

# New Perspectives for Engineering as a Global and Transversal Discipline

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**Abstract** – *The relational character of engineering, as well as the principles of environmental, cultural, and social sustainability make possible new perspectives of the discipline. The aim of this study is the New European Bauhaus (NEB), based on its predecessor, the historical Bauhaus, by taking into account and advocating for premises such as transversality and interdisciplinarity. In addition, NEB marks an evolution due to the different socio-economic and paradigmatic background and challenges that the historical Bauhaus faced and are still to be faced by the NEB today. If the historical Bauhaus was oriented towards architecture, the new one should take engineering into account with the idea that the concept of smart transcends the city and reaches the territory.*

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**Keywords:** Bauhaus, Education, Engineering, Architecture, Smart Territory

## Nomenclature

NEB	New European Bauhaus
BIM	Building Information Modelling
NEBA	New European Bauhaus Academy

## I. Introduction

The perspective of the New European Bauhaus (NEB), set by its founding documents [1]-[3] on which this work is based, is the transversality of science, art, and technology which has been also the key in the historical Bauhaus [4]. Moreover, the culture of human, social and environmental sustainability is more present nowadays because of the climate crisis and Covid19 pandemic [5] and their direct and indirect consequences such as the Ukraine war [6], energy or inflation crisis. Underlying all of that is the transition from object and thing focus of historical Bauhaus to relations as a required centre of attention and efforts in the contemporary society.

Collective intelligence implying human and machine collaborations is considered crucial today. NEB should inaugurate a new relational paradigm, based on the interrelationality and transdisciplinarity of different areas [7]. This has been boosted by the speed of computer processing, practically immediate in regards to action, which moreover implies the influence of almost instantaneous (real time) response to said action [8]. Just over a century after founding Bauhaus in 1919 in Weimar by Walter Gropius it can be said that it was one of the most influential institution of the XXth century [9]. During its three phases, i.e. from Weimar to Dessau and Berlin, as well as from Gropius to Meyer and to Mies van der Rohe, Bauhaus has changed its approach to innovation through

transversality in science, art, design, architecture, etc. [9].

Meyer stressed the social function of architecture, seen as a public good and not as a private luxury. Mies van der Rohe increased the stress on the architecture. After its dissolution, the new impulses to revive the Bauhaus have been along the lines of linking art, science, and technology with the different prominence of one or the other discipline depending on the scenario [10]. On the other hand, the creation of the Bauhaus school has been directed towards the idea that in the field of aesthetics everything is equivalent and multidisciplinary. Its ideas have been based on the union of art and functionality, and its students have been taught to create, as reflected in Bauhaus founding manifesto [11]. As a particularity, it is worth pointing out the concept of the form as other authors will later claim the structural truth [12] or the meaningful form [13]. On the other hand, engineering and construction have been affected by each industrial revolution and professional specialization came with industrial development [14]. Before the Enlightenment and furthermore first industrial revolution, there has been no division between architects and engineers [15], [16].

Today, the fourth industrial revolution [17] is principally based on cyber-physical systems that have generated their own spaces and collective intelligence [18]. Digitization and sensorization are a new reality. Complex rolling and bent organic forms sculpture-like futurist constructions are being enabled by the introduction of the form. Engineering balances abstract forms and ornaments with utility [14]. By taking into account all the above, this study is centred on the conception of the NEB from the perspective of engineering and its characteristics. Engineering itself is intended to be a bridge between two worlds, the one of

science and technology and the other one of art and culture. In this way, it brings forward the historical Bauhaus ideal of transversality. Likewise, this study aims to encourage critical thinking that makes the establishment of connections between different fields of scientific and artistic knowledge possible. Concepts of transversality, sustainability, and relational character will be analyzed as the foundations of the New European Bauhaus, by taking the Historical Bauhaus as a basis for reference and transposing the analysis to the nowadays world.

The paper is organized and developed as follows: III. Theoretical Framework, IV. Materials and Methods, V. Transversality, VI. Sustainability, VII. Education, VIII. Society and IX. Conclusion.

## II. Theoretical Framework

The historical Bauhaus is a response to the first two industrial revolutions, while the New European Bauhaus needs to digest the other two or three, including here the fifth one in social and environmental sustainability [19].

It is appropriate to point out that until the 20th century the Cartesian paradigm prevails. It was inspired by rationalism, which presupposed that fundamental human nature is rational, intellectual, and logical. It denied the value of intuition, creativity, and imagination and focused on the thing with which the historical Bauhaus coexisted.

With the theory of relativity, enunciated by Einstein, traditional concepts of time and space as absolute and independent entities are broken. They become interrelated with each other, and thus their relative character is discovered. This is the basis for the quantum paradigm. In general, the main elements that determine the new paradigm are various and interrelated. The main one is the ontological non-existence of matter since all reality is an eternal and constant flow of energy [20]. Chronologically, science has been the first discipline where the new paradigm has emerged, assuming a series of characteristics, which should be applied to the remaining disciplines. Transdisciplinarity is generated [7] and it is progressively integrated into the daily lives of people. A great leap will have to be taken in the direction of this emerging time axis. Thus, there is a need for a new relational paradigm in the context of the New European Bauhaus (Fig. 1). Today the focus has shifted from more production to less consumption in order to reach environmental sustainability as well as to proclaim human-centeredness.

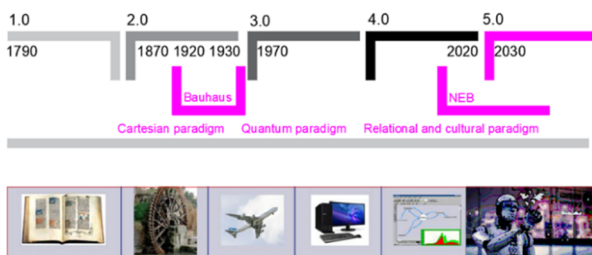


Fig. 1. Industrial revolutions & social paradigms.  
Source: Own elaboration

The beginnings of historical Bauhaus were influenced by the First World War, and by the need to absorb the first two Industrial Revolutions, i.e. there was a pressing need for housing [21]. From a historical perspective, what is now understood and celebrated as ‘Bauhaus’ is not historical Bauhaus per se, but a well-known and popular conception and the idea of modern architecture that has remained true to an idealistic vision. A precursor to the New European Bauhaus concept’s focus on social and environmental sustainability is The Davos Declaration from 2018 [22], signed by culture ministers from the EU member states. The New European Bauhaus is intended to address climate change, pollution, and biodiversity loss, as an extension of the premises of the European Green Deal [23], and to make sustainability more tangible when designing good living spaces. NEB is presented as an innovation pool, which creates an innovation ecosystem with actors working on different stages of the innovation process [24].

## III. Materials and Methods

This study builds on the theoretical perspective of critical qualitative inquiry, and the case study analysed from this standpoint is the New European Bauhaus, as depicted in its EU official founding documents [25], status report [26] and proposals for future [27]. The research is also based on the study of premises of historical Bauhaus such as transversality drawing from different available sources, primary (Bauhaus documents) and secondary ones (analysis documents of historical Bauhaus). Different socio-economic and paradigmatic backgrounds and challenges cause the social evolution, so that sustainability should be taken into account as the basic approach.

## IV. Transversality

The multidisciplinary is especially relevant in an era of hyper-specialization and in a way a commodification of everything, including the art and culture. Historical Bauhaus has been in this sense a school of ideas that has become embedded in every aspect of life. Design has become the way of living and a way of creation. A new system of living arising from the first and second industrial evolutions has become aesthetically attractive while at the same time suitable for mass production. This has been in a sense the ethics of aesthetics, which is raised as well in the idea of the New European Bauhaus [1].

Historical Bauhaus has achieved the transversality of disciplines with the fusion of aesthetic principles claimed by art with industrial requirements. Transversality is not only a transmission of knowledge between disciplines, but also a disposition for joint action [28] and this aspect seem to prevail in the EU and NEB sustainability understanding as the different stakeholders co-participation, especially in what refers to innovation [2]. In this context, NEB High Level Roundtable is built, composed of inspiring thinkers and practitioners acting as its ambassadors. Furthermore, in April 2022 NEB Lab a ‘think and do’ tank was created

[29]. Nonetheless, there are several terms for similar concepts. Interdisciplinarity is used to refer to more than one branch of knowledge, combining different disciplines or professional specialties and above all, belonging to all of them, being difficult to associate it with just one [30].

When the different fields of knowledge and arts are overprotected and isolated, it leads to a lack of global perspective and exhaustion of new ideas and visions. Live arts or the BIM (Building Information Modelling) methodology in engineering [31] are the exponents of interdisciplinarity. In BIM, architects and engineers share and nurture a real-time model of projects. This requires coordination, but in this way, it also helps in the detection of interferences that can be corrected. An additional effort should be made to know other disciplines, especially in the experiential sense. Creative processes are parallel in all the disciplines including science and arts. In many cases, their procedures can be transferred and extrapolated. Aesthetics and implicitly design and style should be a bridge between the worlds of art and culture, science and technology.

Goethe stated that poetry and science could be combined. "It is forgotten that science comes from poetry and that, as times change, the two could meet again on a higher plane, with reciprocal advantages" [32]. Both science and arts were born from human curiosity about facing the world and the unknown [28]. It should be noted that the concepts of art and science are today complex, multidimensional in nature, and difficult to define.

Likewise, the previously mentioned relatively recent division between the disciplines of architecture and civil engineering should be pointed out. With interdisciplinary work, the conflicts among disciplines can be overcome and the individual elements that converge are mutually reinforcing the innovation [33]. Today, architecture seems to be the field of creativity and aesthetics while engineering is reserved for technology and science.

Nonetheless, engineering is understood in this study not only as a science but also as an expression of the necessary synthesis of art and technology. Clarity of external expression and cleanliness and efficiency of internal behaviors have always been the goal of the best engineers and scientists. Even Einstein has referred to concepts related to art such as beauty and harmony [34]. The consideration of other opinions, not only the one from specialists is already present in Vitruvius, who has pointed out that the architect should have the humbleness to admit and take advantage of the warnings that may be given, not only by other artists but also by those who do not profess the art. Everyone, and not only the architects, should be able to judge rationally the works. In addition, as ancient times reference architects, Vitruvius warned of the first conflicts between disciplines [35]. In this scenario, aesthetics and simplicity are the premises of good engineering [16] and thus the backbone of sustainability.

In addition, the economic considerations, as well as minimalism, are cultural traditions that relate this conception to Bauhaus. There are many examples of arts fascination with science. New art forms emerge thanks to technology and materials developments.

A good example was Salvador Dali. This artist felt an unprecedented fascination for science: Einstein's theory of time, the uncertainty principle, nuclear physics, and, as a surrealist he was a psychoanalyst. Moreover, he managed to capture it in his works, merging creation with the main discoveries of the 20th century science. The artist regretted that knowledge was too compartmentalized [36].

The need for transversality between disciplines is evident in the joint work of the artist Chillida with the engineer Fernández-Ordóñez [37] as well as the philosopher Heidegger [38], where this crossed relationship among artist-engineer-philosopher is not anecdotal. The union of these people and not others sought to provide an answer to what is also intended in this work: identifying whether there are limits where physical-technical space becomes artistic space [39]. Since then, the compartmentalization of knowledge thought, and expression has only increased. Its consequences are reflected in the decline of education and consequently with what is nowadays produced.

Humanistic and artistic education of engineers is necessary to allow transversality and to make creativity flourish. In this sense, interdisciplinarity and so-called innovation cross-pollination [40] are crucial because the excessive isolation of disciplines can, in turn, exhaust the creative impulse which is the prerequisite for them.

In this context, the New European Bauhaus initiative is perceived in this study as a player to reinforce the idea of transversality and sustainability. Renewed commitment towards creativity and experimentation is to echo historical Bauhaus ethos, as Bauhaus means 'house of construction', transversal collaborative construction. The reconciliation of fine and applied arts, merging of functionality with aesthetics as well as practical application of arts were guiding Bauhaus' concerns and should guide the new one.

The New European Bauhaus is thought to be an interdisciplinary project that will create experimental spaces where art, culture, science, and technology can mingle, imagine, test, and demonstrate new solutions helping to develop new leading markets [41]. Therefore, the positioning of the NEB as an approach to transversality is totally necessary [21]. Science, art, technology, and innovation are considered the backbones of a sustainable culture, engineering, and industry (Fig. 2).

The NEB aims to be a bridge between different fields, as a critical mediation of the forms of modern civilization and local culture [42], for which engineering can be the structuring tool.

## V. Sustainability

There is a sustainability as the NEB goal but also a concern of the initiative survival and development.

NEB funding and governance are the main issues, spreading the NEB ideas and corresponding regulations in all the EU countries and involving its Member States.

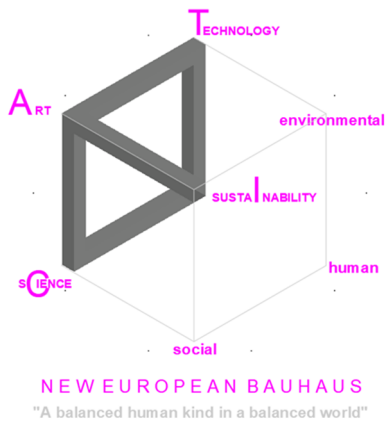


Fig. 2. A new sustainability culture. Source: reprinted with permission from [21]

There is a lack of clarity in the NEB funding from 2023 onwards, to be dealt with through new NEB mission creation and Horizon Europe and other EU policies revision in this sense, as proposed by the European Parliament (2022) [43]. Furthermore, the NEB is envisaged to be a new stand-alone EU Programme. In the NEB project, sustainability should be the main goal, seen from environmental and social perspectives [2]. Social sustainability is foreseen to be dealt with mainly through inclusiveness and its two dimensions, i.e., accessibility and affordability, as they should help solve the housing crisis and advance social cohesion. Sustainable development goals should be addressed in this way, also in culture [44]. The NEB is being set up in three phases: Design, Deliver, and Diffuse, followed by evaluation and monitoring. So far, the NEB actions are centered on promoting the innovative initiatives through New European Bauhaus Prizes, NEB Festival and innovative projects regarding especially cities, e.g. CrAft cities, or proximity-based 15-minutes cities initiative proposals.

NEB labelling is also contemplated [26], [45]. All projects should deal with the built environment as a whole but should focus on different aspects such as climate challenges, accessibility, social cohesion, digital construction, sustainable bio-resources, etc.

Environmental sensitivity is also recognized in Bauhaus. Walter Gropius postulated that a designed form should follow the laws of nature to function effectively.

After its closure, the generation of Bauhaus school members, Maholy-Nagy, Bayer, and the subsequent generation of students and admirers such as Buckminster Fuller and Ian McHarg picked up its ideas of ecological design. In order to bring forward the sustainability perspective, the science side should be present. The construction sector should be seen from a circular perspective: building, maintenance, and demolition should be considered since its very conception [41]. The life cycle of the infrastructures and sharing of the available information should be boosted through the implementation of collaborative methodologies such as previously mentioned BIM. It needs regulators to support the take-off and become an institutionalized norm.

In general, smart territory [46] is an engineering stronghold, not only the smart city [47] concept should find its application in the New European Bauhaus project.

Smart Territories, as a network of infrastructures, communications, and municipalities, are currently after the COVID-19 pandemic the forced evolution of Smart Cities [48]. There are several approaches to opening the smart cities concept by including people-centred smart infrastructures [49]. The construction industry has realized the opportunities and possibilities offered by the methodologies of collaborative processes. BIM methodology, which is currently being implemented worldwide and soon will be mandatory, has the potential of transforming the construction industry. It contains and manages the information of the end-to-end project and product life cycles, which together with the IoT and AI-generated data and information can be reused but also allows for better monitoring and performance of the construction [50]. A very important fact to keep in mind is that throughout the life cycle of the project, from the idea of the construction or building to its demolition and recycling, there is a continuous feedback process. In other words, the BIM model centralizes all the information of a project (geometric or 3D, time or 4D, costs or 5D, environmental or 6D, and maintenance or 7D) in a digital model developed by all its agents. It is continually being modified in such a way that at any moment, the reality and the model are identical and it will be useful for the design of sustainable infrastructure. Engineering and infrastructures should be the tools that support the smart territories and they are considered a priority in the NEB.

They have been understood as means of communication and development until now. However, they have to be upgraded to the current technological level. The smart territory is understood in this work as a place [51], transcending physical meanings. It becomes a model of social and cultural sustainability. Nowadays, the public administrations have to promote it without the slightest kind of doubt in order to boost the technology in the infrastructure sector, in new projects, and in the conservation of heritage to generate the place. Such a network of articulations should transcend the rigidity of the isolated artefact that is the city and generate more and more places, as environments of cooperation and coexistence between municipalities whose purpose is to respond to the needs of the population. Smart territories are monitored in such a way that the system is nourished by the amount of data necessary as base information in order to allow different actions. The foregoing requires collaborative environments, citizens' interaction, and involvement in new models of coexistence. Likewise, the existential commitment to sustainability in the engineering-art-nature relationship poses a difficulty that transversality and collaborative work between disciplines such as artists, architects, and engineers has to overcome.

Nowadays, on many occasions, the art component has been trivialized by relating it to the search for new wraps for constructions, even if they are out of scale. That oversized works present the subsequent problems of

operation, conservation, and extra costs that violate the ethical principle of engineering. The New European Bauhaus is to foster innovative solutions in terms of engineering, architecture, and materials. Nature-based materials such as wood can play a crucial role in the design as they can have a double benefit: stocking carbon emissions in buildings and avoiding emissions that would have been needed to produce conventional construction materials [41]. Low-tech buildings and their materials are undoubtedly an example to take into account in construction. However, high-tech materials usually seem to dominate the innovation conversation. Low-tech materials such as wood or stone are not considered even though the use of local materials and local production in general generates the lowest possible carbon footprint.

These common materials can be the perfect excuse to generate truly innovative projects following the premise of sustainability. Several projects in Africa [52] have demonstrated the innovativeness of the so-called low-tech architecture, which even acts as an economic stimulant that provides jobs in production, manufacturing, and construction. The building integrates with the local culture and becomes a part of the place and the community of people that take pride in the work. It is undoubtedly an example of social and cultural sustainability.

## VI. Education

An interesting aspect is the hybrid character of Bauhaus, expressed through the industry and the academy involvement. It had several registered companies in its short history. The success of Bauhaus students in the industry can be another example to follow and to look closely for in the New European Bauhaus. Bauhaus, in the first place, has been a state-sponsored school. It has brought an important reform in the pedagogy of art, design, and architecture. It has been thought of as an inclusive educative space, students have been allowed to enter irrespective of their social background, previous education, or, in principle, gender. Bauhaus education is still influencing today, thus, it would require a revision under the New European Bauhaus. All the education time has been centred on experimentation and participation.

This approach is especially relevant in the urgent sustainability commitment when critical ways of making a new world are needed more than ever. It is important to the industry orientation, which is common to all three stages of Bauhaus under its different directors and reverted into an aesthetic revolution. However, education and pedagogy in experimental and participative space have been crucial to its current cult position more than anything.

Thus, these dimensions need to be revisited in the New European Bauhaus idea. Currently, the stage of human development in terms of virtuality is very different when compared to the old Bauhaus. The plasticity of our brain is gradually adapting to this new way of being in the world and the Academy should transform the educational model within the framework of the New European Bauhaus.

Concretely, the transition from reading to the screen is

a reality, simultaneity, data access and processing and the study of complexity should be considered [53]. In particular, schools of architecture, engineering, art, design, and the humanities should promote and teach collaborative work with methodologies similar to BIM.

There are difficulties in transforming existing programs; more educators with sufficient practical knowledge should be available, allowing for the alignment of educational outcomes and industry needs. Nevertheless, the foregoing should not contradict the need for a global education, which does not underestimate knowledge in the humanities through technical studies for example [54]. It is necessary to pursue knowledge in the Renaissance sense of the term, as opposed to hyper-specialization and reductionism. In terms of cultural values society demand principles of purity and technical quality that translates into constructions of the greatest cleanliness, expressiveness, and harmony. Should not these values be common to the architect and the engineer? It should be possible to re-integrate both types of academic training into a single profession that, enriched by all kinds of cultural and scientific values, had a more integral vision of reality and could decisively contribute to the construction of a completer and more harmonious human environment [55]. Engineers must should education about the concept of Human factors or ergonomics [56]. It is an interdisciplinary and inclusive knowledge in line with the assumptions of the New European Bauhaus. It is, broadly, about a design concerning the capabilities of humans.

Emphasis is placed on designing the products with which people work, the tasks or jobs that people perform, and the environments in which people live. In this context and so far, there are not many advancements in the NEB regarding education. There is the European Parliament (2022) proposal to involve the knowledge triangle innovation-research-education. Horizon Europe NEB nexus report [25] proposals are more encouraging in this sense, including NEB University Clusters, NEB education curricula, and what is more NEB Academy (NEBA) motions.

## VII. Society

Bauhaus has prioritized function over artistic consistency. The activity to be run in the house and the building placement setting has been the main premises for design articulation. Especially during Meyer's time apart from the study of individual human needs, the search for social organization harmony has been brought forward.

There has been a strong vision of democracy promotion and expression through architecture. The search for aesthetic perfection, especially relevant during Mies van der Rohe's epoch, has been done to represent a symbol of social unity, where man himself without the ornament distraction should have space to be creative and able to develop a new attitude towards life. Nowadays, the approach to art has changed thoroughly. Society today sees it as normal that art is not understood. It can even be alienating, and any judgment of quality seems to be out of

its scope [57]. From the social role of art, the next step in a similar direction of paradigm shift is the concept of participatory art, the advocacy for art as resistance to any phenomenon of homogenization or globalization. The central project on which the New European Bauhaus has to pivot is to find ways of relating the different disciplines that focus on the meaning of what is produced. What matters are the ideas, the experiences, and the possibilities that result from these interactions. On the other hand, a bridge, an airport, a stadium, a power station, a station, a highway, a retaining wall, and a dam are all constructions of the area inhabited by humans. This conception of the area goes beyond mere constructions. Edifices produce places that grant spaces. The essence of construction is to make the way for a liveable environment [58]. The consummation of the essence of the building is to erect places by assembling their spaces, surpassing their physical quality due to their social significance that should be facilitated by engineering [59] and by the New European Bauhaus [60]. The NEB has to facilitate life in the sense of inhabiting and generating places with the tool of engineering. Nevertheless, traditional civil engineering interrupts its creation process in the consideration of integration in the environment in the sense of integration in nature, in physical space. On rare occasions, a social or cultural demand is met, or its importance in the community is taken into account. Society calls for engineering to generate places beyond physical meaning.

Place required by nowadays society is understood as a matter of aesthetic experience, the generator of discourses between the creations of man and nature, and culture.

Thus, future engineering should focus on the generation of social relations, and collective and shared processes in the public space. Engineers sometimes forget that the functionality-beauty dichotomy does not mean anything but the inability to satisfy what people want: functionality and beauty.

No one should be forced to choose between the two. Society wants beauty. Currently, there is no need to survive in nature because humans have left the natural world and created their own one. The human race has been expanding and forming a reality made by humans. That society on many occasions is associated as a lack of beauty in favor of the functionality of building blocks where no one wants to live, horrendous subway stations, and listless shopping malls.

Society vindicates the concept of habitability of buildings already enunciated by Heidegger after the reconstruction of the Second World War. As in the case of a bridge, construction has to generate a place.

Engineering is undoubtedly a fundamental tool in the sense of improving well-being in terms of generating beauty. Making useful and aesthetic engineering works is an obligation since beauty in particular has a strong impact on the well-being of society. The beauty of engineering is a social value. The engineering work has a value above all, which is its democratic character from its conception to its use. Concepts of collective authorship, and opportunity for social equality generation, as characteristics of

democracy, are linked to the socio-cultural significance of engineering. Furthermore, it is necessary to overcome the old commonplace, inherited from the Industrial Revolution, with the functionality-beauty dichotomy, which equates the useful with the unsightly [61]. Monotony is not gratifying, details are relevant and society wants beauty as it makes people feel harmonious and happy [62], even more than the cleanliness or safety of the inhabited space [63]. On the other hand, culture is a transversal concern and constitutes a fundamental pillar for sustainable development. It also has value in itself.

Thus, culture should be the fourth dimension of sustainable development. Culture evolves society, fosters critical thinking, and transforms the socio-technical landscape, expressing and negotiating collective narratives, which is at the very heart of the European Project [64]. The NEB should be oriented to reject the autonomy of art, avoiding that it has its own spaces disconnected from other forms of experience. It should remove dualities and dichotomies and not reduce the discourse to choose between art and crafts, culture and science, aesthetics and engineering, between the means and an end.

In the connections, the concept of the place appears as social and cultural transcendence. The best formula to guarantee the respect for the environment, for nature, always unrepeatable, is to think that what is taken from the environment while building human constructions, should be given back in and to culture [65]. Civil engineering, for example, as a part of life, while including its own socio-economic and practical values, approaches art in its attempt to democratize it [66] and advocates to move art away from its reduction to what a museum contains, putting it at hand on a day-to-day basis (Fig. 3). Since the beginning of the NEB, the democratization of art will be a priority.

Architecture and engineering are valuable tools to strengthen aesthetic concepts. They should be seen as part of the artistic and cultural development of society. In this sense, it seems clear that if art is understood to be relegated to the museum, engineering is a true exponent of the expected democratization of art, because it is itself far from the packaging of the exhibition, as it is accessible to everyone.



Fig. 3. Roman Bridge of Alcántara. Source: Own elaboration

## VIII. Conclusion

If the historical Bauhaus was oriented towards architecture, the New European Bauhaus will have to take the engineering into account, together with the idea that the concept of smart transcends the city and reaches the territory. It will do so also based on the relational character required of engineering, as well as the principles of transversality and environmental and social sustainability.

In a sense, the New European Bauhaus should absorb the impact and overwhelming cultural consequences of the subsequent two or three industrial revolutions, the last one being sustainability. The NEB should preserve the legacy of the Bauhaus School that today continues to have a strong influence on educational design institutions around the world, keeping its positions away from the dividing lines between disciplines and its idea of closeness between the functional and the aesthetic, organized through the innovation and stakeholders' participation. After Smart cities, the development of the territory and smart infrastructures is needed. These should count inextricably on the participation of society. They are structures in collaborative environments whose data is fed by the community. As an example, sensors integrated into a bridge will allow a passer-by to warn of a detected fault.

Increasing virtualization and remote work are the tendencies reinforced by the pandemics to take into account in the NEB. The collaborative methodologies should be a vehicle for the design and management of the construction during all life cycles. BIM is significantly behind the deadlines set by European administrations for its mandatory use in all infrastructure and projects with public funding territories. The new education is required because it is a fact that people are overcoming the test of a new world with the education they received. It is far from what is required in today's world. In this new education, there should be a deeper interrelation between disciplines and art. For example, it should be noticed that an advanced society like Japan is trying not to take into account any of the old historical references in its new educational commitment, expressly valuing the concepts of society, disciplines, and arts, transversality, and aesthetic considerations. Sustainability requires inclusiveness and a consideration towards universal values, to try to avoid concepts of race, class, or place, in addition, advocating for the concept of the citizenry of citizens of the world and a more precise and focused vision of today's complex world. The indefinite progress ideology is overcome through sustainable development. The cybernetic revolution has fragmented the previous world of objects in which the historical Bauhaus developed. Technology at the service of human happiness, freeing humans from repetitive tasks, which are now assumed by machines, is the result of this successive automation. The objective should be to reconcile the benefits and progress with sustainability, care for the environment, and respect for human rights. In a certain sense, the main objective of the historical founder of the Bauhaus, which has been to "re-imagine" the physical world through the unity of all the arts, where architecture has been the sum of all efforts,

should be transposed to today's world, although from a less reductionist and more general perspective. Beyond that, this research shows that it is necessary to approach the problem from the point of view of the transversality of disciplines, of engineering as a global and transversal discipline, which goes beyond reducing it to architectural constructions as the historical Bauhaus did.

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