theatre), the main body of the factory is an architectural landmark in the surrounding urban environment. It is a privileged block on the outskirts of the historic centre of Florence, surrounded by green corridors separating the complex from the surrounding residential blocks and facilities. It stands in an area of low building density, with many green spaces such as the Parco delle Cascine and close to the Novoli University Campus, the airport and the railway station, with direct connections to other districts with great creative production to the west of the city. The complex features a series of buildings with a compact floor plan and volume, built in a characteristic rationalist style. The volumes range from one to seven storeys above ground level and are arranged parallel or orthogonal to the east-west axis of the Mugnone stream, except for the management building, which sits diagonal to the grid along Via delle Cascine. Between the different nuclei there are also connecting spaces and services, simple asphalted courtyards for production and processing, and tree-lined gardens for the management and offices.

Despite the private initiative that gave rise to this project, its foundations were laid following a bottom-up strategy. From the closure of the factory in 2001 until 2014 some of the buildings were used by creators from the performing arts sector, and it served as a warehouse for the Teatro della Pergola. It was also occasionally used for events and fashion shows, which were the seed of the creative occupation of the complex. Today, Manifattura Tabacchi combines workspaces, cultural and creative areas with accommodation and education. It also establishes partnerships with educational institutions, hosting the Polimoda campus, offering training provided by the Istituto dei Mestieri d'Eccellenza LVMH (IME), as well as classrooms which are occupied by Florence's Academy of Fine Arts. It will soon p.129 be the Italian headquarters of the European Research Infrastructure for Heritage Science (E-RIHS). Among its most notable events are the Residenze d'Artista and SUPERBLAST (a call for artists under 40).

The rehabilitation and adaptation project is based on a major masterplan developed by Concrete Architectural Associates (2017), later revised by Studio Mumbai and SANAA (2019). The architectural design is by Q-BIC (2020) and the landscape design by Antonio Perazzi. Other studios and professionals such as Piuarch, Studio Urquiola, Quincoces-Dragò & Partners, Aut Aut Aut Architettura and Studio Lauria also participated. The strategy, respecting its status as a listed building, is based on the structural use and maintenance of the original façades and walls. New necessary elements (communication and toilets) have been incorporated into existing parts and an adaptation following regulations has been carried out (figures 12 and 13).

The result is a large multifunctional complex offering Florence and the international creative community a rich programme occupying more than 100,000 m^2 of built area, of which nearly 50,000 m^2 is dedicated to creative production uses (figure 13). A further 16,300 m^2 of open spaces are available to the public. The programme includes workshops for artisans, creators and producers; traditional and co-operative offices; showrooms; concept and retail shops; catering areas; student and private residences; hotel space; a nursery; a craft brewery; outdoor communal garden areas and underground car parks.

Manifattura Tabacchi approaches the programme for reuse aiming to create an autonomous district, a re-industrialised city. Unlike other interventions analysed, here it does not seek hybridisation or multi-functional uses for each building. Instead, the abundant spaces allow different complementary uses to be distributed throughout the complex, forming an independent and self-sufficient creative ecosystem.

CONCLUSIONS

The three case studies presented aim, through different proposals, to meet the current demands in terms of the safeguarding of productive memory and the conservation of industrial heritage, relying on the potential of the Creative Industries. Based on this common axes are identified, making up aspects crucial to the success of these interventions.

p.131 Preserving the architectural integrity of these spaces has been paramount in all cases, but what sets these projects apart is their ability to innovate within the limits of conservation. The Tabačka and Manifattura Tabacchi projects have demonstrated the possibility of maintaining the historic character of a building while integrating contemporary technology and functionality. This approach not only respects the past but revitalises it in an emerging context. In contrast, with its concept of raw space The Cable Factory takes a more radical approach, allowing for almost unlimited adaptability within a protected structural framework. This capacity for innovation and preservation shows that adaptive reuse should not be seen as a compromise between the new and the built, but as an intervention technique which allows the historical narrative of pre-existing industrial architecture to continue to be read.

Similarly, flexibility emerges as an essential feature in these projects. Spaces that can adapt to the changing needs of time and community not only survive but thrive. This can be seen from the continually evolving uses at The Cable Factory and Tabačka, where spaces are constantly redefined in answer to a wide range of demands. In addition, the focus on energy efficiency and the unbuilt environment, as seen in Manifattura Tabacchi, underlines the importance of integrating sustainable practices not only in the construction and renovation, but also in the day-to-day operation of these centres. This ensures that adaptive reuse is not simply a short-term solution, but an enduring strategy that can evolve with the community. This is idiosyncratic to industrial architecture, often adapted to the technical and technological advances and economic guidelines of its time.

Community participation also proves to be a key factor in the sustainability and success of these projects. In both Tabačka Kulturfabrik and The Cable Factory, community involvement from the outset has ensured that the spaces respond to the real needs of their users, creating a sense of ownership and ensuring decentralised management. This approach not only empowers the community, but also creates a resilient and flexible management model that can adapt to changes in the cultural and economic context. Although the Manifattura Tabacchi project is managed by a private initiative, its success has also depended on the ability to integrate local and institutional actors, demonstrating that collaboration between different levels of management is crucial for the long-term viability of projects. This is key to preventing future speculation and the consequent processes of over-tourism and gentrification, as it implements policies that favour the local community, such as maintaining the rental prices of the spaces or raising them depending on the scale of the company and its origin, the inclusion of children in the activity programmes, etc.

All three cases demonstrate that the preservation of heritage with a productive past through the creative economy and through the adaptive reuse of its architecture has significant potential to catalyse urban regeneration and revitalise communities. However, the impact goes beyond the economic; these projects have reshaped the social dynamics in their neighbourhoods. For example, Tabačka has transformed a previously marginalised area into a vibrant hub of cultural activity, while The Cable Factory has done the same in Helsinki, creating a space that is not just a hub of creative production, but is also a symbol of the city's cultural identity. Manifattura Tabacchi, meanwhile, shows how an integrated hybrid approach involving education, commerce and culture can regenerate not just a building, but an entire urban sector, promoting long-term sustainability and social development.

Together, Tabačka Kulturfabrik, The Cable Factory and Manifattura Tabacchi demonstrate that the adaptive reuse of industrial heritage, when approached as a collective, flexible and respectful process, has the potential to generate profound and lasting impact in communities. These projects not only preserve the past but redefine it as a foundation on which to build a future in which culture, creativity and community are the driving forces behind conservation and urban regeneration. This strategy offers a replicable model for other cities and regions seeking to revitalise their industrial heritage, fostering architectural conservation as well as social and economic development.

Roles CRediT:

Safiya Tabali (ST); José-Manuel Romero-Ojeda (JMRO); María F. Carrascal Pérez (MFCP): Conceptualization; Investigación; Visualization; Methodology; Writing – original draft; review & editing) -borrador original; revisión y edición (ST 33,3%; JMRO 33,3%; MFCP 33,3%)

All of the authors declare that there is no conflict of interest with the results of the study

Funding

This work is part of a regional competitive R+D+i project, promoted by the Regional Ministry of Development, Territorial Articulation and Housing of the Andalusian Regional Government, called "CREAfab. Methodologies for a creative reindustrialisation of historic centres" (reference US.22-03). Call: Competitive grants for Andalusian Public Universities for the development of research projects in the areas under the responsibility of the General Secretariat for Housing (Resolution of 4 March 2022). Period of execution: 2022-2024 (15 months). Budget: €50,000.00. The funding entity has not participated in the execution of the research.

S. TABALI ET AL. "Arquitecturas industriales y transformación creativa. Tres casos de estudio europeos" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024

1 SÁNCHEZ-MONTAÑÉS, Benito; CASTILLA, Manuel V. Fábricas de resiliencia. Una oportunidad para el patrimonio industrial: el caso de La Trinidad. In: *ACE: Architecture, City and Environment* [online]. Barcelona: Universitat Politècnica de Catalunya, June 2020, Year 15, no. 43 [accessed: 16-03-2024]. ISSN-e 1886-4805. Available at: https://revistes.upc.edu/index.php/ACE/article/view/9192. DOI: https://doi.org/10.5821/ace.15.43.9192.

2 SOBRINO, Julián. Fábricas que cierran: la paradoja de lo productivo desocupado. In: Marta PELEGRÍN RODRÍGUEZ; Fernando PÉREZ BLANCO. *Arquitectura dispuesta: preposiciones cotidianas*. Seville: Editorial Universidad de Sevilla, 2015, pp. 182-197. ISBN 978-84-472-1796-0.

3 Idem.

4 SÁNCHEZ-MONTAÑÉS, Benito; CASTILLA, Manuel V., op. cit. supra, note 1, p. 3.

5 RODRÍGUEZ MARÍN, Francisco José. Criterios de intervención en la rehabilitación del patrimonio industrial arquitectónico. In: *Gremium* [online]. Mexico City, January 2018, vol. 5, no. 9, pp. 35-50 [accessed: 11/08/2024]. Available at: https://www.redalyc.org/articulo.oa?id=684175705004.

6 Available at: https://ticcih.org/wp-content/uploads/2013/04/NTagilSpanish.pdf.

7 Available at: https://ticcih.org/about/about-ticcih/dublin-principles/.

8 HERNÁNDEZ MARTÍNEZ, Ascensión. El reciclaje de la arquitectura industrial. In: María del Pilar BIEL IBÁÑEZ, *Patrimonio Industrial y la Obra Pública.* Zaragoza: Gobierno de Aragón, Department of Education, Culture and Sport, 2007, pp. 29-51. ISBN 978-84-8380-059-1.

9 Idem.

10 PLEVOETS, Bie; CLEEMPOEL, Koenraad van. *Adaptive Reuse of the Built Heritage: Concepts and Cases of an Emerging Discipline* [online]. London: Routledge, 2019 [accessed: 19-08-2024]. ISBN-e 9781315161440. Available at: https://www.taylorfrancis.com/books/mono/10.4324/9781315161440/adaptive-reuse-built-heritage-bie-plevoets-koenraad-van-cleempoel. DOI: https://doi.org/10.4324/9781315161440.

11 Former Bankside power station, designed by the architect Sir Giles Gilbert Scott in 1947, converted to house the Tate Collection by Herzog & De Meuron. Inaugurated in 2000 and extended in 2016.

12 Four former gas tanks for public lighting in Vienna, Austria, built between 1896 and 1899 and converted into a hybrid residential, commercial and cultural complex by architects Jean Nouvel, Coop Himmelblau, Manfred Wehdorn and Wilhelm Holzbauer between 1999 and 2001.

13 Former power station in Madrid built in 1900, converted by Herzog and De Meuron as the headquarters of the CaixaForum project in the capital, a centre for contemporary art and culture of the "La Caixa" Foundation. Inaugurated in 2008.

14 BULLEN, Peter. A.; LOVE, Peter E.D. Adaptive reuse of heritage buildings. In: *Structural Survey* [online]. Bingley: Emerald Publishing Limited, 2011, vol. 29, no. 5, pp. 411-421 [accessed: 19-08-2024]. Available at: https://www.emerald.com/insight/content/doi/10.1108/02630801111182439/full/html. DOI: https://doi.org/10.1108/02630801111182439.

15 West wing of the Palais des Musées d'Art Moderne, built in 1937 on the banks of the Seine by Jean-Claude Dondel and André Aubert, converted into a cinema and exhibition space by Lacaton & Vassal, with an initial intervention in 2001 and a subsequent extension in 2012.

16 A former coal mining complex built in 1917 in the city of Genk, whose power plant was transformed into a cultural and creative centre by the 51N4E studio in 2010.

17 ÁLVAREZ ARECES, Miguel Ángel. El Patrimonio Industrial en España. Situación actual y perspectivas de actuación. In: María del Pilar BIEL IBÁÑEZ, coord. *Patrimonio Industrial y la Obra Pública.* Zaragoza: Gobierno de Aragón, Department of Education, Culture and Sport, 2007, pp. 9-25. ISBN 978-84-8380-059-1. Available at: https://dialnet.unirioja.es/servlet/libro?codigo=507168&orden=0&info=open_link_libro.

18 Idem.

19 Competitive research project of a regional nature, promoted by the Regional Ministry of Development, Territorial Planning and Housing of the Andalusian Regional Government, led by María F. Carrascal Pérez. Available at: https://grupo.us.es/creativecity.

20 TABALI, Safiya; ROMERO-OJEDA, José-Manuel; CARRASCAL-PÉREZ, María F. Industrias creativas y patrimonio industrial. Metodologías para la construcción de un panorama internacional de referencias. In: Begoña YAÑEZ-MARTÍNEZ, Lorena LÓPEZ-MÉNDEZ and Daniel ZAPATERO GUILLÉN. *Arte y educación en contextos multidisciplinares*. Madrid: Dykinson, 2023, pp 249-268. ISBN 978-84-1170-305-5.

21 AÑÓN ABAJAS, Rosa María. Despejar la arquitectura, liberar el espacio y ampliar conceptos. In: *Proyecto, Progreso, Arquitectura* [online]. Seville: Editorial Universidad de Sevilla, 2021, n. º 24, pp. 4-17 [accessed: 25-03-2024]. ISSN-e 2173-1616. Available at: https://revistascientificas.us.es/index.php/ppa/article/view/16177. DOI: https://doi.org/10.12795/ppa.2021.i24.10.

22 UNCTAD. Creative Economy Outlook 2022. Overview. In: *United Nations Conference on Trade and Development* [online]. Geneva: United Nations, 2022 [accessed: 21-03-2024]. Available at: https://unctad.org/system/files/official-document/ditctsce2022d1_overview_es.pdf.

23 FLORIDA, Richard. *The Rise of the Creative Class*. New York: Basic Books, 2002. ISBN 9780465029938.

24 FLORIDA, Richard. *Cities and the Creative Class*. London: Routledge, 2004. ISBN 9780415948876.

25 BATHELT, Heral; MALMBERG, Anders; MASKELL, Peter. Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation. In: *Progress in Human Geography* [online]. Thousand Oaks CA: SAGE Publications, vol. 28, no. 1, 2002, pp. 31-56 [accessed: 22-03-2024]. Available at: https://journals.sagepub.com/doi/abs/10.1191/0309132504ph469oa DOI: http://dx.doi.org/10.1191/0309132504ph469oa.

26 CARTA, Maurizio. *Creative City. Dynamics, Innovations, Actions*. Trento: LISt Laboratorio Internazionale Editoriale, 2007. ISBN 9788895623030.

27 LANDRY, Charles. *The Art of City Making*. London: Earthscan and International Institute for Environment and Development, 2006. ISBN 978-1-84407-245-3.

28 LANDRY, Charles. *The creative city: A toolkit for urban innovators*. London: Routledge, 2012. ISBN 978-1-84407-598-0.

29 EUROPEAN COMMISSION. Creative Europe 2021-2027-Push Boundaries [Online]. Directorate-General for Education, Youth, Sport and Culture, European Union, 2021 [accessed: 21-03-2024]. Available at: https://data.europa.eu/doi/10.2766/794740.

30 GARCÍA-VÁZQUEZ, Carlos. *Cities After Crisis. Reinventing Neighborhood Design From the Ground-Up*. London-New York: Routledge, 2022. ISBN 9780367673277.

31 UNESCO. *Policies for Creativity. Guide for the development of cultural and creative industries*. United Nations Educational, Scientific and Cultural Organization; Ministry of Foreign Affairs and Cooperation, Government of Spain, 2010. ISBN 978-92-3-304190-5. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000220384.

32 CALLE VAQUERO, Manuel de la. Turistificación de centros urbanos: clarificando el debate. In: *Boletín de la Asociación Española de Geografía* [online]. Madrid: AGE, December 2019, n.º 83, pp. 1-40 [accessed: 23-03-2024]. ISSN-e 2605-3322. Available at: https://bage.age-geografia.es/ojs/index.php/bage/article/view/2829. DOI: https://doi.org/10.21138/bage.2829.

33 Available at: https://ajuntament.barcelona.cat/fabriquescreacio/es.

34 Available at: https://www.mataderomadrid.org/arquitectura.

35 Available at: https://www.tabakalera.eus/es/.

36 Available at: https://latermicamalaga.com/.

S. TABALI ET AL. "Arquitecturas industriales y transformación creativa. Tres casos de estudio europeos" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024

37 EVANS, Graeme L. Creative Cities, Creative Spaces and Urban Policy. In: *Urban Studies* [online]. Thousand Oaks CA: SAGE Publishing, 2009, vol. 46, no. 5-6, pp.1003-1040 [accessed: 18-08-2024]. ISSN-e 1360-063X. Available at: https://journals.sagepub.com/doi/10.1177/0042098009103853. DOI: https://doi.org/10.1177/0042098009103853.

38 BENITO DEL POZO, Carmen. Europa ante el patrimonio industrial. Financiación comunitaria a los proyectos de recuperación patrimonial. In: *RAE. Revista Asturiana de Economía* [online]. Oviedo: Asturian Association of Economic Studies, 1996, n.º 6, pp. 183-195. Available at: https://dialnet.unirioja.es/servlet/articulo?codigo=3865914.

39 HIDALGO-SÁNCHEZ, Francisco-Manuel; TABALI, Safiya; CARRASCAL-PÉREZ, María F. CREAfab App: herramienta digital para la investigación y gestión de procesos de reindustrialización creativa en ciudades históricas In: Juan CALATRAVA, David ARREDONDO GARRIDO and Marta RODRÍGUEZ ITURRIAGA. *Communicating architecture. From the origin of modernity to the digital era* [online]. Granada: Editorial Universidad de Granada, 2024, pp 1613-1626 [accessed: 18-10-2024]. ISBN-e 978-84-338-7371-2. Available at: https://editorial.ugr.es/libro/comunicar-la-arquitectura_139503/.

40 Idem.

41 TABALI, Safiya; ROMERO-OJEDA, José-Manuel; CARRASCAL-PÉREZ, María F. Creative industries and industrial heritage. Methodologies for the construction of an international panorama of references. In: Begoña YAÑEZ-MARTÍNEZ, Lorena LÓPEZ-MÉNDEZ and Daniel ZAPATERO GUILLÉN. *Art and education in multidisciplinary contexts*. Madrid: Dykinson, 2023, pp. 249-268. ISBN: 978-84-1170-305-5.

42 GARCÍA TIELVE, Natalia. Heritage and production: from tobacco factories to cultural industries. In: Ábaco. Gijón (Asturias): CICEES, 2018, n.º 97, pp. 86-94. ISSN 0213-6252. Available at: https://www.jstor.org/stable/26562068.

43 Available at: https://www.unesco.org/en/creative-cities/kosice.

44 ŠUJANOVÁ, Katarína. 2017. Každé väčšie mesto by malo mať svoju "tabačku" (Every big city should have its "Tabacka"). In: *Forbes* [online]. Bratislava: Barecz & Conrad Media [accessed: 19-08-2024]. Available at: https://www.forbes.sk/kazde-vacsie-mesto-by-malo-mat-svoju-tabacku/.

45 Available at: https://www.kaapelitehdas.fi/en/.

46 Available at: https://www.tanssintalo.fi/en.

47 Available at: https://www.kaapelitehdas.fi/en/suvilahti/.

48 Available at: https://www.manifatturatabacchi.com/.

S. TABALI ET AL. "Arquitecturas industriales y transformación creativa. Tres casos de estudio europeos" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024
 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.06

J. PARRA-MARTÍNEZ ET AL. "Nunca fue tan valiosa la basura: industrias, arquitecturas y paisajes del residuo" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024

DOI http://dx.doi.org/10.12795/ppa.2024.i31.07

NUNCA FUE TAN *VALIOSA* LA BASURA: INDUSTRIAS, ARQUITECTURAS Y PAISAJES DEL RESIDUO

NEVER WAS TRASH SO *VALUABLE*: INDUSTRIES, ARCHITECTURES AND LANDSCAPES OF WASTE

José Parra-Martínez (0000-0003-0142-0608)
Asunción Díaz-García (0000-0001-7454-1203)
Ana Gilsanz-Díaz (0000-0002-5043-665X)

p.135 INTRODUCTION

On a sunny September morning in 1967, Robert Smithson took the bus from Manhattan to Passaic to tour Lower Dundee, an "*unimaginative suburb*"[1] lined with abandoned factories, pontoons and pumping platforms that bore witness to the boom and bust of industrial potential. His photographic record of that walk sparked a personal aesthetic and philosophical experience of entropy, which would convince him that "*the future is lost somewhere in the dumps of the non-historical past*"[2] (figure 1).

Decades later, Jane Bennett would have another inspiring encounter with residue before the grate of a storm drain in Baltimore: a plastic work glove, a dead rat, a plastic bottle cap, among other elements, "*shimmied back and forth between debris and thing*". The philosopher noticed their presence as, on the one hand, "*stuff to ignore, except insofar as it betokened human activity*", and, on the other hand, as "*existents in excess of their association with human meanings, habits, or projects*"—objects that commanded attention in their own right. Despite being remnants, their materiality challenges us "*as vivid entities not entirely reducible to the contexts in which (human) subjects set them*"[3].

Both the chimneys and pipes immortalized by Smithson and the banal pieces of plastic observed by Bennett are material fragments expressing the negative sign order of industry. The entropy of post-industrial landscapes, as a measure of the processes that push everything irreversibly towards a state of greater equilibrium, opens the perception to scenarios of deterioration where, as Kevin Lynch elucidates, "*waste calls to waste*"[4], which attracts all possible forms of loss and degradation[5].

p.136 When thinking about such places from an architectural perspective, however, the discourses seem to be caught up in the fascination with factory buildings and their potential for reuse. The particularity of their spaces and construction systems, the promise of their technologies or their plastic forcefulness have served to inscribe notable industrial facilities in the pantheon of modern myths. But a building is a "*contested territory*"[6] whose understanding cannot be reduced to what it appears to be as an autonomous, decontextualized and depoliticized object. From the iconic transparency exhibited by the Taylorist efficiency of the Van Nelle Fabriek, to the monumentality with which visions inherited from the Werkbund and the Bauhaus were bound together in the Zollverein mining complex, the dazzling image of these architectures and their subsequent heritage status have obscured the role they played in the landscapes and conflicts of their time. Thus, coal mining in the Ruhr basin, responsible for Germany's post-war economic miracle, cannot be dissociated from the environmental and public health damage caused in the region; nor can the Rotterdam plant be separated from the history of a company linked to Dutch colonial trade and, consequently, to the traumatic past of the people and ecosystems of the Indonesian archipelago whose plantations produced the raw materials that drove the factory's vaunted stepped design.

Given the intricate networks in which industrial buildings interact, this paper focuses on the material consequences of the excess of manufacturing that has grown addictively over two hundred years of 'machinist civilization', that is, on its detritus. It examines cases of (post-)industrial architectures and landscapes designed to treat, reinsert or displace these wastes. This raises the question of how architecture contributes to overproduction, or whether it aspires to give new values to the material we call trash. The aim is to provide some instrumental reflections on the meaning of waste, the landscapes that support its industry and how the factories that reprocess it can acquire a critical dimension to meet the challenges of the present.

LOST FUTURES BEYOND INDUSTRIAL RUIN

Before the current succession of crises plunged post-modernity into a pre-apocalyptic time, in 2006, Basurama, one of the Spanish collectives that has worked hardest to bring the issue of waste to public awareness, convened various specialists to discuss its implications (figure 2). In his speech, entitled *Never was trash so beautiful*[7], José Luis Pardo stated, paraphrasing Marx, that the wealth of capitalist societies "*presents itself as an immense accumulation of trash*": governed by a kind of *Malthusian* principle, their waste grows faster than the means to dispose of it, requiring more and more landfills where we can scavenge the garbage and continue to discard without drowning in our own waste[8].

His words take on a tragic resonance today in the untold volume of polluting debris dumped into all the planetary ecosystems. Despite their scale, environmental catastrophes caused by industrial activity are not taken for granted as a concern because we make an effort to ignore them. According to Naomi Klein, "*ours is a culture of disavowal, of simultaneously knowing and not knowing [...] who makes our goods, who cleans up after us, where our waste disappears to—whether it's our sewage or electronics or our carbon emissions*"[9].

p.137 The success of the waste economy is to make it go unnoticed; it is part of capitalism's strategy of concealment. Therefore, Pardo underlined, trash is "*that which does not have a place, that which is misplaced and, therefore, that which has to be moved to another place hoping that it might disappear*"[10]. The construction of the modern order, Zygmunt Bauman explained, involved such a compulsive production of waste that it was necessary to export it to other places usually subject to colonial rule. These served as dumping grounds as globalization turned the world into a garbage dump of junk things, spaces, times and even lives. When it was realized that "*the planet [was] full*"[11] and there were no more places left to sweep[12] waste away, trash became a real inconvenience.

The stigmatization and invisibilization of waste are inseparable from the devaluation of the surplus, from an overproduction that has filled our existence with useless objects. In the 1960s, Georges Bataille was already questioning modern economics, arguing that production and acquisition were means subordinated to wasteful expenditure, that is, luxury. Since power "*is exercized by the classes that expend*", they never pay attention to the "*poverty*"[13] that it entails.

For his part, in *The Waste Makers*, an early critique of post-war American consumerism, the economist and sociologist Vance Packard presented waste as a measure of a society's ethical dimension and revealed how industry and advertising pressured citizens with promises of security, success or status that encouraged wastefulness; he also warned that incipient concepts, such as disposable, and strategies of planned obsolescence not only destroyed resources and community values, but designed lives that, "*tomorrow, more than ever, [...] will be 'disposable'*"[14].

Inequality is both cause and effect of capitalism, the lubricant that greases an iniquitous machine of multiplying profits through dispossession. This is a central idea in David Harvey's social theory, with which Nancy Fraser agrees, from a feminist perspective, when she denounces that capitalism depends on the "*availability of nature as a source of 'productive inputs' and a 'sink' for production's waste*"[15]. Yet, however ecocidal the negative externalities on which the system is based may be, as Fredric Jameson's commented when discussing Koolhaas's notion of 'junkspace', it seems "*easier to imagine the end of the world than to imagine the end of capitalism*"[16]. Indeed, living as we live means **p.138** constantly discarding material[17]. Still, wondered cultural critic Ian Buchanan, when even separating one's own trash seems like too much to ask, what hope does the planet have? "*Throwing stuff away makes us the kinds of subjects that we are*", thus, aspiring to "*change everything*", as Klein demanded, requires relinquishing the world we have—something only possible through a complete transformation of subjectivity[18].

MACHINES AND ARCHITECTURES IN CONVERSATION WITH WASTE

In contrast to pre-industrial societies, where waste was recovered through more informal routines, such as feeding domestic animals, today's urban waste management is the result of the gradual incorporation of specialized techniques. These constitute an ever burgeoning by-product industry that operates on its own waste. Knowing how to industrially transform material's lost futures helps to cultivate ecological subjectivities. The first realization came with the 1973 oil crisis. It highlighted the West's dependence on an external and finite resource. The economic system was no more than a subsystem of natural systems, which made it clear that "*the energy crisis was also linked to the ecological crisis*"[19], and it was necessary to move towards an energy-based definition of socio-political structures, which would also be transferred to architecture and land use.

In Spain, an early effect of this crisis was the passing of the first law on urban waste[20], which entrusted the Ministry of Industry and Energy with the investigation of procedures to achieve more efficient waste treatment[21]. After the restoration of democracy and the change in consumer habits, in 1982, the first municipal solid waste (MSW) recycling plant was inaugurated in Madrid and, with it, the familiar igloos for collecting glass appeared. The entry into the EEC in 1986 was a regulatory turning point. Subsequently, the EU directive[22] on plastic and paper packaging flooded the streets with yellow and blue containers and, with the new millennium, a European framework for the deposit of waste in controlled landfills was also established[23]. Spurred on by successive EU provisions, the Spanish legislation has been adding state regulations that provide for the generation and professionalization of the management of MSW, until arriving at the current measures that aspire to a 'utopian' circular economy[24].

The tightening of the Brussels guidelines on recycling and recovery has turned waste into a lucrative industry, so **p.139** much so that in the late 1990s, major construction companies turned their operations around in order not to miss out on the 'sustainability business'. The economic interests that motivated the adaptation of these companies to the new requirements gave rise to real 'waste wars' in public tenders for the creation of new waste treatment plants and the operation of their landfills. This competition led some construction companies, together with their engineering teams, to open up a space for reflection on public works and, although architecture could only marginally occupy this breach, it managed to enter the fray to offer valuable proposals.

Two examples illustrate this phenomenon: the 'Las Dehesas' complex in Valdemingómez, southeast of Madrid, built between 1996 and 2000 by Iñaki Ábalos and Juan Herreros, with a capacity to treat 750 000 tonnes of waste per year (figure 3); and a plant in Villena (Alicante), designed in 1999 by the Valencian architect Lourdes García-Sogo which, since 2006, has been processing 85 000 tonnes of waste per year (figure 4). The first was irrefutably a media attraction—it seems no coincidence that, after its opening, a group of students from the ETSAM founded the collective Basurama; the second plant, located on the periphery, was almost unknown. Regardless of their scale, these projects tested innovative approaches to waste industry spaces that, two decades later, deserve to be revisited. On the one hand, both were interpreted as complex sites connected to a no less complex system of sorting centres. On the other

J. PARRA-MARTÍNEZ ET AL. "Nunca fue tan valiosa la basura: industrias, arquitecturas y paisajes del residuo" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024
 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.07

hand, their respective landfills were located in mundane peri-urban spaces and, although they assimilated the aesthetic experience of entropic landscapes inaugurated by Smithson, it shifted towards an eminently practical dimension.

As García-Sogo, concerned about architecture's disaffection with such infrastructures, asserted, they are not like artefacts nor simply malodorous destinations for waste. On the contrary, a MSW treatment plant is "*a sophisticated* **p.140** *invention that allows the land to be clean, the material to be recycled and the city to function*"[25], i.e. a solution to a major architectural and urban issue. In the face of the trash pits, the presence of heavy machinery and the protocols of its management, the architect ensured that those who worked in these environments could labor in the best working conditions. Her maxim: "*every machine has a margin*"[26], expresses the conviction that, if engineering resolves the mechanical efficiency of processes, architecture takes care of the habitability of its environments. This was an issue that also applied at the Madrid plant, especially with the strict deodorization of the sorting area where the staff—mostly women—manually classified the waste.

Moreover, inspired with a didactic zeal and not without choreographic qualities, both projects revealed a hitherto invisible place. "*We proposed—and this decision partly gave us the necessary advantage to win the competition—to give this operation a public and political content*"[27] declared Ábalos & Herreros. Both proposals offered a new type of industrial architecture, hybrid and with sufficient scale to accommodate the slopes of the landfill and the alchemy **p.141** of a landscape shaped by a flux of complex and unpredictable material transformations that escape representation.

Under a single envelope perforated by large courtyards, the two factories attempt to group together a usually heterogeneous set of structures. Although, in Valdemingómez, the composting area remained as a shed adjacent to the main building, in the case of Villena, it was possible to concentrate everything in a single enclosure (figure 5).

Both architectures dialogued, in different ways, with the apparent confusion of the processes of selection and multiple waste transformations that took place within them: in the Madrid project, emphasizing its gravitational echo in the slope section; in the Alicante project, with a symmetrical layout determined by the route of its double conveyor belt and the intention of suspending the control cabin and the didactic classroom as panoptic devices in the centre of the volume created by the curved roof.

In their approaches resonated a *Latourian* "*democracy extended to*"[28] both the discarded material and the machines that processed it and to the architecture that contained them. In order to raise awareness of waste, they opened the 'black box' of the landfill to educate about its composition and functioning: visitors and staff would watch the continuous movement of the belts through which the waste material was conveyed onwards to a new life.

Likewise, both factories assumed the ephemeral condition of their partially recyclable architectures, whose **p.142** useful life, linked to that of their landfills, was estimated at that time at twenty-five years. However, improved landfill compaction techniques have slowed down the speed of reaching the maximum landfill height which, according to regulations, would dictate the closure of the site.

Today, both complexes are still in operation and coexist with more recent architectural and landscape proposals, such as those of the Batlleiroig studio in Catalonia, which have taken over from them and updated their programs to meet new eco-social challenges[29]. However, these waste management facilities are entropic landforms that arouse objections in the municipalities where they are located because of the perceived devaluation of their surroundings (figure 6).

STRANGE TOPOGRAPHIES

The social and landscape recovery of the topographical features that these architectures fashion often materializes a natural fantasy. In Valdemingómez, the current transformation of the original landfill into a green carpet[30] brings to mind the unsolicited design of hillocks that Ábalos & Herreros incorporated into their plant project. Far from any pretence of naturalness, they employed a 'mechanical' orange that intensified the strangeness of the pre-La Mancha horizon and defined an "*area of impunity*"[31] scattered with uncommon uses (figure 7). Rejected in a later competition, the **p.144** dreamscape of a mineral plateau has metamorphosed into "*a terrible verdure*"[32], a tectonic confection, a product of the collusion between science, technology and capitalism (figure 8).

In his essay *Parks for Profit,* the sociologist Kevin Loughran[33] exposes how expensive and often ostentatious parks resulting from the transformation of former industrial complexes cause gentrification processes where landscape design revitalizes old picturesque patterns to catalyze real estate investment. The planting element has always been a civic alibi, as no one questions its benefits. From Alphand's hygienist uses and Olmsted's pastoral scenographies, an urban park is perceived as an inherently positive infrastructure: it provides outdoor recreation, aesthetic experiences and, inscribed in a long genealogy of "*happy*" bodily metaphors[34], it is recognized as a "*lung*" that purifies the congested atmosphere of a city. However, as Robert Smithson remarked, scrutiny of these foundational projects reveals that, beneath these narratives, there is a dialectical materialism applied in a pioneering way to landscape: **p.145** "*Olmsted's Parks exist before they are finished, which means in fact they are never finished; they remain carriers of the unexpected and of contradiction on all levels of human activity, be it social, political, or natural*"[35].

However, under the premise of recovering industrial memories, well-known post-industrial parks maintain the illusion of restoring a supposed biological authenticity, although what they actually do is to encapsulate and ignore insurmountable contradictions, such as those referred to by Smithson or adduced by Loughran. On the one hand, as badges of an attractive urban ideology that postulates cities as community-based, dense and decarbonized spaces, they postpone more far-reaching policies. On the other hand, they deepen the cognitive dissonance

J. PARRA-MARTÍNEZ ET AL. "Nunca fue tan valiosa la basura: industrias, arquitecturas y paisajes del residuo" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024

between consumption and environmental impact, as nature is trusted to do our job, alleviating any ecological guilt for unsustainable habits[36].

Interestingly, in his analysis of widespread practices of eco-imposture, Loughran overlooks one of the most disturbing versions of 'techno-pictorial' parks: converted landfills, such as New York's Freshkills, once the world's largest urban landfill (figure 9). However, his reflections on the picturesque are still valid, since the aesthetic and ideological basis of this movement has not yet been surplanted as the hegemonic image of nature in the West, determining "*which landscapes [are] valuable*" and which are not for our cities[37]. Thus, the closed landfills also resort to this visual eroticism to legitimize their new urban function and appeal to a sanitized vision of a present that exhibits its moral superiority over a dirty and indefensible past.

On these lines, which seems to dictate the development of numerous peripheries, Madrid is a clear example of "*verdolâtrie*"—to use the term coined by Alain Roger to denounce the idealization of the Anglo-Saxon 'green' and its reduction to an atopic "*packaging*"[38]. This would be the case of the Tierno Galván Park in Legazpi, which covers the industrial waste of the south of the Spanish capital; the green hills of Cerro del Tío Pío, built on the rubble of a slum settlement in Vallecas; or the emblematic regeneration of the Manzanares riberbank. They are landscapes traversed by multiple conflicts, spaces of collision and sediment that accumulate histories of rejection and friction of active strata, such as gases and leachates that, despite being covered by a thin veil of vegetation, retain all their agency.

Koolhaas's image of the urban conglomerate as a landfill in continuity with the other "*junkspaces*" [39], can be extended to the surface of the planet. Sealed under layers of earth, the socio-environmental footprint of the discarded material remains: the energy and water consumption involved in its extraction, the pollution from its dumping, the loss of biodiversity, etc., are imprinted alongside the geological trace of deterritorialized metals and the waste that will survive into the future. As Jussi Parikka points out, the body of the earth "*is a compilation machine, an assembly line, which offers a natural history of the changes over past decades of intensive industrial involvement in our planet*". Trash, dredged sediments, chemical pollution "*are taxonomically indistinguishable*" from soil[40].

The word 'residue' comes from *residuum*, the remainder left at the bottom, a noun derived from the Latin verb *residēre*, meaning 'to settle'. Etymologically, residues are, therefore, those things that endure. Timothy Morton boldly rethinks post-human ecologies from this idea of permanence, noting that, since the late 18th century, when following **p.147** the Industrial Revolution humanity began depositing a thin layer of carbon in the Earth's crust and, after 1945, when another layer of radioactive waste was added, the Anthropocene age has been accelerating to such an extent that "*hyper objects*"[41] like global warming are effects of the intertwining of human time with geological time[42]. This more incisive gaze, already advanced by Smithson when he suggested an entropic picturesqueness that conceived nature as a conflictive artifice, must enter, as Gabriel Ruiz-Larrea recommends, "*into the new post-natural environments as the new reality from which to act [because] they demand other narratives and new ways of understanding the temporality of matter*"[43].

In the face of such imperatives, architecture must question the complacency of many narratives of technological success, some as iconic as CopenHill. Under this moniker, alluding to the geological profile of the casing designed by BIG, the conversion of this plant, inaugurated in 2017, responds to Copenhagen's 'zero carbon' target for 2025. It involves a gargantuan biomass combustion system that requires the import and industrial digestion of trash (figure 10). In the innermost depths of its pristine interior, CopenHill hides its stomach, an insatiable CO_2-breathing crematory furnace capable of consuming 560 000 tonnes of waste per year. Such an investment in incineration which, under the euphemism of 'energy recovery', renounces recycling to favour the emissions business, shows another face of the **p.148** MSW industry, for the time being, very marginal in Spain.

This hermetic building 'greenwashes' a web of interests and relationships that the municipal authorities defend under the pretext of a negligible footprint, but challenged by the scientific community, mainly because of the volume of waste that must be moved for the plant to function. The picturesque image and the 'media hyping' of the leisure program that covers its roof with a ski slope and hiking trails soften the opaque infrastructures of the Capitalocene. This has anaesthetizing effects that distort the impact of these machines when architecture deactivates their political charge, so much so that only episodes of technical failure, natural disasters or social conflicts allow us to grasp the magnitude of the socio-ecological reality of capitalism, as is evident when a garbage strike buries the city under mountains of waste (figure 11).

ECOLOGIES OF SUBTRACTION: NOTES FROM NEW MATERIALISMS

As Keller Easterling argues, solid waste, chemical spills and other consequences of industry are often examined through the lens of blame. Political arguments and chimeras, such as that of a new technology capable of reversing the planetary devastation, are built on them[44]. Her thesis is that instead of isolating problems and looking for partial solutions, their interaction allows them to be treated as resources. In a world beyond the human, Easterling claims, problems are full of potential if we accept the failure they imply as "*a raw and limitless field of value*"[45]. In the face of the neoliberal mantra that confuses success with growth, the problems of accumulation can be rethought from an economy of "*subtraction*" that, instead of being read negatively, as loss, it is understood as an opportunity for **p.149** surprising "*exchanges*"[46].

Related to the "*social role of waste*"[47] and the culture of reuse that Lynch also addressed in the context of the energy crisis of the 1970s, it is worth looking at an extreme case of the management of subtractive ecologies: the

J. PARRA-MARTÍNEZ ET AL. "Nunca fue tan valiosa la basura: industrias, arquitecturas y paisajes del residuo" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024

J. PARRA-MARTÍNEZ ET AL. "Nunca fue tan valiosa la basura: industrias, arquitecturas y paisajes del residuo" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024

so-called 'toxic colonialism'. This includes industries that outsource waste costs, such as shipbreaking in India and Bangladesh, or e-waste manufacturing, illustrative of how rich countries dispose of their most polluting waste in the territories of the Global South, taking advantage of more lax labor and environmental regulations.

Without denying the health and ecological threat, even in the darkest scenarios of deterioration, waste is a form of binding agent. This was the case in Agbogbloshie, Accra (Ghana), which, before its controversial clearing, was the largest electronic scrap yard in the world, and also one of the unhealthiest places in Africa (figure 12). As architects DK Osseo-Asare and Yasmine Abbas have analyzed, under these entropic shadows, the flow of digital components from the West generates an informal but highly specialized activity of recovery and repair that nurtures transnational and domestic import/export networks, middlemen, technicians and microlenders "*scaling up and down the value chain*"[48]. These landscapes of decomposition take on collective agency through flexible circuits where communities share situated knowledge. They represent, despite their apparent derangement, a genuine circular economy that excludes waste. In them, creativity and cooperative design allow value to be perceived, bestowed and manipulated "*in spaces and materials where otherwise it would remain latent, invisible and intangible*" [49]. They are the antithesis of the closed system of indiscriminate waste exploitation advocated by CopenHill.

If waste is a cultural construct, the current environmental, geopolitical and eco-social challenges of industry require architecture to open up to new ways of enunciating and engaging with the material world. The entropic approach, as advocated by Javier García-Germán in understanding form as a "*temporal clot of matter, energy and information in its evolution towards something else*" [50], provides a stimulating framework for understanding the material reality of industrial waste and its landfills as reservoirs of entropy, and thus pure power.

From a relational ontology, other contemporary assumptions also offer conceptual tools to address such **p.150** potentiality from more ecologically consistent visions. The so-called new materialisms, which emerged in the first decade of the 21st century, have been assimilated to a "*material turn*"[51] for their renewed emphasis on the process of materialization-imbrication of the physical, mental and social continuum[52] advanced by the ecosophy of Félix Guattari[53]. These currents interweave philosophical and sociological concerns with those of the natural sciences, political ecology and feminisms. Authors such as Karen Barad, Jane Bennett or Laura Tripaldi reject any demarcation between the natural and the artificial, the organic and the inert, and advocate, even, to stop considering inorganic elements as inactive substances to accept that they become continuous with our body and our culture, collapsing "*the boundary between mind and matter*"[54]: they hybridize with our bodies and our psyche, reminding us that we are "*compost*"[55].

Bennett argues that everything is alive, interconnected and in process; animals, plants, rocks, air, human-made artefacts and even their waste are "*vibrant matter*". Like Latour, she does not admit mechanistic views of matter but delves into its entanglements and "*mediations*"[56] to dismantle the idea that objects are passive while human beings actively transform reality. Her theory of a "*distributive agency*"[57] of assemblages of biological, geological, technological and climatic entities explores how, in their mutual affect, matter is multidimensional, counter-intuitive and self-creative, that is: prone to self-organize and trigger unpredictable changes. From the synthesis of a new material to a chemical pesticide, anything we believe to be inanimate can alter the entire web of relationships in which it participates, whether it is driving a new industry or infiltrating toxins into an ecosystem, as Rachel Carson warned us[58]. From this viewpoint, Bennett deduces, trash retains a "*vibrant materiality*" that "*can never really be thrown 'away', for it continues its activities even as a discarded or unwanted commodity*"[59]. It has value because its activity does not cease but continues to influence the world through a host of vitalities at play. For feminist thought, therefore, claiming responsibilities cannot be postponed, so that the awareness of any manifestation of deterioration or precariousness, given its immanent vitality, guarantees a commitment in the form of affection, care and a renewed imagination.

CODA

As Basurama's precursor activism demonstrated, considering trash as waste is a failure of imagination. The very designation of 'residue' as a spoilt substance to be disposed of refers to a coercive will that imposes meanings and undermines our creativity by accepting without resistance that something cannot or should not be thought better.

Deterioration, disuse or rejection are part of an excess that cannot be completely erased, for the waste contains a potential open to reinterpretation precisely because it is underdetermined. According to the geographer Tim Edensor, through processes of decay, waste materials gradually mutate in character and resituate themselves outside of social **p.151** apparatuses and hierarchies, acquire distinct properties and offer alternative channels for interaction. Trash cannot be narrated sequentially or articulated in pre-established patterns. On the contrary, Edensor celebrates, it is replete with aspirations and conjectures that "*implode into the present*" to disrupt in uncontrolled ways the social imaginaries and certainties offered by power. Stripped of use and exchange value, waste reveals "*the political assumptions and desires which lie behind the ordering of matter*" [60], deploys an affordance that blurs the boundaries between past and future, and invites us to speculate—by imbuing the place where it is located with new meanings—on how space and materiality might be experienced differently[61].

By destabilizing modern epistemologies, these visions of matter open architecture to new fields of political intervention in which to deploy a radical imagination. An example of disciplinary ability to reveal the authenticity of trash and mobilize its agency from industry is the installation *Trash Peaks* by Jazairy and Ghosn for the 2017 Seoul Biennale. Built on data, it dialogued with visionary proposals from the Western architectural tradition to reflect on "*undesired matters of waste*", and to "*place them within the geographic imagination of the city and its surrounding landscape*"[62]:

a cenotaph that filters concentrations of leachate; a volcano that uses fungal species to extract rare earths from electronic waste; or a monumental tower that envelops concrete and metal waste (figure 13).

Simultaneously, on land, while 'major architecture' relies on the *deus ex machina* of technology to solve problems of its own making—an attitude in which persist the virulent iconicity of certain errant approaches that advocate hyper-technification and Nordic asepsis as solutions to waste management—the art of the seasoned *bricoleur* in African dumps reveals the full value that residues acquire when they are attributed with new meaning and waste is placed "*at the centre of hands-on and heuristic approaches to learning-by-doing*"[63].

Because, as Pardo insisted, evoking T.S. Eliot's poem *The Waste Land*, "*trash has a fate, a future, a secret and hidden identity*"—but it requires embarking on a journey to uncover it[64]. Just as Smithson did when, in his search for industrial ruin, he gave value to a landscape by monumentalizing its waste. Similarly, Denise Scott Brown—who was also invited to speak in Madrid by Basurama—urged us to rediscover architecture through the resignification of waste. For, if in the seventies, the revolutionary act was to learn from Las Vegas, concluded the architect, now we must undertake a "*wide-eyed, open-minded visit to the waste dump*"[65].

Roles CRediT:
José Parra-Martínez (JPM); Asunción Díaz-García (ADG); Ana Gilsanz-Díaz (AGD). Conceptualization, methodology, analysis, and original draft (JPM 40% - ADG 40% - AGD 20%). Fieldwork and interviews (JPM 40% - ADG 20% - AGD 40%). Visualization and image management (JPM 20% - ADG 50% - AGD 30%). Manuscript writing and editing (JPM 40% - ADG 40% - AGD 20%). Authorship (JPM 33% - ADG 34% - AGD 33%).

All of the authors declare that there is no conflict of interest with the results of the study.

FUNDING
This paper has benefited from a grant awarded to consolidated research groups by the Regional Department of Innovation, Universities, Science, and Digital Society of the Generalitat Valenciana Government through the research project "A Situated View: Women's Architecture in Spain from Peripheral Approaches, 1978-2008", with grant code AICO/2021/163 (2021-2023).

1 SMITHSON, Robert. The Monuments of Passaic. In: *Art Forum*. New York: Art Forum Media LLC, 1967, no. 6, p. 51. ISSN 0004-3532.

2 Ibid., p. 51.

3 BENNETT, Jane. *Vibrant Matter. A Political Ecology of Things.* Durham, NC: Duke University Press, 2010, pp. 4-5. ISBN 978-0-8223-4633-3.

4 LYNCH, Kevin. *Wasting Away*. San Francisco: Sierra Club Books, 1990, p. 73. ISBN 0-87156-675-3.

5 For perspectives on degradation and strategies for approaching deterioration through architecture see TUSET DAVÓ, Juan José. Possible Guidelines for Vital Action On Deterioration. In: *Proyecto, Progreso, Arquitectura* [online]. Sevilla: Editorial Universidad de Sevilla, 2011, no. 4, pp. 76-87 [consulted: 30-09-2024]. ISSN-e 2173-1616. DOI: https://doi.org/10.12795/ppa.2011.i4.05.

6 LATOUR, Bruno; YANEVA, Albena. Give Me a Gun and I will Make All Buildings Move: An ANT's View of Architecture. In: Reto GEISER, ed. *Explorations in Architecture: Teaching, Design, Research*. Basel: Birkhäuser, 2008, p. 86. ISBN 978-3-7643-8921-5.

7 The conference, held at La Casa Encendida on May 17, 2006, as part of the Urban Distortions series, is available online at: https://basurama.org/b06_distorsiones_urbanas_pardo.htm. Its text was also included in the magazine *Arquitectos* (CSCAE), no. 2, 2007, and would later become the title of a collection of writings edited by the philosopher (see next note).

8 PARDO, José Luis. *Nunca fue tan hermosa la basura*. Barcelona: Galaxia Gutenberg, 2010, p. 163. ISBN 978-84-8109-855-6.

9 KLEIN, Naomi. *This Changes Everything.* Toronto: Knopf, 2014, p. 147. ISBN 978-0-307-40199-1.

10 PARDO, José Luis, op. cit. supra, note 8, p. 165.

11 BAUMAN, Zygmunt. *Wasted Lives. Modernity and its Outcasts.* Cambridge, UK: Polity Press, 2004, p. 4. ISBN 0-7456-3164-9.

12 In the original language of this article (Spanish), the word 'basura', derived from the Latin verb *verrere* (to sweep), denotes what needs to be dragged away for cleaning, thus etymologically referring to a concept that is relative and dependent on the location where it is found. In English, both the words 'garbage' and 'rubbish' come from Old French, referring respectively to animal remains and waste. The latter derives from the Latin term *robacia*, which means 'remnants', 'debris', or unwanted materials that need to be removed or swept away to another place.

13 BATAILLE, Georges. *La part maudite. Précédé de La notion de dépense.* Paris: Les Éditions de Minuit, 1967, pp. 31-32. ISBN 978-2-7073-0181-9.

14 PACKARD, Vance. *The Waste Makers*. New York: David McKay, 1960, p. 45. ISBN 978-1-93543-937-0.

15 FRASER, Nancy. Contradictions of Capital and Care. In: *New Left Review* [online]. London: New Left Review Ltd, 2016, no. 100, p. 101 [consulted: 30-09-2024]. ISSN-e 2044-0480. Available at: https://newleftreview.org/issues/ii100/articles/nancy-fraser-contradictions-of-capital-and-care.pdf

16 JAMESON, Fredric. Future City. In: *New Left Review* [online]. London: New Left Review Ltd, 2003, no. 21, p. 76 [consulted: 30-09-2024]. ISSN-e 2044-0480. Available at: https://newleftreview.org/issues/ii21/articles/fredric-jameson-future-city.pdf

J. PARRA-MARTÍNEZ ET AL. "Nunca fue tan valiosa la basura: industrias, arquitecturas y paisajes del residuo" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024

J. PARRA-MARTÍNEZ ET AL. "Nunca fue tan valiosa la basura: industrias, arquitecturas y paisajes del residuo" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024
Con licencia CC BY-NC-SA 4.0 – DOI http://dx.doi.org/10.12795/ppa.2024.i31.07

17 Despite holistic sensibilities and notable efforts to reduce waste, such as those from permaculture, the staggering figures of food waste cannot be overlooked either, with the global index equivalent to one-third of the food produced worldwide, according to data compiled by the FAO.

18 BUCHANAN, Ian. What Must We Do About Rubbish? *Drain Magazine* [online]. New York: Pratt Institute, 2016, vol. 13, no. 1 [consulted: 30-09-2024]. ISSN 2469-3022. Available at: https://drainmag.com/what-must-we-do-about-rubbish/.

19 GARCÍA-GERMÁN, Javier, ed. *De lo mecánico a lo termodinámico*. Barcelona: Gustavo Gili, 2010, p. 8. ISBN 978-84-252-2347-1.

20 Law 42/1975, of November 19, on Waste and Municipal Solid Waste. Available at: https://www.boe.es/boe/dias/1975/11/21/pdfs/A24360-24364.pdf.

21 Hoy se inaugura en Madrid la primera planta de reciclaje de basuras. *ABC*, September 28, 1982, p. 42.

22 Directive 94/62/EC of the European Parliament, of December 20, 1994, on packaging and packaging waste, transposed into Spanish law through Law 11/1997, of April 24, on Packaging and Packaging Waste. Available at: https://www.boe.es/boe/dias/1997/04/25/pdfs/A13270-13277.pdf.

23 Council Directive 1999/31/EC of April 26, 1999, on the landfill of waste, transposed into Spanish law by Royal Decree-Law 1481/2001, of December 27, which regulates the disposal of waste through landfill. Available at: https://www.boe.es/buscar/pdf/2002/BOE-A-2002-1697-consolidado.pdf.

24 Royal Decree-Law 553/2020, of June 2, regulating the transfer of waste within Spanish territory. Available at: https://www.boe.es/buscar/pdf/2020/BOE-A-2020-6422-consolidado.pdf; Royal Decree-Law 646/2020, of July 7, regulating the disposal of waste in landfills. Available at: https://www.boe.es/boe/dias/2020/07/08/pdfs/BOE-A-2020-7438.pdf; Law 7/2022, of April 8, on Waste and Contaminated Soil for a Circular Economy. Available at: https://www.boe.es/buscar/pdf/2022/BOE-A-2022-5809-consolidado.pdf.

25 GAITERO, Ana. Los pilares de la basura. *Diario de León*, March 2, 2003, p. 21.

26 PARRA-MARTÍNEZ, José. *Interview with Lourdes García-Sogo*, January 17, 2024.

27 SOLÀ-MORALES, Ignasi de, coord. *Recycling Madrid. Ábalos & Herreros*. Barcelona: Actar, 2000, p. 24. ISBN 978-84-95273-43-7.

28 LATOUR, Bruno. *We Have Never Been Modern*. Cambridge, MA: Harvard University Press, 1993, p. 142. ISBN 0-674-94838-6.

29 BATLLEIROIG. *Merging City and Nature.* New York: Actar, 2023. ISBN 978-1-63840-009-7.

30 This proposal, authored by Israel Alba, was the winning entry in a competition held in 2000, which stipulated the transformation of the landfill into a forest park. ALBA, Israel. A Recovered Landfill in the Construction of a Metropolis: The Valdemingómez Project, Over Time. In: *Ri-Vista* [online]. Florencia: Firenze University Press, 2018, vol. 16, no. 1, pp. 68-89 [consulted: 30-09-2024]. ISSN 1724-6768. DOI: https://doi.org/10.13128/RV-22989

31 SOLÀ-MORALES, Ignasi de, op. cit. supra, note 27, p. 96.

32 LABATUT, Benjamín. *Un verdor terrible*. Barcelona: Anagrama, 2020. ISBN 978-84-339-9897-2. Labatut's original title, roughly "A Terrible Greening" or "A Terrible Verdure", has been translated into English as *When We Cease to Understand the World* (London: Pushkin Press, 2021. ISBN 978-1-782276-142).

33 LOUGHRAN, Kevin. *Parks for Profit: Selling Nature in the City*. New York: Columbia University Press, 2022. ISBN 978-023-1194-05-1.

34 JONES, Karen. 'The Lungs of the City': Green Space, Public Health and Bodily Metaphor in the Landscape of Urban Park History. In: *Environment and History* [online]. Winwick: White Horse Press, February 2018, vol. 24, no. 1, p. 50 [consulted: 30-09-2024]. ISSN 1752-7023. DOI: https://doi.org/10.3197/096734018X15137949591837

35 SMITHSON, Robert. Frederick Law Olmsted and The Dialectical Landscape (1973). In: FLAM, Jack, ed. *Robert Smithson, the Collected Writings*. Berkeley and Los Angeles, CA: University of California Press, 1996, p. 160. ISBN 0-520-20385-2.

36 LOUGHRAN, Kevin, op. cit. supra, note 33, p. 135.

37 Ibid., pp. 145-146.

38 ROGER, Alain. *Court traité du paysage*. Paris: Gallimard, 1997, p. 134. ISBN 978-2-07-074938-6

39 KOOLHAAS, Rem. Junkspace. In *October*. Cambridge, MA: The MIT Press, 2002, no. 100, p. 179. ISSN 0162-2870.

40 PARIKKA, Jussi. *A Geology of Media*. Minneapolis, MN: University of Minnesota Press, 2015, p. 110. ISBN 978-0-8166-9552-2.

41 These are such immense entities that, surpassing any human capacity for observation, can only be inferred through mathematical models. MORTON, Timothy. *Arquitectura sin naturaleza.* Madrid: Bartlebooth, 2023, p. 75. ISBN 978-84-127165-2-8.

42 This renders the modern distinction between human and non-human agents inoperative, to the extent that notions like 'nature' or 'environment' are now presented to us as "*obsolete*", becoming a problem in themselves. Ibid., p. 59.

43 RUIZ-LARREA, Gabriel. Geologías críticas posnaturales. In: Antonio GILAREZ LÓPEZ and Pablo IBÁÑEZ FERRERA, eds. *Más allá de lo humano.* Vigo: Bartlebooth, 2018, p. 51. ISBN 978-84-09-06950-7.

44 EASTERLING, Keller. *Medium Design: Knowing How to Work on the World*. London: Verso, 2021, p. 93-94. ISBN 978-1-78873-935-1.

45 Ibid., p. 109.

46 EASTERLING, Keller. *Subtraction.* London: Sternberg Press, 2014, p. 3. ISBN 978-3-95679-046-1.

47 LYNCH, Kevin, op. cit. supra, note 4, p. 60.

48 OSSEO-ASARE, DK; ABBAS, Yasmine. Waste. In: *AA Files* [online]. London: Architectural Association School of Architecture, 2019, no. 76, p. 179 [consulted: 30-09-2024]. ISSN 0261-6823. Available at: https://www.jstor.org/stable/27124602.

49 Ibid., p. 181.

50 GARCÍA-GERMÁN, Javier, op. cit. supra, note 19, p. 14.

51 Actually, it would involve a double turn, as neo-materialism is "*a return to metaphysics [...] immanentist and monist; and, in turn, a return to physis understood as matter-energy and autopoietic flow*". PALACIO, Marta, ed. *Neo-materialismo.* Buenos Aires: Prometeo, 2021, p. 10. ISBN 978-987-574-946-7.

52 COOLE, Diana; FROST, Samantha, eds. *New Materialisms: Ontology, Agency, and Politics.* Durham, NC: Duke University Press, 2010, pp. 2-3. ISBN 978-0-8223-4772-9.

53 GUATTARI, Félix. *The Three Ecologies*. London: The Atholone Press, 2000. ISBN 0-485-00408-9

54 TRIPALDI, Laura. *Parallel Minds: Discovering the Intelligence of Materials*. Falmouth: Urbanomic, 2022, p. 62. ISBN 978-1- 913029 -93-7.

55 HARAWAY, Donna. *Staying with the Trouble: Making Kin in the Chthulucene*. Durham, NC: Duke University Press, 2016, p. 101. ISBN 978-0-8223-6224-1

56 LATOUR, Bruno. *Pandora's Hope. Essays on the Reality of Science Studies*. Cambridge, MA: Harvard University Press, 1999, p. 21. ISBN 0-674-65335-1.

57 BENNETT, Jane, op. cit. supra, note 3, p. 21.

58 CARSON, Rachel. *Silent Spring*. Boston: Houghton Mifflin, 1962.

59 BENNETT, Jane, op. cit. supra, note 3, p. 6.

60 EDENSOR, Tim. Waste Matter. The Debris of Industrial Ruins and the Disordering of the Material World. In: *Journal of Material Culture* [online]. New York: SAGE Publications, 2005, vol. 10, no. 3, p. 330 [consulted: 30-09-2024]. ISSN-e 1460-3586. DOI: https://doi.org/10.1177/1359183505057346.

61 EDENSOR, Tim. *Industrial Ruins: Space, Aesthetics, and Materiality*. New York: Berg, 2005, pp. 116-119. ISBN 978-1-84520-077-0.

62 GHOSN, Rania; JAZAIRY, El Hadi. Trash Peaks: A Terrarium of the Anthropocene. In: *Architectural Design* [online]. Hoboken, NJ: John Wiley & Sons Ltd., 2020, vol. 90, no. 1, p. 33 [consulta: 30-09-2024]. ISSN 0003-8504. DOI: https://doi.org/10.1002/ad.2522.

63 OSSEO-ASARE, DK; ABBAS, Yasmine, op. cit. supra, note 49, p. 181.

64 PARDO, José Luis, op. cit. supra, note 8, p. 166.

65 SCOTT BROWN, Denise. The Art in Waste. In: *Urban Distortions* [online]. Madrid: Basurama, 2006 [consulted: 30-09-2024]. Available at: https://www.basurama.org/b06_distorsiones_urbanas_scott_brown_e.htm.

J. PARRA-MARTÍNEZ ET AL. "Nunca fue tan valiosa la basura: industrias, arquitecturas y paisajes del residuo" Proyecto, Progreso, Arquitectura. Noviembre 2024. E. Universidad de Sevilla. ISSN 2171–6897 / ISSNe 2173–1616 – RECEIVED 02-04-2024 / ACCEPTED 12-09-2024

REVISTA PROYECTOPROGRESOARQUITECTURA
AÑO XV

31

PROYECTO
PROGRESO
ARQUITECTURA
GI HUM-632 UNIVERSIDAD DE SEVILLA